ENERGYSOLUTIONS

Bulk Waste Disposal and Treatment Facilities Waste Acceptance Criteria

Revision 6

(Includes Class A LLRW, Mixed Waste, and 11e.(2) Disposal Embankments)

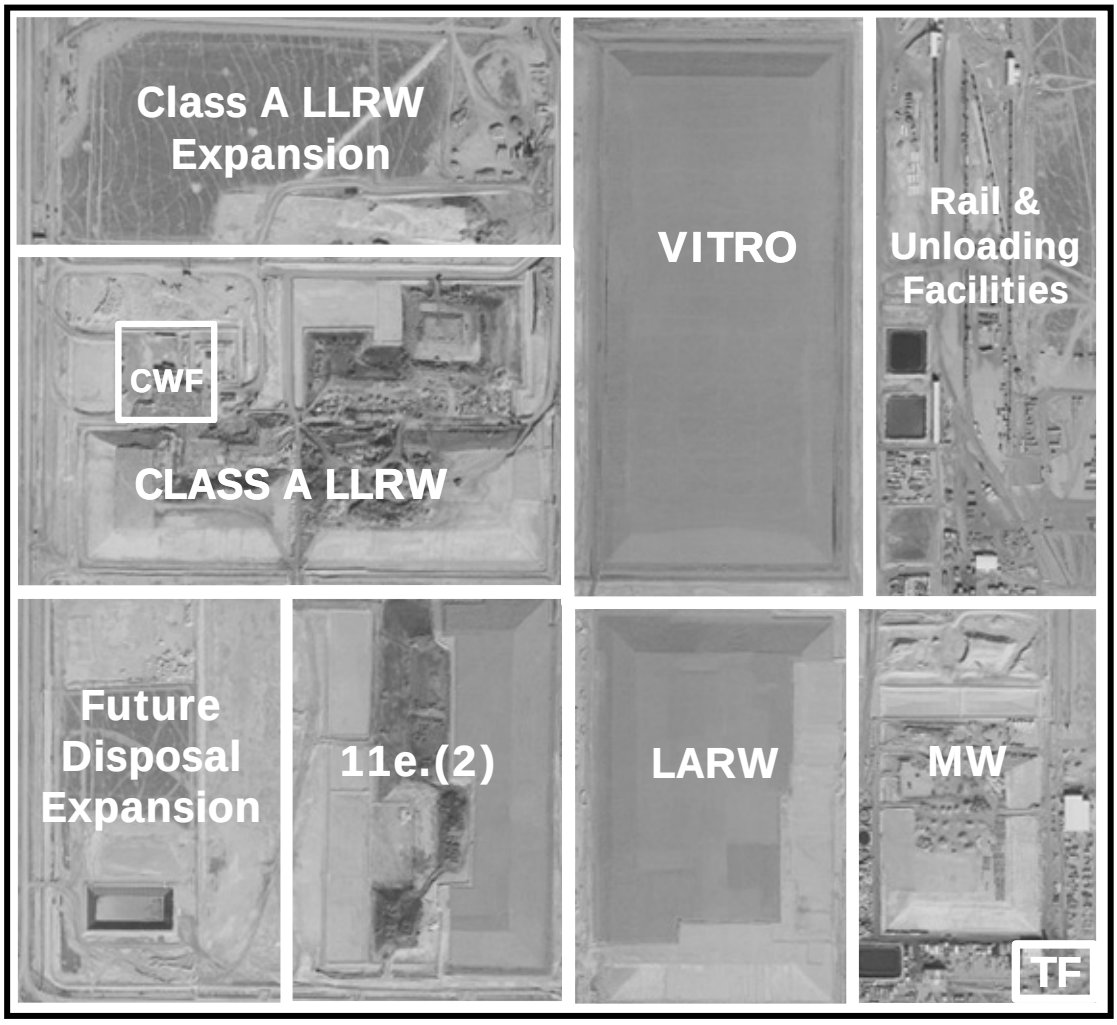

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TABLE OF CONTENTS

SECTION 1

INTRODUCTION

1.1 PURPOSE

EnergySolutions has developed this Bulk Waste Disposal and Treatment Facilities – Waste Acceptance Criteria (BWF WAC) document to assist waste generators and their contractors by providing information about the capabilities and requirements of EnergySolutions' disposal and treatment facilities. EnergySolutions is authorized to receive:

- Class A Low-Level Radioactive Waste (LLRW)
- NORM/NARM
- Class A Mixed LLRW (i.e., radioactive and hazardous)
- 11e.(2) Byproduct Material
- PCB Radioactive, and
- Other various forms and types of radioactive wastes

The BWF WAC provides information on EnergySolutions' waste acceptance processes including:

- Waste characterization and profiling,
- Pre-shipment sampling and analysis,
- Waste packaging, transportation and delivery,
- Waste receipt, verification sampling and acceptance, and
- Waste treatment and disposal

These waste acceptance criteria collectively pertain to the Bulk Waste and Treatment Facilities which are described in detail below. The BWF WAC does not apply to EnergySolutions' Containerized Waste Facility (CWF). Please refer to the CWF WAC which can be downloaded from EnergySolutions' website at www.energysolutions.com.

1.2 SCOPE

Numerous state and federal agencies regulate the management, transportation, treatment and disposal of radioactive and hazardous materials. Due to the regulated nature of these activities, this document provides guidance on EnergySolutions' waste acceptance process and should be used in conjunction with current copies of EnergySolutions' licenses, permits and applicable state and federal regulations. These license, permits, and regulations govern over any information contained in this document. Generators may request variances from the BWF WAC on a case-by-case basis. EnergySolutions will evaluate such requests and provide written notification to the generator if the variance is approved.

EnergySolutions' licenses and permits along with links to applicable parts of the Utah Radiation Rules are included on EnergySolutions' website at www.energysolutions.com. In addition, Appendix A of this document contains a list of contact information for both EnergySolutions and the State of Utah. Representatives of EnergySolutions' Business Development Department are available to answer any questions and can be contacted at (801) 649-2000.

1.3 RESPONSIBILITIES

The generator is responsible to characterize, classify, schedule, manifest, package and transport waste shipments to EnergySolutions' disposal facility in accordance with the BWF WAC, licenses, permits, and applicable state and federal regulations. For waste classification, generators must have in place a quality control program to ensure compliance with the waste classification requirements. The generator or authorized representative must complete and submit a Radioactive Waste Profile Record (EC-0230) to EnergySolutions for review and approval prior to shipment. Additional forms and certifications may also be required such as the Special Nuclear Material Exemption Certification, the PCB Waste Certification, and the Land Disposal Restriction Notification and/or Certification. Section 4 details the waste profiling process. The generator or authorized representative should be available to resolve issues that arise associated with waste shipments.

EnergySolutions is responsible to safely and compliantly receive, treat (if applicable), and dispose of waste shipments in accordance with all applicable permits, licenses, and regulations. EnergySolutions will provide disposal and/or treatment certificates upon request from the generator. In addition, EnergySolutions will contact the generator to resolve non-conforming waste shipments or discrepancies with the contractual terms and conditions associated in accordance with the receipt and management of waste shipments.

SECTION 2

SITE AND FACILITY DESCRIPTION

2.1 DISPOSAL SITE SELECTION

The initial selection of the EnergySolutions disposal site location dates back to the late 1970s when the Department of Energy (DOE) and the State of Utah began the cleanup of an abandoned uranium mill site. The Vitro mill site, located in central Salt Lake City, was one of the first sites cleaned up under the DOE Uranium Mill Tailings Remediation Action (UMTRA) Program.

The DOE investigated 29 sites to identify the safest permanent disposal site for these materials. After eight years of characterization and evaluation of several sites, the agency selected the Clive site located in Utah's West Desert approximately 75 miles west of Salt Lake City. The site's remote location, low precipitation, naturally poor groundwater, and low-permeability clay soils were some of the attractive qualities of the area. From 1984 to 1988, the Vitro tailings were relocated to Clive and placed in an above-ground disposal cell.

The vision of EnergySolutions is to provide a private disposal option for cleanups similar to Vitro. These cleanups would be carried out across the country by the Environmental Protection Agency (EPA), DOE, Department of Defense, and private companies. At that time, these agencies had very few options for offsite disposal of radioactive wastes. In order to provide a new option for these contaminated materials, the land adjacent to the Vitro disposal embankment was purchased and a license application was submitted to receive and dispose of Naturally Occurring Radioactive Materials (NORM). Since 1988, EnergySolutions' Radioactive Material License (RML) has been amended several times, expanding the types of radioactive materials to include low-level radioactive waste (LLRW), in addition to NORM.

2.2 LICENSES, PERMITS, AND AUTHORIZATIONS

EnergySolutions is permitted, licensed, and authorized to receive, treat, and dispose Class A LLRW, NORM/NARM, Class A Mixed LLRW, 11e.(2) Byproduct Material, Special Nuclear Material based on concentration limits, as well as Polychlorinated Biphenyl (PCB) Radioactive Waste, and PCB Mixed Waste in accordance with the following documents:

- Radioactive Material License (RML) Number UT 2300249, as amended
  - Class A LLRW as defined in Utah Administrative Code R313-15-1008
  - Class A Mixed LLRW (radioactive and hazardous)
  - NORM/NARM
  - Special Nuclear Material (concentration based limits)

- 11e.(2) Byproduct Material License Number UT 2300478, as amended
  - 11e.(2) Byproduct Material as defined by the Atomic Energy Act, as amended

- RCRA Part B Permit Number UTD982598898, as amended
  - Storage, treatment, and disposal of Mixed Waste
  - Authorizes disposal of specific types of PCB regulated waste in the Mixed Waste disposal facility

- Groundwater Quality Discharge Permit Number UGW450005, as amended
  - Authorizes disposal of specific types of PCB regulated waste in the Class A LLRW disposal facility

- Special Nuclear Material (SNM) Exemption Order issued by the NRC, as amended
  - Authorizes receipt, storage, treatment, and disposal of waste containing SNM based on concentration limits rather than mass limits

- TSCA Coordinated Approval issued by the EPA Region 8, as amended
  - PCB Radioactive and PCB Mixed Waste (40 CFR Part 761)

Section 3 details the various waste types and waste forms that are acceptable at EnergySolutions. Waste streams that are regulated by multiple regulations must meet the requirements for each applicable regulation.

2.3 SITE LOCATION AND ACCESS

EnergySolutions' operations are conducted on and adjacent to Section 32, Township 1 South, Range 11 West, SLM, Tooele County, Utah. The facility is located approximately 75 miles west of Salt Lake City and about three miles south of Interstate 80, Exit 49. The site is conveniently accessed by both highway and rail transportation. The disposal site address is:

EnergySolutions LLC
Clive Disposal Site
Interstate 80, Exit 49
Clive, UT 84029 (84083 if using Fed Ex)
Phone: (435) 884-0155

EnergySolutions receives waste shipped via bulk truck, containerized truck, enclosed truck, bulk railcars, rail boxcars, and rail intermodals. The transportation access allows EnergySolutions to operate throughout the entire year. The disposal site is accessed by the Union Pacific Railroad at EnergySolutionsEnergySolutions' private siding. EnergySolutions uses more than seven miles of track and three locomotives for railcar management. Covered railcar roll-over and covered railcar decontamination facilities allow for the efficient unloading, decontamination and return of rail shipments.

2.4 DISPOSAL AND TREATMENT FACILITIES

The design and operation of the EnergySolutions disposal site provides a long-term disposal solution with a minimal need for active maintenance after closure. EnergySolutions uses an above-ground engineered disposal cell. The design of these cells is patterned after DOE and EPA specifications for the VITRO disposal embankment. Each licensed disposal embankment meets or exceeds the applicable regulatory requirements.

The locations of EnergySolutions' waste treatment, disposal, and operations areas are identified in Figure 2-1. EnergySolutions' waste operations are managed as three facilities: "Treatment Facility" (TF), "Bulk Waste Facility" (BWF), and "Containerized Waste Facility" (CWF).

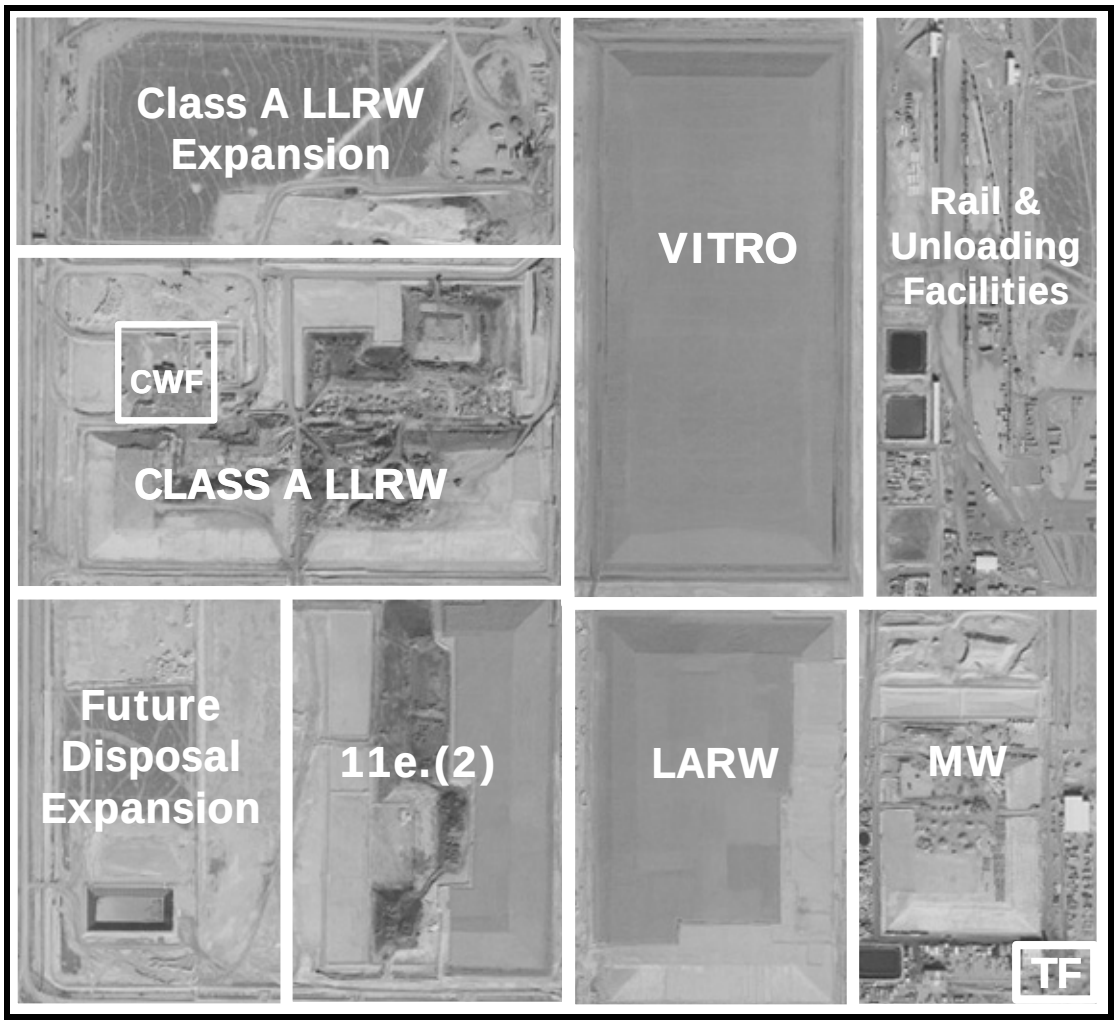


Figure 2-1. EnergySolutions' Disposal and Treatment Facilities

Treatment Facility

Waste shipped to EnergySolutions for treatment or liquid solidification prior to disposal is managed at EnergySolutions' "Treatment Facility". The Treatment Facility is shown in Figure 2-1 as "TF". EnergySolutions' treatment and solidification capabilities include the following:

- Chemical Stabilization, Neutralization, Deactivation, Oxidation, Reduction
- Macroencapsulation of hazardous debris or radioactive lead solids
- Debris Spray Washing
- Microencapsulation
- Thermal Treatment of Organics
- Mercury Treatment

Bulk Waste Facility

Waste shipped for direct disposal that is compliant with the ALARA Criteria described below is managed at EnergySolutions' "Bulk Waste Facility" by either removing the waste from the container or filling the container with a grout-like mixture to minimize void spaces. Waste that is removed from the shipping container is typically compacted into 12-inch soil lifts. Waste that consists of debris items that do not have a dimension small enough to be compacted into the 12-inch soil lifts are disposed of using grout in a different disposal area within the Bulk Waste Facility. Waste is directly disposed at the Class A LLRW, Mixed Waste, or 11e.(2) disposal embankments. Bulk containers (e.g., intermodals, gondolas, etc.) and non-bulk containers (e.g., drums, boxes, etc.) are acceptable for receipt at the Bulk Waste Facility (BWF).

Containerized Waste Facility

Waste shipped for direct disposal exceeding EnergySolutions' ALARA Criteria is managed at the "Containerized Waste Facility" (CWF). Waste must be packaged in disposal containers (e.g., drums, boxes, liners, etc.) instead of bulk containers (e.g., intermodals, gondolas, etc.) for shipments to the CWF since EnergySolutions will not remove such waste from its container due to the elevated dose rates. Please refer to EnergySolutions' CWF WAC for information on shipping waste to the CWF.

The design and operation of the EnergySolutions disposal site provides a long-term disposal solution with a minimal need for active maintenance after closure. EnergySolutions uses an above-ground engineered disposal cell. The design of these cells is patterned after DOE and EPA specifications for the VITRO disposal embankment. Each licensed disposal embankment meets or exceeds the applicable regulatory requirements.

2.4.1 ALARA Criteria for the Bulk Waste and Treatment Facilities

EnergySolutions has implemented an "As Low As Reasonably Achievable" (ALARA) Criteria to minimize worker exposures. The ALARA Criteria is not a license condition but is used as the primary distinction between waste that is acceptable for direct disposal at the BWF and CWF. Wastes with higher dose rates exceeding the ALARA Criteria are disposed at the CWF where waste packages are directly disposed without sampling and actual waste handling. Conversely, wastes with dose rates less than the ALARA Criteria may be disposed at the BWF since the waste is sampled and, in most cases, removed from the shipping container.

As shown in the table below, these ALARA Criteria define allowable external contact dose rates and loose surface contamination limits for waste managed at the bulk disposal facility.

External Contact Dose Rate	**Removable Surface Contamination On Exterior Surfaces of Debris**
< 200 mR/hr on manifested container	< 500 dpm α/100 cm^2
< 500 mR/hr on external, accessible surfaces of waste in container	< 50,000 dpm β,γ/100 cm^2
< 80 mR/hr on contact of unshielded containers with resin	

External Contact Dose Rate Limits

The external contact dose rate limit of 200 mR/hr applies to the manifested container (e.g., drums/boxes on a flatbed truck or enclosed van, bulk containers such as intermodals, sealands, cargo containers, etc.). If drums or boxes are shipped in a bulk container, such as an intermodal, and the intermodal is manifested as the strong, tight container, then the external contact dose rate of 200 mR/hr applies to the intermodal and not to the drums or boxes inside the intermodal. The drums and boxes in this case would be considered waste and must not contain any item with dose rates exceeding 500 mR/hr on the external, accessible surfaces of the item.

The dose rate for debris items such as pipes should only be measured on the exterior surfaces and on the plane surface of the opening of the pipe to demonstrate compliance with the ALARA Criteria. For example, the internal pipe surfaces may exceed the 500 mR/hr dose limit only if the surface plane to the opening of the pipe is less than 500 mR/hr. Shield plates used to cover the opening of the pipe should not be used solely to lower the dose rates below the criteria since EnergySolutions is required to remove or penetrate into the debris items to fill internal voids with grout material.

Another example is DAW placed into 55 gallon drums and compacted into pucks. The dose rate criteria apply to the external surfaces of the puck itself and not to the DAW inside the puck.

Resin External Contact Dose Rate Limits

The dose rate for unshielded resin containers applies to the container itself whether it is the manifested container or not. This is due to the required resin blending process that necessitates worker proximity to the waste. Resins with dose rates that exceed these limits must be disposed at the CWF.

Removable Surface Contamination Limits

The same ALARA principles apply to the removable surface contamination limits. The main concern is controlling loose contamination on the exterior surfaces of debris items removed from the container. Fixatives may be applied to the debris items to reduce the removable contamination levels below the specified limits.

Requests for Exceptions

Exceptions to the ALARA Criteria are evaluated on a case-by-case basis. For example, Mixed Waste exceeding the ALARA Criteria will be evaluated since the CWF cannot accept Mixed Waste for disposal. Generators must provide radiation and contamination surveys of the container and/or waste item when requesting approval to exceed the ALARA Criteria. Dose rate measurements at one foot from the waste should be provided on the radiation survey. The transportation mode and manifested package information should also be included with the request. The generator must receive written approval for exemptions to the ALARA Criteria prior to shipment of the waste.

2.4.2 Bulk Waste Facility

The Bulk Waste Facility (BWF) includes the following disposal embankments and structures:

- Class A LLRW and NORM disposal embankment

- 11e.(2) Byproduct Material disposal embankment
- Mixed Waste disposal embankment for LDR compliant solid waste
- Intermodal unloading facility for unloading and staging bulk waste shipments for disposal
- Railcar Rollover facility for unloading and staging bulk waste shipments for disposal
- Rail Wash Facility for decontamination, surveying, and releasing of railcars
- Container Wash Facility for decontamination, surveying and releasing of bulk containers

2.4.3 Containerized Waste Facility

The Containerized Waste Facility (CWF) has been designed and constructed to handle disposal packages exceeding EnergySolutions' ALARA Criteria for the Bulk Waste and Treatment Facilities (e.g., disposal containers greater than 200 mR/hr). Shipments to the CWF typically are shipped in a shielded transportation package such as a cask as illustrated in Figure 2-2. This BWF WAC document does not pertain to waste shipped to the CWF. Please refer to the CWF WAC located on EnergySolutions' website at www.energysolutions.com for the requirements in shipping to this disposal facility.

Figure 2-2. Cask Shipment at the Containerized Waste Facility

2.4.4 Treatment Facility

The treatment facility is located within the Mixed Waste footprint. The Treatment Facility is designed for radioactive waste that requires treatment for RCRA constituents and for liquid radioactive wastes requiring solidification prior to disposal. Currently, all waste processed at the Treatment Facility are disposed in the Mixed Waste disposal embankment. The Treatment Facility includes open and covered

waste storage areas for storing, sampling, and staging Mixed Waste shipments, including the following buildings and areas:

- Mixed Waste Operations Building
- Mixed Waste Treatment Building
- Liquids Storage Building
- Mixed Waste storage, staging and sampling areas

Treatment options for Mixed Wastes include:

- Chemical Stabilization – Including oxidation, reduction, neutralization and deactivation.
- Amalgamation – For the treatment of elemental mercury.
- Macroencapsulation – For the treatment of radioactive lead solids, RCRA metal-containing batteries and hazardous debris.
- Microencapsulation – To reduce the leachability of hazardous constituents in mixed wastes that are generally dry, fine-grained materials such as ash, powders or salts.
- Liquid Solidification – For the solidification of radioactively contaminated liquids such as aqueous solutions, oils, antifreeze, etc. to facilitate land disposal. Mixed waste liquids can also be treated and solidified at the Treatment Facility.
- Vacuum Thermal Desorption of Organic Constituents - For the thermal segregation of organic constituents from wastes. The organic liquid condensate must be treated prior to disposal. The non-liquid waste residue will be further treated for metal contaminates (if required) and disposed at the Mixed Waste embankment.

Each of these treatment technologies are discussed in further detail in Section 3.1.3.

SECTION 3

WASTE CRITERIA

3.1 ACCEPTABLE RADIOACTIVE WASTES

The type, form, and quantity of LLRW, NORM, 11e.(2) byproduct material, and mixed waste that EnergySolutions can receive for treatment and disposal is governed by the various licenses and permits under which EnergySolutions operates. EnergySolutions has been issued an Agreement State Radioactive Material License (License #UT 2300249, as amended) by the Utah Division of Radiation Control (DRC). This license authorizes EnergySolutions to receive Class A LLRW, NORM, and NARM waste. EnergySolutions has been issued a separate license to receive and dispose of uranium and thorium mill tailings byproduct material as defined by section 11e.(2) of the Atomic Energy Act of 1954, as amended.

The Utah Division of Solid and Hazardous Waste (DSHW) issued EnergySolutions a RCRA Part B Permit (Permit #UT 982598898, as amended) to treat and dispose of hazardous waste which is also contaminated with LLRW, NORM, or NARM wastes (mixed waste). Early in 1999, EnergySolutions received a Permit modification which authorized the receipt and disposal of PCB Radioactive and PCB Mixed wastes. In 2002, EnergySolutions received a TSCA Coordinated Approval from the EPA to expand PCB receipt and disposal options. The TSCA Coordinated Approval has been subsequently expanded to include additional types of PCB radioactive and PCB mixed wastes.

3.1.1 Class A Low-Level Radioactive Waste

EnergySolutions is authorized to receive Class A Low-Level and Mixed Low-Level Radioactive Waste. These wastes must be classified in accordance with the requirements of the Utah Administrative Code (UAC) R313-15-1008, Classification and Characteristics of Low-Level Radioactive Waste. Utah rule R313-15-1008 is similar to the NRC Waste Classification requirements in 10 CFR 61.55 with the addition of Radium-226. Generators responsible for classification of the waste must have in place a quality control program to ensure compliance with the waste classification requirements and prepare and retain with manifest documentation a record documenting the generator's waste classification analysis. Shippers and generators should also review NRC IE Bulletin No. 79-19 to ensure compliance with applicable training requirements in managing LLRW.

The information provided below is a summary of the waste classification regulations and how generators must classify their LLRW prior to shipment to EnergySolutions. Further guidance is provided in NRC's "Branch Technical Position on Concentration Averaging and Encapsulation", as amended (BTP). All generators shipping LLRW to EnergySolutions must comply with the NRC's BTP as specified in Condition 16 of the Radioactive Material License.

Determination of waste class involves two considerations. First, consideration must be given to specific long-lived radionuclides listed in Table I of UAC R313-15-1008. Second, consideration must be given to specific short-lived radionuclides listed in Table II of UAC R313-15-1008. The waste is Class A if the radionuclides listed in either Table I or Table II are not present in the waste. Both tables are provided below.

The concentration limits for determining waste class are given in curies per cubic meter with the exception of the following Table I radionuclides which are given in nanocuries per gram: alpha-emitting transuranic radionuclides with a half-life greater than five years, Pu-241, Cm-242, and Ra-226. The following bullets outline the steps for determining waste class per R313-15-1008.

Classification Tables from UAC R313-15-1008

Table I

Radionuclide	Ci/m^3	nCi/g
C-14	8	
C-14 (act)	80	
Ni-59 (act)	220	
Nb-94 (act)	0.2	
Tc-99	3	
I-129	0.08	
Alpha-emitting transuranics > 5 year half-life		100
Pu-241		3,500
Cm-242		20,000
Ra-226		100

- When the waste does not contain any radionuclides listed in either Table I or II, it is Class A.
- When the concentration does not exceed 0.1 times the value in Table I, the waste is Class A.
- When the concentration exceeds 0.1 times the value in Table I, but does not exceed the value in Table I, the waste is Class C. EnergySolutions is not authorized to receive Class B and Class C waste.
- For wastes containing mixtures of radionuclides listed in Table I, the total concentration shall be determined by the sum of fractions rule as illustrated in the example below.
- When the waste does not contain any of the radionuclides listed in Table I, classification shall be determined based on the concentrations shown in Table II.

Table II

Radionuclide	Column 1 Ci/m^3	Column 2 Ci/m^3	Column 3 Ci/m^3
Total of all radionuclides < 5 year half-life	700	*	*
H-3	40	*	*
Co-60	700	*	*
Ni-63	3.5	70	700
Ni-63 (act)	35	700	7,000
Sr-90	0.04	150	7,000
Cs-137	1	44	4,600

* There are no limits established for these radionuclides in Class B or C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes shall be Class B unless the concentrations of other radionuclides in Table II determine the waste to be Class C independent of these radionuclides.

- When the concentration does not exceed the value in Column 1 of Table II, the waste is Class A.
- When the concentration exceeds the value in Column 1 but does not exceed the value in Column 2 of Table II, the waste is Class B.
- When the concentration exceeds the value in Column 2 but does not exceed the value in Column 3 of Table II, the waste is Class C.
- For wastes containing mixtures of the radionuclides listed in Table II, the total concentration shall be determined by the sum of fractions rule.

For waste material that contains more than one radionuclide, the waste must be classified by applying the sum of fractions rule described in UAC R313-15-1008(1)(g). This rule states:

> "For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each radionuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits shall all be taken from the same column of the same table. The sum of fractions for the column shall be less than 1.0 if the waste class is to be determined by that column."

The following examples demonstrate the application of the sum of fractions rule in determining waste class.

EXAMPLE #1: A generator has one 55 gallon container of soil contaminated with plutonium-238, radium-226, uranium-234, uranium-235, uranium-238, cesium-137, and strontium-90. The density of the soil is 1.6 g/cm^3 and is used to convert concentration units from pCi/g to Ci/m^3. The radionuclide concentration in the container is as follows:

Radionuclide	Container Concentration (pCi/g)	Container Concentration (Ci/m^3)*	Table I Class A Concentration Limit (pCi/g)	Table II Class A Concentration Limit (Ci/m^3)
Pu-238	3,000	4.8 E-03	10,000	- -
Ra-226	6,000	9.6 E-03	10,000	- -
U-238	5,000	8.0 E-03	- -	- -
U-235	1,100	1.8 E-03	- -	- -
U-234	5,000	8.0 E-03	- -	- -
Sr-90	5,000	8.0 E-03	- -	0.04
Cs-137	8,000	1.3 E-02	- -	1

* The soil density (1.6 g/cm^3) is used to convert from pCi/g to Ci/m^3.

The sum of fractions rule is applied to the container according to the radionuclides listed in Table I and II as follows:

$$\text{Table I:}\quad \frac{3.0E+03}{1.0E+04}+\frac{6.0E+03}{1.0E+04}=9.0E-01$$

$$\text{Table II:}\quad \frac{8.0E-03}{4.0E-02}+\frac{1.3E-02}{1.0E+00}=2.6E-02$$

Based on the sum of fractions rule, the waste in this container is determined to be Class A waste (i.e., 90 percent of the Class A limit for Table I radionuclides). This container is acceptable for disposal at EnergySolutions since it meets the sum of fractions rule. The uranium radionuclides are not included in the sum of fractions calculation since these radionuclides are not included in Table I or II of R313-15-1008.

EXAMPLE #2: A generator has one 55 gallon container of Dry Active Waste (DAW) contaminated with americium-241, technetium-99, europium-155, colbalt-58, and cesium-135. The density of the DAW is 0.25 g/cm^3 and is used to convert Table II units from pCi/g to Ci/m^3. The radionuclide concentration in the container is as follows:

Radionuclide	Container Concentration (pCi/g)	Container Concentration (Ci/m^3)*	Table I Class A Concentration Limit (pCi/g)	Table II Class A Concentration Limit (Ci/m^3)
Am-241	6,000	1.5 E-03	10,000	- -
Tc-99	900,000	2.3 E-01	0.3 Ci/m^3	- -
Eu-155	150,000	3.8 E-02	- -	700
Co-60	100,000	2.5 E-02	- -	700
Cs-135	500,000	1.3 E-01	- -	- -

* The DAW density (0.25 g/cm^3) is used to convert from pCi/g to Ci/m^3.

The sum of fractions rule is applied to the container according to the radionuclides listed in Table I and II as follows:

$$\text{Table I:}\quad \frac{6.0E+03}{1.0E+04}+\frac{2.3E-01}{3.0E-01}=1.4E+00$$

$$\text{Table II:}\quad \frac{3.8E-02}{7.0E+02}+\frac{2.5E-02}{7.0E+02}=9.0E-05$$

Based on the sum of fractions rule, the waste in the DAW container exceeds the Table I Class A concentration limit and would not be acceptable at EnergySolutions. Note that Cs-135 is not included in the sum of fractions calculation since this radionuclide is excluded in Table I or II of R313-15-1008.

Waste Classification Labels on Packages

All waste packages containing LLRW (including Mixed LLRW) must be labeled either "Class A Unstable" or "Class AU" and appropriately marked in Block 16 of the Uniform Low-Level Radioactive Waste Manifest Form 541. There are no State or Federal regulations that prescribe the size or color of the classification labels. The Utah DRC, however, requires that each package be labeled with a minimum of 0.5-inch lettering in contrasting color ("Generator Site Access Permit Enforcement Policy - Utah Division of Radiation Control", as amended). This requirement also applies to bulk packaging (e.g., intermodals, gondolas, etc.).

LLRW Compact Export Approval

EnergySolutions' disposal site is not classified as a LLRW compact site under the Federal Low-Level Radioactive Waste Policy Act, as amended. Condition 9A of the Radioactive Material License requires generators to demonstrate that the LLRW has been approved for export to EnergySolutions prior to the initial shipment of waste. Approval is required from the LLRW compact of origin, or for states unaffiliated, the state of origin. This license condition only applies to non-DOE generators of LLRW and excludes Mixed LLRW. In addition, EnergySolutions is not authorized to receive LLRW from the Northwest Compact. Please contact EnergySolutions for assistance in complying with this license condition.

3.1.2 NORM/NARM Waste

EnergySolutions' Radioactive Material License allows receipt and disposal of Naturally Occurring or Accelerator-Produced Radioactive Material (NORM/NARM). NORM/NARM does not include Byproduct, Source, or Special Nuclear Material and generally contains radionuclides in the uranium and thorium decay series. Since NORM/NARM waste is not considered LLRW, the waste classification regulations do not apply.

3.1.3 Class A Mixed Low-Level Radioactive Waste

EnergySolutions is authorized to receive Class A Mixed Low-Level Radioactive Waste (Mixed Waste) for (1) disposal, or (2) treatment and disposal. Mixed Waste is defined by EnergySolutions' RCRA Part B Permit (# UTD982598898) as:

> Waste defined by the Low Level Radioactive Waste Policy Act, Public Law 96-573; this is radioactive waste not classified as high-level radioactive waste, transuranics waste, spent nuclear fuel, or byproduct material as defined by section 11e.(2) of the Atomic Energy Act, and contains hazardous waste that is either listed as a hazardous waste in Subpart D of 40 CFR 261 and/or exhibits any of the hazardous waste characteristics identified in Subpart C of 40 CFR 261, or hazardous waste which also contains naturally occurring radioactive materials.

In accordance with 40 CFR 268.7, a Land Disposal Restriction Notification and/or Certification must accompany each shipment of Mixed Waste. This includes former hazardous wastes that have been treated to remove the Hazardous Waste Codes.

3.1.3.1 Acceptable Hazardous Waste Codes

The specific EPA Hazardous Waste Codes that may be received by EnergySolutions are identified in its RCRA Part B Permit. A copy of this permit is included on EnergySolutions' web site at www.energysolutions.com or on the Utah Division of Solid and Hazardous Waste web site at www.hazardouswaste.utah.gov/envirocare.htm. The following Utah Hazardous Waste Codes are not acceptable at EnergySolutions: F999 and P999.

3.1.3.2 LDR Compliant Mixed Waste

Mixed Waste must be analyzed to determine if treatment is required prior to disposal. Mixed Waste that is determined to be compliant with the Land Disposal Restriction (LDR) treatment standards specified in 40 CFR 268 may be directly disposed in EnergySolutions' Mixed Waste disposal embankment. EnergySolutions is required to verify LDR compliance for all Mixed Waste streams prior to disposal.

Condition 14.B of the Radioactive Material License prohibits EnergySolutions from disposing of characteristic Mixed Waste after treatment in the LLRW disposal embankment. EnergySolutions has extended this condition to Mixed Waste treated by generators at their facility. The waste profile must describe the waste as having undergone treatment. As a result, any waste that at the point of generation was considered a hazardous waste per 40 CFR 261 will be disposed of in the Mixed Waste disposal embankment. As noted above, an LDR Certification must be included with the shipping paperwork for treated Mixed Waste (including formerly characteristic or listed hazardous waste).

3.1.3.3 Mixed Waste Requiring Treatment

EnergySolutions may also receive Mixed Waste that requires treatment in order to comply with LDR treatment standards. EnergySolutions is approved under the RCRA Part B Permit to operate a mixed waste treatment facility. Mixed Waste that is not LDR compliant may be treated by EnergySolutions using one of the following treatment technologies or methods:

- Chemical Stabilization, Oxidation, Reduction, Neutralization, and Deactivation
- Macroencapsulation of hazardous debris or radioactive lead solids
- Debris Spray Washing
- Microencapsulation
- Thermal Treatment of Organics
- Mercury Treatment (Amalgamation)

Chemical Stabilization

Chemical stabilization involves the addition of approved chemical reagents in accordance with a waste-specific treatment formula and is performed in mixers at EnergySolutions' Treatment Facility. Formula additions of waste, reagents, and water involve the following chemical processes to chemically bind contaminants to reduce their ability to leach from the waste.

- Stabilization (STABL)
- Deactivation (DEACT)
- Neutralization (NEUTR)
- Oxidation (CHOXD)
- Reduction (CHRED)

Formula development may also be applied to Mixed Waste with very low levels of organic contaminants that require chemical destruction in order to meet total concentration based standards versus a leach standard as determined by the Toxicity Characteristic Leaching Procedure (TCLP) test. Mixed Waste requiring chemical stabilization may be sized and homogenized using various equipment including shredders, vibrating screens, and mixers.

Macroencapsulation of Hazardous Debris and Radioactive Lead Solids

Mixed Waste consisting of hazardous debris may be macroencapsulated as illustrated in Figure 3-1 in accordance with the "Alternative Treatment Standards for Hazardous Debris" as specified in 40 CFR 268.45. Treatment of hazardous debris via macroencapsulation must meet the following criteria:

> "Macroencapsulation of hazardous debris requires application of surface coating materials such as polymeric organics (e.g., resins and plastics) or use of a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media" (40 CFR 268.45).

In order for hazardous debris to qualify for this alternative treatment, the waste must comply with the debris definition in 40 CFR 268.2(g).

> "Debris means solid material exceeding a 60 mm particle size that is intended for disposal and that is: A manufactured object; or plant or animal matter; or natural geologic material. However, the following materials are not debris: Any material for which a specific treatment standard is provided in Subpart D, Part 268, namely lead acid batteries, cadmium batteries, and radioactive lead solids; Process residuals such as smelter slag and residues from the treatment of waste, wastewater, sludges, or air emission residues; and intact containers of hazardous waste that are not ruptured and that retain at least 75% of their original volume. A mixture of debris that has not been treated to the standards provided by § 268.45 and other material is subject to regulation as debris if the mixture is comprised primarily of debris, by volume, based on visual inspection" (emphasis added).

Figure 3-1. Macroencapsulation of Hazardous Debris

Therefore, packaged waste subject to macroencapsulation (MACRO) may contain other material that does not meet the debris definition (e.g., paint chips, scale, etc.) to the extent that the mixture is "comprised primarily of debris". Consistent with the ALARA principle, this definition provides generators with

flexibility in managing waste streams requiring treatment without having to sort and segregate non-debris items prior to treatment. However, as noted in 40 CFR 268.2(h), "deliberate mixing of other hazardous material with debris to change its treatment classification (i.e., from waste to hazardous debris) is not allowed under the dilution prohibition in § 268.3."

Radioactive Lead Solids (RLS) are another type of hazardous waste that requires treatment via macroencapsulation. Radioactive Lead Solids include, but are not limited to, all forms of lead shielding and other elemental forms of lead. There are no size criteria for RLS unlike the 60 mm particle size requirement for hazardous debris. As such, smaller forms of RLS such as lead shot or fines require macroencapsulation prior to disposal.

EnergySolutions' MACRO treatment capability accommodates any size or weight of hazardous debris, thus enabling the generator to reduce the amount of time and cost associated with preparing waste packages for shipment. Generators with large debris over 20,000 pounds requiring macroencapsulation will provide the following information to EnergySolutions for review during the waste acceptance process: drawings, photographs, dimensions, weight, description of access ports to internal voids, radiological dose rate and contamination levels, and loading plans.

Debris Spray Washing

Debris Spray Washing is another alternative treatment option utilized by EnergySolutions to treat hazardous debris. High pressure water is sprayed at the debris surface to remove hazardous constituents to a "clean debris surface". This treatment technology is best if used on non-porous debris such as metal. ''Clean debris surface'' criteria are specified in 40 CFR 268.45:

> "Clean debris surface means the surface, when viewed without magnification, shall be free of all visible contaminated soil and hazardous waste except that residual staining from soil and waste consisting of light shadows, slight streaks, or minor discolorations, and soil and waste in cracks, crevices, and pits may be present provided that such staining and waste and soil in cracks, crevices, and pits shall be limited to no more than 5% of each square inch of surface area."

Microencapsulation

Microencapuslation (MICRO) is a technology used on Mixed Waste to reduce the leachability of the hazardous constituent. The types of Mixed Waste most suitable for MICRO include, but are not limited to, ash, powders, and salts. MICRO involves the combining of waste with molten polyethylene to form a material that does not leach hazardous constituents in excess of established TCLP treatment standards. Mixed Waste is placed into the mixer with polyethylene. These are mixed at a high frequency with shear and frictional forces until the polyethylene melts and mixes with the waste to create a microencapsulated waste form. The treatment system includes size separation, size reduction, and a waste dryer for waste preparation prior to treatment.

Thermal Treatment of Organics

Mixed Waste streams contaminated with organic hazardous constituents are among the most difficult waste streams to treat. The LDR treatment standards are expressed in terms of total organic concentrations (i.e., mg/kg) versus TCLP concentration based standards. As such, treatment of organic contaminated waste streams requires either destruction or removal of the organic constituent from the waste.

EnergySolutions utilizes Vacuum-Assisted Thermal Desorption technology (VTD) to treat organic contaminated waste streams. Mixed Waste streams are heated in the VTD system at sufficient temperatures

to volatize the organic constituents which are then condensed and collected as a liquid. The thermally treated residue is then sampled to verify LDR compliance. In some cases, the treatment residue will require additional treatment to stabilize hazardous metals prior to disposal. The organic liquid condensate will require further treatment to comply with LDR treatment standards.

Mercury Treatment

Elemental mercury contaminated with radioactive materials must be treated via amalgamation per 40 CFR 268.40. Amalgamation of elemental mercury involves the mixing of reagents with the mercury to produce a non-liquid, semi-solid amalgam that reduces the potential emissions of elemental mercury vapors to the air. The Utah DSHW also requires the amalgamation treatment to reduce the leachability of elemental mercury to below the characteristic concentration limit of 0.2 mg/L TCLP. This requirement applies to amalgamated mercury treated at either EnergySolutions' Treatment Facility or treated at another facility and shipped to EnergySolutions for disposal. Generators may ship elemental mercury contaminated with radioactive materials to EnergySolutions for treatment and disposal.

EnergySolutions is also capable of treating both Low (< 260 ppm Hg) and High Mercury Subcategory waste streams (≥ 260 ppm Hg). Waste streams containing Low Subcategory Mercury must be treated to less than 0.025 mg/L TCLP mercury. The EPA requires High Mercury Subcategory waste streams be treated thermally by incinerating (IMERC) or retorting (RMERC). EnergySolutions has received a site-specific treatment variance from the Utah Solid and Hazardous Waste Control Board to treat High Mercury Subcategory waste streams via stabilization instead of IMERC or RMERC. Consequently, waste streams containing High Subcategory Mercury are treated via stabilization and analyzed post-treatment to ensure the TCLP mercury results are less than 0.2 mg/L.

Hazardous debris that is contaminated with mercury may be macroencapsulated in accordance with the "Alternative Treatment Standards for Hazardous Debris" as specified in 40 CFR 268.45. Elemental mercury must be removed from hazardous debris to the maximum extent practical including, but not limited to, draining pumps, hoses, pipes, etc. and wiping excessive mercury from external surfaces.

3.1.4 11e.(2) Byproduct Material

EnergySolutions is licensed by the Utah DRC to receive and dispose of 11e.(2) byproduct material as defined by the Atomic Energy Act, as amended. 11e.(2) byproduct material is defined as the tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. Shipments of 11e.(2) waste will be managed and disposed of in a separate disposal embankment specifically licensed and designed for this material.

3.1.4.1 Radionuclide Concentration Limits

EnergySolutions may accept 11e.(2) byproduct material with an average concentration in any transport vehicle (truck or railcar) not to exceed 4,000 pCi/g for natural uranium or for any radionuclide in the Radium-226 series, 60,000 pCi/g for Thorium-230, or 6,000 pCi/g for any radionuclide in the thorium decay series. EnergySolutions' 11e.(2) Byproduct Material License does not require a sum of fractions calculation. The concentration limits are based on the average concentration of the 11e.(2) byproduct material over the transport vehicle upon receipt and not each individual container on the transport vehicle.

3.1.4.2 Acceptable Forms of 11e.(2) Byproduct Material

In addition to soil and soil-like 11e.(2) byproduct material, EnergySolutions may accept 11e.(2) contaminated debris. The generator must certify in the Radioactive Waste Profile Record that the debris was either generated during the cleanup of an 11e.(2) facility or is an integral part of the operations of extraction or concentration of uranium or thorium.

All debris must be less than 10 inches in at least one dimension and no longer than 8 feet in any dimension. Debris that exceeds this size limit (e.g., 11e.(2) oversize debris) is not acceptable for disposal under the 11e.(2) license. Generators with 11e.(2) contaminated debris that are unable to size the debris prior to shipment must contact EnergySolutions' Customer Service representative to make necessary arrangements for EnergySolutions to size the debris upon receipt.

Shipments of 11e.(2) byproduct material containing free liquid will be considered nonconforming and managed in accordance with EnergySolutions' 11e.(2) license.

3.1.4.3 Certification of 11e.(2) Byproduct Material

EnergySolutions requires that each generator or owner certify in writing that the waste is 11.e(2) byproduct material as defined by the Atomic Energy Act, as amended. Specifically, the generator or owner must certify that the waste materials are tailings or waste produced by extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. The generator or owner must also certify that the waste material does not contain any other radioactive waste or hazardous waste. The generator or owner must provide the following information as it relates to the 11e.(2) byproduct material:

- License under which the waste was processed
- Licensee that was issued the license
- License issue and/or expiration date
- Issuing agency
- Type of license
- Volume of tailings

The generator or owner must attach to the certification a list of all radiological and non-radiological constituents in the waste and the maximum and average concentrations of such constituents. EnergySolutions will perform an independent verification as to the accuracy of the information contained in the certification.

3.1.4.4 Shipping Paperwork for 11e.(2) Byproduct Material

Although 11e.(2) byproduct material is specifically excluded from the definition of Low-Level Radioactive Waste; EnergySolutions requires that all shipments be manifested using the Uniform Low-Level Radioactive Waste Manifest (NRC Forms 540 and 541). However, 11e.(2) byproduct material does not have to be classified in accordance with the requirements of URC R313-15-1008. Generators may enter "N/A" in column 16 of the NRC Form 541 for Waste Classification.

3.1.5 Special Nuclear Material

Condition 13 of the Radioactive Materials License incorporates the Special Nuclear Material Exemption issued by the NRC. Under specified conditions, the exemption allows EnergySolutions to possess waste containing SNM in greater mass quantities than prescribed in 10 CFR Part 150 without obtaining an NRC license pursuant to 10 CFR Part 70. The conditions are based on concentration limits of SNM in the waste and have been established by the NRC to ensure criticality safety. Special Nuclear Material (SNM) is defined in the UAC R313-12-3 as:

> Plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, and other material that the U.S. Nuclear Regulatory Commission, pursuant to the provisions of Section 51 of the Atomic Energy Act of 1954, as amended, determines to be Special Nuclear Material, but does not include source material; or any material artificially enriched by any of the foregoing but does not include source material.

Each generator shipping waste containing SNM (i.e., uranium enriched in U-235, U-233, Pu-236, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Pu-243, or Pu-244) must complete and sign EnergySolutions' SNM Exemption Certification form (EC-0230-SNM) as part of the waste profiling process. A copy of this form must also accompany each radioactive waste manifest for waste streams that contain any of the above isotopes. The SNM Exemption Certification form lists specific requirements that must be met in order for EnergySolutions to receive and accept waste containing any amount of SNM.

The NRC developed the SNM Exemption conditions based on criticality studies and independent calculations. A variety of scenarios were analyzed to determine limiting criticality conditions for waste materials containing SNM. The NRC determined that several conditions in addition to concentration limits would be required to assure criticality safety. A discussion of their approach is documented in the *Safety Evaluation Report Regarding the Proposed Exemption from Requirements of 10 CFR Part 70* (SER) (Docket 40-8989). Specific guidance from the SER is included in this section.

The following information provides general guidance on completing the SNM Exemption Certification form. These guidelines are grouped into four sections similar to the sections on the form.

3.1.5.1 Condition 1 - Percent Enrichment of Uranium-235

The first section contains a table that lists U-235 concentration limits and related measurement uncertainty values for four different scenarios. These scenarios allow for different enrichments, waste configurations and commingling with moderating material in different percentages. The measured concentrations and associated uncertainties of U-235 in individual waste containers at time of receipt must not exceed the values listed in the RML, Condition 13. Generators with low SNM concentrations relative to the specified limits may select the most restrictive scenario which allows more flexibility in demonstrating compliance with other conditions in the SNM Exemption. Check "Not Applicable" if the waste does not contain enriched U-235. Other SNM isotopes including U-233, Pu-236, and Pu-238 through Pu-244 and their associated limits are also listed.

The measurement uncertainty values listed in the last column of the table represent a maximum allowable concentration limit rather than a percentage value. The NRC provides the following guidance in the SER:

> Staff considers that a reasonable measurement uncertainty value (one-sigma) would be in the range of 15 percent. Staff used 30 percent (two-sigma) in calculating the operational limit to increase the confidence level that the concentration of the waste based on a measurement

would not exceed the subcritical value. Other radiochemistry techniques may be used to quantify the concentration of these radionuclides. These techniques typically have lower measurement uncertainty levels, but introduce sampling uncertainty. The measurement uncertainty levels are included in condition 1 and represent 15 percent of the maximum concentration value. A concentration value was used for the measurement uncertainty rather than a percentage value to allow greater flexibility for generators with waste having very low SNM concentrations.

3.1.5.2 Condition 2 – Specified Limits for Waste Containing SNM

Each generator must certify to all five conditions listed in this section and provide justification based on process knowledge, physical observations, and/or testing. These conditions are categorized as follows:

- SNM Isotope Concentration Limits
- Spatial Distribution Requirements
- Bulk Chemical Limits
- Unusual Moderator Limits
- Soluble Uranium Limits

These conditions require the generator to adequately characterize the waste in terms of the range and variability of SNM concentrations in the waste.

SNM Isotope Concentration Limits

Condition 2.a requires the generator to certify that concentrations of SNM in individual waste containers do not exceed the applicable U-235 concentration limit and the concentration limits for all isotopes listed in Table 1 of the SNM Exemption Certification form. Generators must certify that measurement uncertainty values from radiological testing are less than the maximum allowable concentration values listed in Table 1. As previously stated, a concentration value was used for the measurement uncertainty rather than a percentage value to allow greater flexibility for generators with waste having very low SNM concentrations.

Spatial Distribution Requirements

Condition 2.b requires the generator to certify that the SNM is homogeneously distributed throughout the waste or that the SNM concentrations in any contiguous mass of 600 kilograms (1,323 lbs) do not exceed on average the specified limits. This certification may be based on process knowledge or testing of the waste. The SER provides the following guidance on verifying spatial distribution of SNM:

> Knowledge of the process by which the waste was generated or laid down may assure that the concentration varies smoothly throughout the volume with a maximum in a known location. It is then only necessary to measure the concentration at this maximum plus other measurements confirming smooth variation. In other cases where a smooth variation in SNM concentration in the waste is not present, additional measurements and characterization will be needed.

If spatial distribution of SNM in the waste is not known through process knowledge, generators may be able to certify to this requirement by using the following example.

EXAMPLE: A generator's waste stream contains less than 10 percent enriched U-235. Based on the limits in Condition 1, the corresponding U-235 concentration limit is 1,900 pCi/g. The mass of U-235 at a concentration of 1,900 pCi/g in 600 kg of waste can be calculated using the specific activity for U-235 ($2.16X10^6$ pCi/g) as follows:

$$\frac{1{,}900\,\frac{pCi}{g} \times 600{,}000\,g}{2.16X10^6\,\frac{pCi}{g}} = 527.8\ g\ U235$$

If the total mass of U-235 per container does not exceed the mass of U-235 in 600 kg of waste at 1,900 pCi/g, then compliance with the spatial distribution requirement can be achieved. Therefore, for this example, the mass of U-235 in the waste containers must not exceed 527.8 grams. Compliance with DOT regulations must also be met for shipments containing SNM.

Radioactive liquid waste containing SNM may also be accepted for solidification prior to disposal provided the SNM concentration does not exceed the SNM concentration limits specified in Condition 1. For containers of liquid waste with more than 600 kg of waste, the total activity (pCi) in the manifested container must not exceed the SNM concentration in Condition 1 times 600 kg of waste. For example, the maximum activity of Pu-239 in any manifested container of liquid waste is 6.0 mCi as shown below:

$$10{,}000\,\frac{pCi}{g} \times 600{,}000\ g = 6.0X10^9\ pCi = 6.0\ mCi\ Pu\text{ - }239$$

The maximum activity of SNM in the liquid waste is limited by the volume of liquid shipped in a container and the concentration of SNM in the waste. Consequently, to comply with this condition, the Pu-239 concentration allowed in the liquid waste decreases as the size of the shipping container increases.

Bulk Chemical Requirements

Condition 2.c excludes wastes containing "pure forms" of chemicals containing carbon, fluorine, magnesium, or bismuth in bulk quantities except as allowed by the conditions in Section 1 (e.g., a pallet of drums, a B-25 box). By "pure forms," it is meant that mixtures of the above elements such as magnesium oxide, magnesium carbonate, magnesium fluoride, bismuth oxide, etc. do not contain other elements. Demonstration of compliance with this condition may be based on process knowledge or testing.

The exclusion of bulk quantities of these chemicals in waste containing SNM is based on the criticality studies conducted by Oak Ridge National Laboratories (ORNL) for the NRC. The ORNL studies used silicon dioxide (SiO_2) to represent the waste matrix in performing criticality calculations. Additional studies were performed replacing the silicon in the SiO_2 matrix with other common elements and determined that the above chemicals produced more reactive systems. Therefore, the NRC implemented this condition to restrict waste forms that contain pure forms of these chemicals.

Unusual Moderator Limits

Condition 2.d limits the total quantities of beryllium, hydrogenous material enriched in deuterium, or graphite to one percent or less of the total weight of the waste (except as allowed by the conditions in

Section 1). Information supporting this requirement may be based on process knowledge, physical observations, or testing. The following explanation from the SER provides the basis for this limit:

> Unusually effective neutron moderating materials, such as beryllium, graphite, or heavy water, could provide a more reactive matrix. Previous evaluations have shown that the presence of large amounts of beryllium can permit criticality to occur at lower concentrations of SNM in soil. Therefore, limiting unusual moderators is required to assure the effectiveness of the SNM concentration limits in maintaining criticality safety. Because prohibiting unusual moderators could result in problems demonstrating compliance, staff decided to set a finite maximum limit on unusual moderators.

Soluble Uranium Limits

Condition 2.e limits highly soluble forms of uranium in waste packages to 350 grams of uranium-235 or 200 grams of uranium-233. If the waste contains mixtures of U-233 and U-235, the waste must meet the sum of the fractions rule on a container basis. Highly soluble forms of uranium include, but are not limited to: uranium sulfate, uranyl acetate, uranyl chloride, uranyl formate, uranyl fluoride, uranyl nitrate, uranyl potassium carbonate, and uranyl sulfate. Compliance with this condition may be based on process knowledge or testing.

This condition is based on an evaluation performed by the NRC to determine mechanisms that could increase the concentration of SNM in the waste. The SER identifies one such mechanism which involves the potential for highly soluble uranium to be readily leached with water and concentrate in the waste. Generators must evaluate each waste stream to determine the chemical composition of uranium in the waste and to ensure that the presence of highly soluble forms of uranium do not exceed the mass limits specified above.

3.1.5.3 Condition 3 – Characterization of Waste Containing SNM

The NRC developed specific pre-shipment requirements that have been implemented into the waste profiling process. EnergySolutions reviews this information to determine if the pre-shipment waste characterization and assurance plan is complete and that the supporting information is sufficient to demonstrate compliance with all SNM Exemption requirements. This section describes the information that must be attached to the Waste Profile and includes the following items:

- Waste Description
- Waste Characterization Summary
- Uniformity Description
- Manifest Concentration

Condition 3.a requires the generator to describe how the waste was generated, the physical form of the waste, and the uranium chemical composition. The uranium chemical composition of the waste is required to support condition 2.e which limits highly soluble forms of uranium. If compliance with this requirement cannot be demonstrated by process knowledge, approved laboratory methods are available to determine the uranium leaching characteristics of the waste.

Condition 3.b requires the generator to describe how the waste was characterized, the range of SNM concentrations, and the analytical results with error values used to develop the concentration ranges. This information is required to support Conditions 1, 2.a, and 2.b. Generators must sufficiently sample and characterize the waste to ensure that the SNM concentrations do not exceed the specified limits and that the SNM is homogeneously distributed throughout the waste.

A description of the spatial distribution of SNM in the waste is required by Condition 3.c. This description supports the certification of Condition 2.b. The NRC provides guidance in the SER to assist generators in demonstrating compliance with this requirement. Section 3.3.3.2 contains the related NRC guidance.

Condition 3.d requires a description of the methods that will be used to determine the SNM concentrations on the manifests. If concentrations of SNM are significantly lower than the specified limits or the SNM is uniformly distributed throughout the waste, generators are not necessarily required to perform direct measurements on every container. Appropriate methods such as scaling factors may be used in these instances. As SNM concentrations approach the limits, however, generators must perform more extensive characterization to determine the range and variability of SNM in the waste. The following NRC guidance is provided in the SER:

> Where the concentration is a small fraction of the concentration limit and characterization results indicate relatively small variation in that concentration, using scaling factors would be an appropriate method to determine SNM concentrations in individual waste containers. However, where the concentration of SNM approaches the concentration limit or the characterization results indicate large variations in SNM containers, using direct measurements on each package would be an appropriate method to determine SNM concentrations in individual waste containers.

Waste packages that contain elevated concentrations of SNM must be characterized by direct measurements which should involve sampling and/or radiological testing procedures for individual packages.

3.1.5.4 Condition 4 – Generator's Certification

The generator's certification of compliance is required in the final section. Each generator must certify that the information provided on the SNM Exemption Certification form is complete, true, and accurate. The form and all supporting information must be attached to the Waste Profile upon submission to EnergySolutions. In addition, the SNM Exemption Certification form must be included with each waste manifest. The information supporting the form, however, should not be included with the manifest.

3.1.6 Polychlorinated Biphenyl (PCB) Radioactive Waste

EnergySolutions is authorized to receive and dispose of most types of PCB/radioactive and PCB/mixed wastes defined by the EPA in 40 CFR 761. The EPA issued EnergySolutions a TSCA Coordinated Approval for receipt and disposal of drained PCB Articles and PCB Containers that contained PCB concentrations equal to or greater than 500 ppm. Wastes received under the TSCA Coordinated Approval must be disposed in the Mixed Waste disposal embankment. All PCB waste shipped to the Mixed Waste disposal facility must be accompanied with a Uniform Hazardous Waste Manifest.

The following sections describe the types of PCB waste categories acceptable for disposal at the Class A LLRW or Mixed Waste disposal embankments. Asterisks indicate PCB waste categories that require disposal in EnergySolutions' Mixed Waste disposal embankment.

EnergySolutions' Ground Water Quality Discharge Permit (GWQDP) and RCRA Permit prohibit the receipt of any PCB liquids except for 1) intact, non-leaking PCB Small Capacitors or 2) PCB waste that will be

treated via VTD. Shipments of PCB wastes containing free liquid will not be accepted by EnergySolutions. Generators shipping PCB wastes in re-usable containers must be lined to prevent PCB contamination on the internal surfaces of the container. Containers contaminated with PCBs will be returned to the shipper as a PCB Container.

3.1.6.1 PCB Remediation Waste

PCB Remediation waste is waste containing PCBs as a result of a spill, release, or other unauthorized disposal, at the following concentrations: (1) Materials disposed of prior to April 18, 1978, that are currently at concentrations ≥ 50 ppm PCBs, regardless of the concentration of the original spill; (2) materials which are currently at any volume or concentration where the original source was ≥ 500 ppm PCBs beginning on April 18, 1978, or ≥ 50 ppm PCBs beginning on July 2, 1979; and (3) materials which are currently at any concentration if the PCBs are spilled or released from a source not authorized for use under this part. PCB remediation waste means soil, rags, and other debris generated as a result of any PCB spill cleanup, including, but limited to soil, gravel, dredged materials, such as sediments, settled sediment fines, and aqueous decantate from sediment, sewage sludge containing < 50 ppm PCBs, buildings and other man-made structures (such as concrete floors, wood floors, or walls) porous surfaces, and non-porous surfaces. Unless sampled and analyzed in accordance with 40 CFR 761.283, .286, or .292, the PCB waste shall be assumed to contain ≥ 50 ppm PCBs (40 CFR 761.61(a)(5)(i)(B)(2)(i)).

PCB Remediation Waste Category	**Definition**	**Acceptable**
Non-liquid Cleaning Materials and PPE	Includes non-porous surfaces and other non-liquid materials such as rags, gloves, booties, other disposable PPE, and similar materials resulting from PCB cleanup activities.	Yes
< **50 ppm or** < **100 μg/100 cm^2**	PCB Remediation waste containing < 50 ppm or < 100 μg/100 cm^2.	
≥ **50 ppm or** ≥ **100 μg/100 cm^2**	PCB Remediation waste containing ≥ 50 ppm or ≥ 100 μg/100 cm^2.	Yes*
* Requires disposal in EnergySolutions' Mixed Waste disposal embankment.		

3.1.6.2 PCB Bulk Product Waste

PCB Bulk Product waste is waste derived from manufactured products containing PCBs in a non-liquid state, at any concentration where the concentration at the time of designation for disposal was ≥ 50 ppm PCBs. PCB Bulk Product waste includes bulk wastes or debris from the demolition of buildings and other man-made structures manufactured, coated, or serviced with PCBs.

PCB Bulk Product Waste Category	Definition	Acceptable
Presumed or known to leach < 10 μg/L PCBs	Plastics (such as plastic insulation from wire or cable; radio, television and computer casings; vehicle parts; or furniture laminates); preformed or molded rubber parts and components; applied dried paints, varnishes, waxes or other similar coatings or sealants; caulking; Galbestos; non-liquid building demolition debris; or non-liquid PCB bulk product waste from the shredding of automobiles or household appliances from which PCB small capacitors have been removed (shredder fluff). Other PCB Bulk Product waste that leaches PCBs at < 10 ug/L of water measured using a procedure used to simulate leachate generation.	Yes
Presumed or known to leach ≥ 10 μg/L PCBs	Paper or felt gaskets, fluorescent light ballasts with PCBs in the potting material ≥ 50 ppm	Yes*
* Requires disposal in EnergySolutions' Mixed Waste disposal embankment.		

3.1.6.3 PCB Articles

A PCB Article is any manufactured article, other than a PCB Container, that contains PCBs and whose surfaces have been in direct contact with PCBs. A "PCB Article" includes capacitors, transformers, electric motors, pumps, pipes and any other manufactured item (1) which is formed to a specific shape or design during manufacture, (2) which has end use functions dependent in whole or in part upon its shape or design during end use, and (3) which has either no change of chemical composition during its end use or only those changes of composition which have no commercial purpose separate from that of the PCB Article.

EnergySolutions received a TSCA Coordinated Approval from the EPA to receive and dispose of drained PCB Articles. PCB Articles must be drained of all liquid to the maximum extent practical but in no case shall the liquid exceed one percent of the waste volume (all free liquid must be absorbed). PCB Articles that have been drained must be filled with sufficient absorbent material to absorb all remaining liquid. Some PCB Articles also require flushing with solvents for a specified time period prior to receipt at EnergySolutions (e.g., PCB Transformers).

The following table lists the various types of PCB Articles and whether the material is acceptable for disposal in either the mixed waste disposal embankment or LLRW disposal embankment.

PCB Articles Category	Definition	Acceptable
PCB Transformers	Any transformer that contains ≥ 500 ppm PCBs.	Yes*[1]
PCB Capacitors (Intact and non-leaking)	Any capacitor that contains ≥ 500 ppm PCBs. Capacitor is a device for accumulating and holding a charge of electricity and consisting of conducting surfaces separated by a dielectric. Assume PCBs ≥ 500 ppm in a capacitor of unknown concentration made prior to July 2, 1979. Assume PCBs < 50 ppm in a capacitor made after July 2, 1979.	--
PCB Small Capacitors	A capacitor which contains less than 3 lbs of dielectric fluid. A capacitor whose total volume is less than 100 cubic inches may be considered to contain less than 3 lbs of dielectric fluid. Includes fluorescent light ballasts containing intact and non-leaking PCB small capacitors and PCB potting material (< 50 ppm).	Yes*
PCB Large High or Low Voltage Capacitors	A large high voltage capacitor contains 3 lbs or more of dielectric fluid and which operates at or above 2,000 volts. A large low voltage capacitor contains 3 lbs or more of dielectric fluid and which operates below 2,000 volts.	No
PCB Hydraulic Machines	Includes die casting machines	Yes*[2]
PCB-Contaminated Electrical Equipment	Any electrical equipment (such as transformers, capacitors, and circuit breakers, including those in railroad locomotives and self-propelled cars) which contain ≥ 50 ppm and < 500 ppm PCBs in the dielectric fluid. In the case of dry electrical equipment, the electrical equipment is PCB-Contaminated if it has PCBs > 10 ug/100 cm^2 and < 100 ug/100 cm^2 as measured by a standard swipe test (40 CFR 761.123).	Yes
Other PCB Articles		--
PCB Article (≥ 500 ppm PCBs)		Yes*
PCB-Contaminated Article	Any article which contains ≥ 50 ppm and < 500 ppm PCBs in the dielectric fluid. In the case of dry electrical equipment, the electrical equipment is PCB-Contaminated if it has PCBs > 10 ug/100 cm^2 and < 100 ug/100 cm^2 as measured by a standard swipe test per 40 CFR 761.123.	Yes

* Requires disposal in EnergySolutions' Mixed Waste disposal embankment.
[1] Requires solvent flushing.
[2] Requires solvent flushing if PCB concentrations ≥ 1,000 ppm.

3.1.6.4 PCB Containers

A PCB Container is any package, can, bottle, bag, barrel, drum, tank, or other device that contains PCBs or PCB Articles and whose surfaces have been in direct contact with PCBs. PCB Containers must not contain any free standing liquid.

PCB Container Category	Definition	Acceptable
≥ **500 ppm PCBs**	The PCB concentration of material which was contained in the PCB Containers was ≥ 500 ppm	Yes*
< 500 ppm PCBs	The concentration of material which was contained in the PCB containers was < 500 ppm	Yes
* Requires disposal in EnergySolutions' Mixed Waste disposal embankment.		

3.1.7 UCNI and Export Controlled Waste

EnergySolutions has been granted approval from the DOE to receive Unclassified Controlled Nuclear Information (UCNI) and Export Controlled radioactive waste. This type of waste primarily originates from the DOE gaseous diffusion enrichment facilities. DOE generators must contact EnergySolutions prior to shipping UCNI and Export Controlled radioactive waste.

3.1.8 Chelating Agents

EnergySolutions is authorized to dispose of waste containing up to 22 percent by weight chelating agents in the Mixed Waste disposal embankment. Waste disposed of in the LLRW disposal embankment must contain less than 0.1 percent by weight chelating agents. Generators may ship waste containing greater than 22 percent chelating agents to EnergySolutions' Treatment Facility once approved during the waste profiling process. EnergySolutions will treat waste containing greater than 22 percent chelating agents prior to disposal in order to comply with this requirement.

3.1.9 Asbestos

EnergySolutions is authorized to dispose of waste containing both friable and non-friable asbestos. The asbestos waste must be described in the Radioactive Waste Profile Record and packaged, marked, and labeled in accordance with applicable federal regulations. Friable asbestos must not be packaged in bulk containers unless approved in writing by EnergySolutions.

Asbestos waste that requires wetting to prevent dispersion must be inspected to minimize free liquids but in no case shall the free liquid exceed one percent of the waste volume. Absorbent material must be added to containers when free liquids are present. Waste streams containing greater than one percent free liquid by waste volume may be shipped to EnergySolutions' Treatment Facility for solidification prior to disposal. Contact EnergySolutions prior to shipping waste streams that contain free liquids.

3.2 ACCEPTABLE FORMS OF RADIOACTIVE WASTE

EnergySolutions' Radioactive Material License authorizes the receipt of radioactive waste in the form of liquids and solids. Solid radioactive waste must contain less than one percent free liquid by waste volume. Generators shipping solid waste must minimize free liquid to the maximum extent practicable. Conversely, liquid radioactive wastes contain greater than one percent free liquid by waste volume (e.g., sludge, wastewater, evaporator bottoms, etc.). EnergySolutions will determine if a waste contains free liquids by either visual inspection or by performing the Paint Filter Liquid Test (EPA SW-846 Method 9095). Liquid radioactive waste is solidified at EnergySolutions' Treatment Facility prior to disposal.

Solid waste includes, but is not limited to, the following forms of waste: soil, sludge, dry active waste, metal, concrete, wood, glass, resin, etc. For simplicity, these waste forms are categorized into either soil or debris waste streams due to the placement criteria specified in the license.

3.2.1 Soil or Soil-Like Wastes

EnergySolutions constructs the disposal embankment by achieving specified compaction criteria and minimizing void spaces in the disposal lift. Construction of the disposal embankment in this manner ensures long-term integrity of the disposal facility. Soil and soil-like waste material are placed in the disposal embankment and compacted in 12-inch soil lifts. The license requires these soil lifts to be compacted to greater than 90 percent of optimum density and at a moisture content not to exceed three percentage points above optimum moisture as determined by the Standard Proctor Method (ASTM D-698). Consequently, soil or soil-like waste must have soil-like properties and conform to the following specifications. Otherwise, the waste material will be considered debris and managed for disposal as described in Section 3.2.2.

Soil/Soil-Like Properties

- Greater than 70 percent by weight compactable material less than 3/4" particle size and 100 percent compactable material less than 4" particle size
- Maximum dry density greater than 70 pounds per cubic foot (dry weight basis)
- Moisture content of the soil or soil-like waste must not exceed three percentage points above optimum moisture upon receipt at EnergySolutions
- Maximum dry density and optimum moisture must be determined by Standard Proctor Method ASTM D-698

EnergySolutions may request a preshipment sample to perform an independent compaction test using Standard Proctor Method ASTM D-698. Generators must include their compaction test results as part of the waste profile submittal.

Shipments of soil or soil-like waste streams may contain some standard size debris in waste packages. The percentage of allowable debris in the waste stream must be listed in the waste profile. Soil or soil-like waste streams with moisture content exceeding three percentage points above optimum moisture are acceptable by EnergySolutions and require additional handling prior to disposal. Contact EnergySolutions' Customer Service representatives prior to shipping soil or soil-like waste streams with elevated moisture content.

3.2.2 Debris

Waste material not meeting the specified soil or soil-like properties is considered debris by EnergySolutions. Debris includes both decommissioning and routinely generated operational waste including, but not limited to, radiologically contaminated paper, piping, rocks, glass, metal, concrete, wood, bricks, resins, sludge, tailings, slag, residues, and personal protective equipment (PPE) that conforms to the debris size requirements.

3.2.2.1 Standard Size Debris

Debris is defined into two broad categories based on size. The first category is standard debris and includes materials that are less than 10 inches in at least one dimension and no longer than 12 feet in any dimension. Debris that does not meet this size criterion is categorized as oversize debris.

Standard size debris is uniformly distributed throughout the 12-inch soil lifts. EnergySolutions adds either native clay or radioactive soil to the debris. Each soil lift is limited to the amount of debris that may be placed with soil to achieve the required compaction criteria. Depending upon the conditions of the disposal agreement, some generators that have both soil and debris may be able to achieve cost savings by delivering these materials together such that the shipping package contains enough soil to mix with the debris to achieve compaction requirements. All debris must be placed in such a way to minimize void space in the soil lift.

3.2.2.2 Oversize Debris and Large Components

Waste material is considered oversize debris if the debris has at one dimension greater than 12 feet or does not have one dimension less than 10 inches. Since oversize debris cannot be compacted directly into the soil lifts, this material is placed in different areas of the disposal embankment where void spaces are minimized to the maximum extent practicable both in and around the debris.

Bulk oversize debris, such as a large component, is also disposed of using this alternative disposal process. EnergySolutions has received and disposed of several large components over 250 tons including steam generators, reactor heads, turbine components, and other large equipment as illustrated in Figure 3-2. Generators should identify these types of materials as part of the waste profiling process. This will allow EnergySolutions to evaluate the off-loading and placement of the large component prior to shipment.

Generally, single items over 20,000 pounds are considered large components and require special handling and engineering reviews prior to placement. The type of information required for large components includes drawings, photographs, weight, dimensions, description of enclosed voids, packaging configuration, rigging and loading plan, identification of lifting points, transportation mode, and radiological characterization and survey documentation. Void spaces within large components must be made accessible via a minimum of two access ports to allow grout in-fill during disposal operations at the Clive disposal facility. Access ports must be at least four inches in diameter unless approved in writing by EnergySolutions.

EnergySolutions may also elect to dispose of dispersible waste forms (e.g., filtercake, dusty material, etc.) or waste with elevated dose rates by not emptying the waste from the container. Void spaces in and around the containers are minimized to the maximum extent practicable.

Figure 3-2. Large Component Disposal

3.2.3 Gaseous Waste

EnergySolutions is authorized to receive gaseous waste in accordance with Utah Administrative Code R313-15-1008(2)(a)(viii). Gaseous waste must be packaged at an absolute pressure that does not exceed 1.5 atmospheres at a temperature of 20 degrees Celsius and the total activity of any container shall not exceed 100 Curies. This information must be identified in the Radioactive Waste Profile Record.

3.2.4 Waste Containing Free Liquids

Wastes containing free liquids greater than one percent by volume are considered liquid waste streams. Generators may use visual inspection of the waste or the Paint Filter Liquids Test to determine if the waste contains free liquids. The Radioactive Waste Profile Record must describe the physical, chemical, and radiological characteristics of the liquid waste. EnergySolutions received approval from the Utah DRC to receive radioactive liquid wastes that are aqueous based. Non-aqueous radioactive liquids require case-by-case approval from the Utah DRC.

EnergySolutions will perform a solidification study on a sample of the liquid waste prior to authorizing shipments. Liquid waste must be solidified and disposed at the Mixed Waste Facility. EnergySolutions has permitted liquid storage tanks to accommodate liquids delivered in tankers and other DOT approved bulk containers.

For generators with waste streams that may contain free liquids, the process by which the liquid will be minimized to less than one percent of the waste volume must be documented in the Radioactive Waste Profile Record. Approval of these waste streams would be considered authorized free liquids.

The presence of unauthorized free liquid within a package or shipment is a significant cause of non-compliance. Each incoming shipment will be tested for free liquids in accordance with EnergySolutions' Waste Characterization Plan using visual inspection of the waste or the Paint Filter Liquids Test.

If a solid waste shipment is found to contain unauthorized free liquids greater than one percent of the waste volume in any manifested container, EnergySolutions is required to promptly notify the generator and the Utah DRC. EnergySolutions may stop shipments of waste material until the cause of the problem is identified and corrected. The Waste Characterization Plan requires that the generator submit a quality control program that identifies the root cause of the problem and outlines corrective actions that will be taken to correct the problem and the quality control measures that will be implemented to prevent recurrence. Until this corrective action plan has been submitted, reviewed, and approved by EnergySolutions' Quality Assurance Manager, no further shipments may be permitted from the waste generator's site.

In order to control free liquid within the waste material, the use of absorbent materials is strongly recommended. Sufficient absorbent material to absorb twice the volume of the potential liquid should be used. Experience has shown that some soil matrices actually 'bleed' moisture out during transport due to vibration. If testing indicates that the waste material, as shipped, could exceed the optimum moisture content (as determined by the Standard Proctor Test) and that a risk of waste form separation exists while the shipment is en route, the precautionary addition of absorbents prior to shipment is strongly advised. To ensure that adequate absorbents are added, generators should also consider testing the moisture content of each shipment.

Although uncommon, in some cases it is possible for precipitation to enter the package resulting in free liquids. Detailed inspections should be completed before waste is placed in transit to ensure the package meets strong-tight criteria and that water cannot enter. EnergySolutions does not maintain a list of approved absorbents or manufacturers. If absorbents are added to the waste, the specific absorbent must be identified in the Radioactive Waste Profile Record (Section B.5).

3.3 PROHIBITED RADIOACTIVE AND MIXED WASTE

Condition 16 of the Radioactive Material License prohibits receipt of the following wastes:

- Sealed sources defined in UAC R313-12 as "radioactive material that is permanently bonded or fixed in a capsule or matrix designed to prevent release and dispersal of the radioactive material under the most severe conditions which are likely to be encountered in normal use and handling" (e.g., instrument calibration check sources, smoke detectors, nuclear density gauges, etc.).
- Radioactive waste which is classified as Class B, Class C, or Greater Than Class C waste.
- Solid waste containing unauthorized free liquids.
- Waste material that is readily capable of detonation, of explosive decomposition, reactive at normal pressure and temperature, or reactive with water or air.
- Waste materials that contain or are capable of generating quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste.
- Waste materials that are pyrophoric. Pyrophoric materials contained in wastes must be treated, prepared, and packaged to be nonflammable.

- Waste materials containing untreated biological, pathogenic, or infectious material including contaminated laboratory research animals. Generators desiring to ship this type of waste must document in the Radioactive Waste Profile Record the process used to treat the potential non-radiological hazard.

The following Mixed Wastes are not acceptable for treatment or disposal at the Mixed Waste facility:

- Hazardous waste that is not also a radioactive waste
- Wastes that react violently or form explosive reactions with air or water
- Pyrophoric wastes and materials
- DOT Forbidden, Class 1.1, Class 1.2 and Class 1.3 explosives
- Shock sensitive wastes and materials
- Lab Packs defined as a container that holds at least two smaller containers of differing liquid hazardous waste
- Compressed gas cylinders, unless they meet the definition of empty containers
- Utah waste codes F999 and P999

SECTION 4

WASTE ACCEPTANCE PROCESS

4.1 WASTE PROFILING PROCESS

This section details EnergySolutions' waste characterization and profiling process. Profiling a waste stream involves collecting samples and obtaining analytical results for the parameters specified on EnergySolutions' Radioactive Waste Profile Record (Waste Profile) (Form EC-0230). The Waste Profile serves the following functions: (1) enables EnergySolutions to evaluate wastes for acceptance, (2) maintains an operating record for the material during acceptance, storage, treatment, if applicable, and disposal of waste shipments, (3) provides a historical record of the waste project for each waste stream, and (4) ensures compliance with EnergySolutions' licenses and permits. The Waste Profile and related instructions can be downloaded from EnergySolutions' web site at www.energysolutions.com. An EnergySolutions Technical Services Representative is also available to assist in the waste profiling process.

The waste profiling process consists of the following steps as illustrated in Figure 4-1:

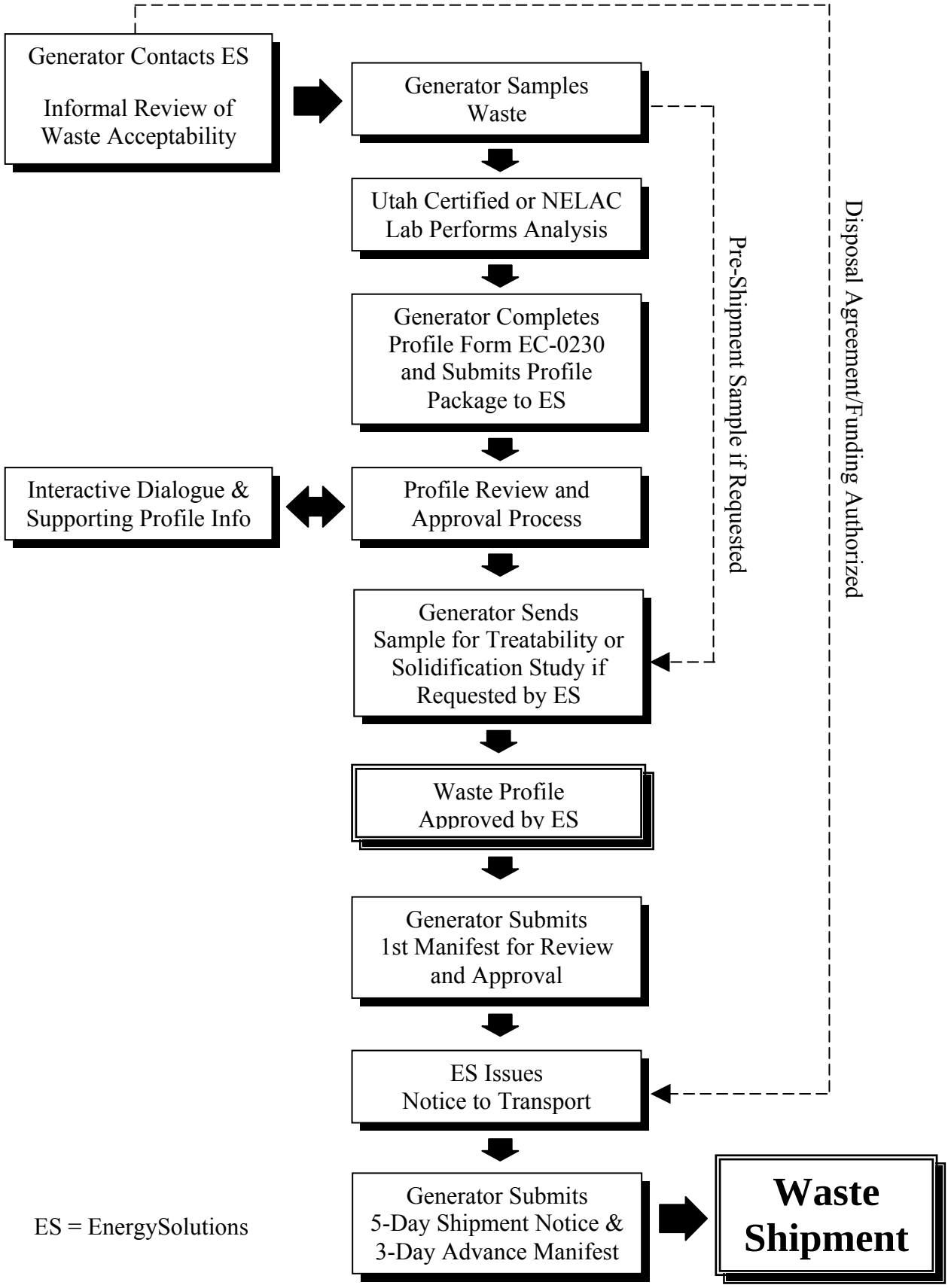
- Initial discussions
- Waste characterization
- Waste Profile Record completion and submittal
- Treatability and/or solidification study sample submitted, if requested
- Profile review and approval
- Notice to Transport

Initial discussions of the waste stream are critical in ensuring that the waste profiling process is accurate and efficient. Technical Services representatives are a resource to the generator in completing this process.

4.2 WASTE CHARACTERIZATION

Early in the process, the generator samples the waste stream where applicable and begins to accumulate the analytical data required in the waste profile record described below. It is critical that chemical analyses are performed by laboratories certified by either the State of Utah or the National Environmental Laboratory Accreditation Conference (NELAC). Generators may contact the Utah Department of Health at (801) 584-8501 or visit their website at http://health.utah.gov to obtain information on the Utah Laboratory certification requirements. Laboratories certified by NELAC are listed on the US EPA's website at www.epa.gov/nerlesd1/land-sci/nelac/accreditlabs.html. Technical Services representatives can also provide current laboratory certification information. Once the analytical support data is available, the generator completes the Waste Profile record as described in the following section.

Figure 4-1. Waste Acceptance Process



4.3 RADIOACTIVE WASTE PROFILE RECORD

The waste profile record is a document required by EnergySolutions' licenses and permits. It provides information in the following areas:

- Generator and waste stream information
- Physical properties and packaging
- Radiological information
- Chemical composition and hazard evaluation

Waste generators must complete a Radioactive Waste Profile Record for every waste stream shipped to EnergySolutions. To complete this form, the generator should use process knowledge along with analytical laboratory results. The form contains the following sections.

- Generator and Waste Stream Information
  These sections request generator contact information and general overview of the type of waste material, physical characteristics, transportation and package modes, identification of specific radionucildes, and the average and range of radionuclide concentrations.

- Chemical and Hazardous Waste Characteristics (LLRW or MW)
  The generator selects the applicable attachment for describing the chemical properties for either LLRW or Mixed Waste. These attachments request the chemical information to evaluate the waste relative to RCRA regulations. Only one of these attachments is required to be signed and submitted to EnergySolutions with the Waste Profile.

- SNM Exemption Certification (EC-0230-SNM)
  This form requests the radiological information to evaluate waste containing SNM with respect to the SNM Exemption issued by the NRC and incorporated into EnergySolutions' license. Condition 3 of the SNM Exemption Certification form requests specific information to be included with the narrative of the Waste Profile.

- PCB Waste Certification (EC-98279)
  This form requests information about the type of Polychlorinated Biphenyls (PCBs) waste included with the waste stream. PCB waste streams must be profiled separately from non-PCB waste streams. EnergySolutions uses this form and supporting information to evaluate PCB waste streams with respect to EnergySolutions' permits and TSCA regulations in 40 CFR 761.

4.3.1 Generator and Waste Stream Information

This section includes contact information for generators, including addresses and responsible parties. The contact information is required for the generator's representative as well as for the individual completing the Waste Profile. The generator must answer a series of questions designed to categorize the waste material that is profiled. The generator identifies the following:

- If the waste is hazardous, and whether it has been treated or requires treatment at EnergySolutions
- If the waste is Low-Level Radioactive Waste and subject to LLRW Compact Export approval
- If the waste contains Special Nuclear Materials, PCBs, or asbestos

4.3.2 Waste Physical Properties and Packaging

The physical and geotechnical properties of the waste include gradation of the material, density range, a full description of the physical composition and characteristics of the waste, moisture content, optimum moisture, and maximum dry density determined by the Standard Proctor Method (for soil or soil-like materials).

The purpose of the physical and geotechnical testing requirements is to demonstrate that the material can be managed at EnergySolutions under existing license/permit requirements and in accordance with EnergySolutions' waste disposal placement methods.

The gradation of the waste may be determined through analysis or waste process knowledge. After an assessment of the entire waste stream, the generator is expected to estimate the amount of material that would pass through the various screens indicated. This information is necessary to determine the method of waste placement.

In this section, the generator addresses questions regarding free liquids. If the waste contains free liquids, the Waste Profile requires a description including the quantity and nature (aqueous or non-aqueous) of the liquid. Solid waste profiled to contain free liquids must be minimized to the maximum extent practical but in no case shall the free liquid exceed one percent of the waste volume upon arrival and inspection at the EnergySolutions disposal site. **Waste streams identified to contain PCBs must not contain any free liquids**.

The waste description is continued by addressing several items in a narrative description and history of the waste provided by the generator as an attachment, referred to as Attachment B.5. The narrative should include the following items as applicable:

- The process that generated the waste
- Waste material physical composition and characteristics
- Radiological and chemical characterization method
- Information requested on the SNM Exemption Certification form, if applicable
- The type and description of PCB waste, if applicable
- Basis for determining manifested radionuclide concentrations
- Description and amounts of absorbents, if applicable
- Basis of non-hazardous or hazardous waste determinations
- Treatment processes, if applicable
- Product information or Material Safety Data Sheets associated with the waste as applicable
- Information requested in other sections of the Waste Profile

4.3.3 Radiological Information

All waste streams must be analyzed to determine the radionuclide concentrations in the waste. The waste must be characterized via gamma spectroscopy, liquid scintillation, or other standard radiochemistry methods to determine the radionuclide concentrations in the waste. Indirect measurements such as dose-to-curie or use of scaling factors may also be used if the process has been validated with direct measurements. Radiological analysis does not need to be performed by a Utah-Certified laboratory. Non-gamma emitting radionuclides such as Fe-55 and Ni-63, may be scaled from the gamma spectral analysis obtained from testing the material

if the waste generator has specific process knowledge of the material being profiled (10 CFR Part 61 analyses).

Please note that discrepancies between radiological information, particularly concentration ranges, and waste manifest documents could delay or prevent acceptance of a shipment. The Waste Profile must always be reviewed with the waste manifest documents prior to shipping waste to EnergySolutions. In the event that radiological, physical, or chemical properties of a profiled waste stream have changed, an update to the Waste Profile must be submitted and approved before such waste can be shipped to EnergySolutions.

EnergySolutions requires that generators evaluate the maximum dose rates and contamination levels anticipated in each waste stream. In the radiological section of Waste Profile, the generator indicates whether or not the maximum dose rate on accessible surfaces exceeds the ALARA Criteria as described in Section 2.3.1.

While EnergySolutions is permitted to receive Class A LLRW, certain radionuclides are subject to additional controls established by the Utah DRC. For example, Radium-226 is limited to 10,000 pCi/g. In addition, the Utah DRC regulates the following radionuclides under Condition 29E of EnergySolutions' Radioactive Materials License:

- Aluminum-26
- Berkelium-247
- Calcium-41
- Californium-250
- Chlorine-36
- Rhenium-187
- Terbium-157
- Terbium-158

EnergySolutions is required to provide a one-time notice for each generator shipping one of these radionuclides to the Class A disposal embankment. For waste shipped for disposal at the Mixed Waste disposal embankment, EnergySolutions must provide a one-time notification for each generator shipping waste containing Chlorine-36 and Berkelium-247. The generator includes the anticipated presence of these nuclides in the radiological information provided in the Waste Profile.

Finally, the generator lists the radionuclides present in the waste stream in conjunction with the expected maximum manifested concentration and the weighted average concentrations expected for each radionuclide. The generator is expected to manifest values for each shipment that are within the maximum values stated in this section of the Waste Profile. In the event that a generator needs to ship waste to EnergySolutions that exceeds the limits in the radiological information section of the Waste Profile, the generator may submit a revised Waste Profile to EnergySolutions for review and approval.

Any additional information including laboratory results for gamma spectroscopy or radiochemistry analysis must be attached to the Waste Profile. Radiological characterization methods and the basis for determining manifested radionuclide concentrations should be included in Attachment B.5 as described above.

4.3.4 Chemical Composition and Hazardous Waste Evaluation

In accordance with the response to the hazardous waste question posed in the generator and waste stream information section, the generator provides one of two attachments with the Waste Profile addressing the chemical composition of the waste.

For hazardous wastes, the generator provides a completed and signed copy of the Hazardous Waste Analysis Certification Attachment. The chemical and hazardous characteristics of the waste stream must be provided in extensive detail. The purposes of chemical testing are to (1) demonstrate that the waste meets specific waste acceptance chemical requirements; and (2) demonstrate that the waste is either non-hazardous, compliant with RCRA treatment standards, or will require treatment prior to disposal. In addition, analysis is required to qualify wastes that may contain other specific regulated constituents.

EnergySolutions' licenses and permits require the results of the following minimum analyses be provided with the Waste Profile:

Analysis	EPA SW-846 Method
pH (liquids only)	Method 9045
PFLT (solid waste only)	Method 9095
Organics (Totals) Results from applicable concentration based treatment standards	Method 8260/8270

The results of these analyses are documented on the Hazardous Waste Analysis Certification Attachment and attached to the Waste Profile.

The Hazardous Waste Analysis Certification Attachment also includes waste codes applicable to the waste stream with corresponding treatment standards or technology codes and worst case concentrations. This information is critical in evaluating wastes for treatment at EnergySolutions.

Applicable Underlying Hazardous Constituents (as defined in 40 CFR 268.48) and other chemicals present are identified at the end of the attachment.

For non-hazardous waste streams, the generator provides a signed copy of the Low-Level Radioactive Waste Certification Attachment. EnergySolutions' licenses and permits require the results of the following analyses be provided with the Waste Profile:

Analysis	EPA SW-846 Method
pH	Method 9045
PFLT (solid waste only)	Method 9095
Reactive Sulfide	Method 9034
Reactive Cyanide	Method 9014
TCLP Metals plus Zinc	Method 6010/7470
TCLP Herbicides	Method 8081
TCLP Pesticides	Method 8151
TCLP Semi-volatiles	Method 8270
TCLP Volatiles	Method 8260

The individual chemical compounds required for these analyses are listed on the Low-Level Radioactive Waste Certification Attachment and correspond to the characteristic D-list constituents (D004 through D043) identified in 40 CFR 261.24 Table 1 as shown below. TCLP Zinc is required by EnergySolutions' Groundwater Quality Discharge Permit.

40 CFR 261.24 Table 1

TABLE 1—MAXIMUM CONCENTRATION OF CONTAMINANTS FOR THE TOXICITY CHARACTERISTIC

EPA HW No.[1]	Contaminant	CAS No.[2]	Regulatory Level (mg/L)
D004	Arsenic	7440–38–2	5.0
D005	Barium	7440–39–3	100.0
D018	Benzene	71–43–2	0.5
D006	Cadmium	7440–43–9	1.0
D019	Carbon tetrachloride	56–23–5	0.5
D020	Chlordane	57–74–9	0.03
D021	Chlorobenzene	108–90–7	100.0
D022	Chloroform	67–66–3	6.0
D007	Chromium	7440–47–3	5.0
D023	o-Cresol	95–48–7	[4] 200.0
D024	m-Cresol	108–39–4	[4] 200.0
D025	p-Cresol	106–44–5	[4] 200.0
D026	Cresol	.....	[4] 200.0
D016	2,4-D	94–75–7	10.0
D027	1,4-Dichlorobenzene	106–46–7	7.5
D028	1,2-Dichloroethane	107–06–2	0.5
D029	1,1-Dichloroethylene	75–35–4	0.7
D030	2,4-Dinitrotoluene	121–14–2	[3] 0.13
D012	Endrin	72–20–8	0.02
D031	Heptachlor (and its epoxide).	76–44–8	0.008
D032	Hexachlorobenzene	118–74–1	[3] 0.13
D033	Hexachlorobutadiene	87–68–3	0.5
D034	Hexachloroethane	67–72–1	3.0
D008	Lead	7439–92–1	5.0
D013	Lindane	58–89–9	0.4
D009	Mercury	7439–97–6	0.2
D014	Methoxychlor	72–43–5	10.0
D035	Methyl ethyl ketone	78–93–3	200.0
D036	Nitrobenzene	98–95–3	2.0
D037	Pentrachlorophenol	87–86–5	100.0
D038	Pyridine	110–86–1	[3] 5.0
D010	Selenium	7782–49–2	1.0
D011	Silver	7440–22–4	5.0
D039	Tetrachloroethylene	127–18–4	0.7
D015	Toxaphene	8001–35–2	0.5
D040	Trichloroethylene	79–01–6	0.5
D041	2,4,5-Trichlorophenol	95–95–4	400.0
D042	2,4,6-Trichlorophenol	88–06–2	2.0
D017	2,4,5-TP (Silvex)	93–72–1	1.0
D043	Vinyl chloride	75–01–4	0.2

[1] Hazardous waste number.
[2] Chemical abstracts service number.
[3] Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.
[4] If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/l.

The attachment also includes a question as to whether or not the waste was at the point of generation of a hazardous waste, and a section to address former hazardous waste codes and additional chemical constituents.

As stated previously, the chemical analysis must be performed by a laboratory holding a NELAC or State of Utah certification. Data provided to the generator prior to any discussions of waste characterization with EnergySolutions may be acceptable for waste profiling purposes upon investigation of associated quality control sample data.

EnergySolutions may waive the chemical laboratory analyses if the material is not amenable to chemical sampling and analysis (e.g., debris items including metal pieces, concrete, plastic, etc.). Justification for waiving the chemical analyses must be provided in the narrative in Attachment B.5. Technical Service representatives can provide direction in cases where the waste meets such a description.

4.3.5 Special Nuclear Material Exemption Certification Form

Waste containing Special Nuclear Material (SNM) must comply with the SNM requirements for concentration, spatial distribution, chemical mixture, solubility and chemical composition of SNM isotopes as described in Section 3.1.5 of the BWF WAC. The EC-0230-SNM form guides the generator through the supporting information that must accompany the Waste Profile and each shipment of waste containing SNM. In addition to answering the questions on the form, the generator includes descriptions in Attachment B.5 for the requirements listed in items 3(a) through 3(d) of the SNM form. A completed and signed copy of the SNM Exemption Certification form must accompany the shipping paperwork for waste shipments containing Special Nuclear Material.

4.3.6 PCB Waste Certification Form

EnergySolutions' RCRA Part B Permit and Groundwater Quality Discharge Permit include the authorizations and requirements for EnergySolutions to receive PCB waste regulated for disposal under 40 CFR 761. The PCB waste types acceptable at EnergySolutions are listed in Section 3.1.6 of the BWF WAC. The generator must include a description of the type of PCB waste in the narrative of Attachment B.5. The PCB Waste Certification form does not need to accompany the waste shipment unless requested by EnergySolutions during the Waste Profile approval process.

4.4 TREATABILITY AND SOLIDIFICATION STUDY SAMPLES

For waste streams requiring treatment or solidification, EnergySolutions will request a preshipment sample to perform a treatability and/or solidification study during the waste profiling approval process. This allows EnergySolutions to develop the necessary treatment and solidification formula prior to receipt of the waste. Preshipment samples are not required for waste streams requiring treatment via macroencapsulation. EnergySolutions may request additional preshipment samples during the waste profiling process to evaluate the waste material prior to receipt.

Preshipment samples should represent the waste material destined for shipment to EnergySolutions. Representative sampling techniques appropriate to radiological and hazardous wastes should be employed in obtaining these samples. Treatability study samples should represent the "worst case" for a waste stream destined for treatment at EnergySolutions. The samples should contain the highest anticipated levels of chemical contaminants in the waste steam to ensure that EnergySolutions can develop a

treatment formula that is adequate for the entire waste stream. EnergySolutions may be required to perform additional treatability studies if the waste shipments contain chemical constituents of concern at concentrations that are higher than the treatability study sample.

Samples should be packaged into one or more sealed containers in such a manner that the sample container will not break during normal shipping conditions. Generally, the volume of sample requested will be less than 5 gallons. Sample containers should be labeled with the waste stream number, date, and a sample ID number. Sample closure devices should also be sealed with a custody or anti-tamper seal to ensure sample integrity.

Preshipment samples sent to EnergySolutions must be properly classed, described, packaged, marked, labeled, and in condition for transport as required by the DOT Hazardous Materials Regulations (HMR) contained in 49 CFR Parts 171 through 180. The Preshipment Sample Authorization forms must be completed and attached to the outside of the shipping package. A Uniform LLRW Manifest (Forms 540/541) must also accompany the shipping paperwork. The manifest number for the shipping paperwork is the Waste Stream ID number (e.g., XXXX-YY). The samples must be sent to the following address:

EnergySolutions
Attention: Sample Control
US I-80, Exit 49
Tooele County
Clive, UT 84029 (84083 if using Fed Ex)
Phone: (435) 884-0155

Treatability studies normally require 30 to 45 days to complete. Please keep this in mind when planning the first shipment of waste. Rush treatability studies are possible; however, there are higher costs for this service. Please contact EnergySolutions if a rush treatability study is required to meet a disposal schedule.

4.5 WASTE PROFILE REVIEW AND APPROVAL

EnergySolutions will assist waste generators throughout the waste profiling process to ensure shipping and acceptance of the waste can be accomplished within the desired timeframe. In order to facilitate timely shipment and receipt of waste materials, EnergySolutions requests that the Waste Profile forms and analytical reports be provided as far in advance of the anticipated shipping date as possible. Upon receipt, EnergySolutions will complete a preliminary review of the waste profile information provided. Comments concerning the Waste Profile will usually be provided within two weeks of EnergySolutions' receipt of the profile information. If additional information is required for pre-acceptance, EnergySolutions will specify the information needed and communicate this to the generator. A comprehensive internal review is completed once all information has been submitted.

In order to assist each generator and accomplish the profile review and approval process as quickly as possible, EnergySolutions has developed a two-phase review process. During the first phase, an EnergySolutions Technical Services Representative will review and assess the Waste Profile, accompanying documentation, and analytical data for acceptability. If necessary, EnergySolutions will provide comments that delineate additional information needed for approval. This process typically takes one to two weeks. Once the additional information or revisions have been received by EnergySolutions and found to be satisfactory, phase 2 of the process begins.

The second phase involves and independent evaluation of the Waste Profile by EnergySolutions' Compliance and Operations Managers. EnergySolutions will notify the generator as soon as the review and approval process is completed.

At this point, the waste stream has been "pre-approved" for management at EnergySolutions, since the waste has been shown to be in compliance with all waste acceptance criteria. EnergySolutions will issue a Notice to Transport once the Waste Profile has been approved and a contractual disposal agreement or necessary funding is authorized for the waste stream.

4.6 NOTICE TO TRANSPORT

EnergySolutions will issue a Notice to Transport (EC-1800) to the generator that authorizes subsequent waste shipments. The Notice to Transport is completed and issued once the Waste Profile is completed and approved by EnergySolutions. A Notice to Transport is also issued in the following situations:

- The Waste Profile is revised in such a way that additional evaluations are required (radiological, chemical, or physical properties change significantly)
- An annual update letter is received for Mixed Waste streams
- The approval to ship is restored after the Notice to Transport is revoked

In the event that the Notice to Transport is revoked, customers will not be able to schedule shipments until the approval to ship is restored and a new Notice to Transport is issued.

SECTION 5

SHIPMENT SCHEDULING AND MANIFESTING

5.1 GENERATOR SITE ACCESS PERMIT

Prior to the first shipment of waste material to EnergySolutions' disposal site, generators must receive a Generator Site Access Permit (GSAP) issued by the Utah DRC. Utah Administrative Code R313-26 establishes the terms for a Generator Site Access Permit Program that authorizes waste generators, waste processors, and waste collectors to deliver radioactive wastes to a disposal facility within Utah. Generators may apply for the GSAP on-line at the Utah DRC's website at www.radiationcontrol.utah.gov/DRC_prmt.htm.

The GSAP number must be listed in Block 5 of the Uniform LLRW Manifest Form 540 and correspond to the shipper's name and facility. Shippers must ensure the GSAP is renewed annually with the Utah DRC.

Shippers are subject to the provisions contained in the "Generator Site Access Permit Enforcement Policy" as amended, UAC R313-14, and UAC R313-19-100 for violations of state rules or requirements in the current land disposal facility operating license regarding radioactive waste packaging, transportation, labeling, notification, classification, marking, or manifesting requirements.

5.2 SHIPPING CHECKLIST

To assist generators with shipments to EnergySolutions, the "Shipping Checklist" shown below in Figure 5-1 provides general contact, scheduling, and manifesting information. Generators and shippers should use this checklist in conjunction with their shipping procedures to ensure compliance with EnergySolutions' waste acceptance process. EnergySolutions' Technical Service Representatives are available to assist generators and shippers during the shipment scheduling and transportation process.

5.3 5 WORKING-DAY ADVANCED SHIPMENT NOTIFICATION

Generators must schedule the shipment to arrive at the facility a minimum of five working days prior to the requested shipment arrival date. EnergySolutions strongly encourages generators to submit the 5 Working-Day Advanced Shipment Notification form prior to the shipment departing from the generator's site. A completed copy of the 5 Working-Day Advanced Shipment Notification form must be sent to the attention of EnergySolutions Scheduling Department to establish an arrival date for each shipment. This form may be downloaded from EnergySolutions' website at www.energysolutions.com. This form must be completed and either emailed to scheduling@energysolutions.com or faxed to the site at (435) 884-3549. Once this form has been received, the Scheduling Department will confirm the shipment's arrival date with the shipper. If all required information is not available at the time of submission, updates may be provided as the information becomes available. The Scheduling Department must be informed in the event that there are delays in the shipment scheduled arrival date.

Scheduling: Must be established at least 5 working days in advance of requested arrival date

- ☐ A "Notice to Transport" has been issued by EnergySolutions for the Waste Profile.
- ☐ **Submitted "5 Working Day Advanced Shipment Notification" form to request shipping schedule. Email form to scheduling@energysolutions.com or fax to (435) 884-3549.**
- ☐ Shipping schedule has been confirmed by EnergySolutions.
  EnergySolutions' Shipping & Receiving Scheduler: (435) 884-0155.

Advanced Manifesting: Must be submitted prior to releasing each shipment/conveyance

- ☐ Manifested information is consistent with the approved Waste Profile.
  Verify that all manifested radionuclides are listed in the approved Waste Profile and that manifested concentrations do not exceed the approved ranges.
- ☐ Verified consignee information on manifests (see below).
  Consignee: EnergySolutions, LLC
  Clive Disposal Site
  Interstate 80, Exit 49
  Clive, UT 84029
  Contact: Transportation Compliance
  Phone: (435) 884-0155
- ☐ Verified Shipment ID/Manifest Number (XXXX-YY-ZZZZ)
  XXXX is the generator number, YY is the waste stream number, and ZZZZ is the shipment number (starting with 0001 for the first shipment/conveyance and incrementing by one for each additional shipment/conveyance). If a Hazardous Waste Manifest is submitted, include the Shipment ID Number in Block 15.
- ☐ Verified valid Utah Site Access Permit number in Block 5 on Form 540. Generators must apply for the permit with the Utah Division of Radiation Control (DRC). The Shipper Name and Facility must be consistent with the Utah Site Access Permit number.
- ☐ Verified that Block 9 of Form 540 specifies EnergySolutions' "Treatment Facility" or "Bulk Waste Facility". Enter "Bulk Waste Facility" for LLRW, 11e.(2) Byproduct Material, and Mixed Waste shipped for direct disposal or enter "Treatment Facility" for waste streams requiring treatment by EnergySolutions prior to disposal.
- ☐ Submitted manifests to EnergySolutions **at least three working days** prior to the shipment arrival date. If possible, please export the manifests and send electronically via email to manifest@energysolutions.com. Otherwise, fax manifests to "Shipping and Receiving – Manifest" at (801) 413-5643. Include the isotope report and if applicable, LDR Notification/Certification forms, Hazardous Waste Manifest, and SNM Exemption Certification form.

Shipment Paperwork and Inspection

- ☐ The original shipping paperwork/manifests accompany each shipment (conveyance). Include the isotope report and if applicable, LDR Notification/Certification forms and Hazardous Waste Manifest.
- ☐ If applicable, **a completed and signed copy of the SNM Exemption Certification form and DOE/NRC form 741** has been included with the shipping papers.
- ☐ If applicable, the Uniform Hazardous Waste Manifest lists all hazardous waste codes associated with the shipment.
- ☐ Containers have been inspected and comply with DOT packaging requirements. Waste must be packaged in a strong, tight container at a minimum.
- ☐ **Containers do not contain unauthorized free standing liquids.**
- ☐ If applicable, containers are labeled **"Class A Unstable" or "Class AU"**. Refer to Block 16 of NRC Form 541.

Figure 5-1. Shipping Checklist

5.4 SHIPPING PAPERWORK

Advance copies of the Uniform Low-Level Radioactive Waste Manifest (Forms 540/541, and 542 if applicable) are required to be sent to EnergySolutions **at least three working days** prior to the shipment arrival date. Shippers must submit the shipping paperwork electronically via email to **manifest@energysolutions.com** or fax to "Transportation Compliance – Manifest" at (801) 413-5643. EnergySolutions encourages submittal of the Uniform LLRW Manifest electronically by exporting the manifest information to a specified file format as discussed below. The advance manifest must include the Uniform LLRW Manifest, Isotope Report (i.e., report summing the total shipment activity for each isotope) and if applicable, LDR Notification/Certification forms, Uniform Hazardous Waste Manifest, and SNM Exemption Certification form.

Additional shipping paperwork may be required depending on the type of waste being shipped to EnergySolutions. The following paperwork may need to accompany the shipping paperwork:

- SNM Exemption Certification form (EC-0230-SNM). This form must be completed, signed, and included with the shipping paperwork for shipments containing Special Nuclear Material.

- LDR Certification and/or Notification form must contain the information required in 40 CFR 268.7. EnergySolutions requires that this information be provided with each shipment of Mixed Waste or waste that has been treated to meet 40 CFR 268 treatment standards.

- Uniform Hazardous Waste Manifest must be included with the shipping paperwork for waste shipments of Mixed Waste. As applicable, EnergySolutions requests that shippers list the gross weight on the manifest.

5.4.1 Instructions for the Uniform LLRW Manifest Forms 540, 541, and 542

The NRC's guidance document "Instructions for Completing the NRC's Uniform Low-Level Radioactive Waste Manifest" (NUREG/BR-0204, Rev. 2, July 1998) should be used by shippers when preparing the shipping paperwork. EnergySolutions requires shippers to include information in both metric units and English units following the International Standard of Units (SI). Additionally, EnergySolutions has specific information that should also be included on the Uniform LLRW Manifest.

Form 540

- Block 5, "Shipper" must list the shipper's company name and facility that corresponds to the Utah Generator Site Access Permit (GSAP) number. Shippers shipping on behalf of the generator and using their GSAP number should list "(shipper's company name) on behalf of (generator's name)".

- Block 5, "Shipment Number" and "Shipment ID Number" may be used by the shipper for their own tracking purposes. In most cases, shippers use the "Manifest Number" in Block 8 as the "Shipment ID Number".

- Block 8, "Manifest Number" must list the EnergySolutions shipment number in the following format: (XXXX-YY-ZZZZ) where XXXX is the generator number, YY is the waste stream number, and ZZZZ is the shipment number (starting with 0001 for the first shipment and incrementing by one for each additional shipment).

- Block 9, "Consignee" must list EnergySolutions' disposal site address as shown below, contact name and telephone number. The address must specify EnergySolutions' "Treatment Facility" or "Bulk Waste Facility". List "Bulk Waste Facility" for LLRW, 11e.(2) Byproduct Material, and Mixed Waste shipped for direct disposal or list "Treatment Facility" for waste streams requiring treatment by EnergySolutions prior to disposal.

  EnergySolutions, LLC
  Clive Disposal Site – Bulk Waste Facility
  Interstate 80, Exit 49
  Clive, UT 84029

- Block 20, "Terms and Conditions" must be listed on the bottom, right corner of the 540 and state the following information:

  A: HAZARDOUS MATERIALS: Generator represents & warrants that Waste Material is (or is not) a hazardous waste as defined in 40 CFR 261. Where the material is a hazardous waste, this shipment is also accompanied by a separate and complete hazardous waste manifest, along with the appropriate land-disposal restriction notice and/or certification as required by 40 CFR 268.
  B: TITLE: Upon acceptance at the disposal site by EnergySolutions, LLC, and all appropriate regulatory authorities, title to the Waste material which conforms to Generator's representation herein shall thereupon transfer from the Generator and be vested in EnergySolutions, LLC
  C: WASTE MATERIAL: Generator represents and warrants that all data set forth in this (UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST) are true and correct in all respects and in accordance with all applicable governmental laws, rules, regulations and EnergySolutions, LLC's facility license.
  D: INDEMNIFICATION: Generator agrees to indemnify EnergySolutions, LLC, its officers, its employees and agents against all losses and liability whatsoever if such losses or liability results from the failure of the Waste Material to conform in all material respects to the data supplied on the (UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST) or if this shipment fails to meet the standards presented by the Department of Transportation of any governmental agency having jurisdiction over such matters.

Form 541

- Block 6, "Container Description" specifically applies to the disposal container. For bulk shipments (e.g., gondola railcars, intermodals, etc.), list "11" for "Bulk, Unpackaged Waste" along with the bulk packaging descriptor if the bulk package does not contain other manifested packages inside. For example, a gondola railcar with a super-load wrapper would be listed as "11A" in Block 6.

- Blocks 7 and 8, "Volume" and "Waste and Container Weight" must list the gross volume and weight of the disposal container and contents. For bulk, unpackaged waste where the waste package will not be disposed (e.g., gondola railcar, intermodal, etc.), list the weight and volume of the waste.

- Block 15, "Radiological Description" must also include a column for the radionuclide concentration expressed in units of pCi/g.

- Block 16, "Waste Classification" must list "AU" for Class A Unstable LLRW. Waste packages must also be labeled either "Class A Unstable" or "Class AU". For NORM or 11e.(2) waste material, enter "N/A" since the waste classification requirements are not applicable.

Form 542

Form 542, "Manifest Index and Regional Compact Tabulation) is required for processors and collectors of LLRW who are shipping LLRW attributed to others for ultimate disposal at EnergySolutions. EnergySolutions requires that processors or collectors submitting the Form 542 do so electronically using the file transfer protocol described in Section 5.4.2 due to the size of the manifest.

5.4.2 Electronic Submittal of the Uniform LLRW Manifest

EnergySolutions developed a document titled "Electronic Submittal of the Uniform Low-Level Radioactive Waste Manifest" to assist generators with the electronic submittal of the Uniform Low-Level Radioactive Waste Manifest (Forms 540, 541 and 542). Generators are able to submit their manifests electronically in a comma-delimited file format to the EnergySolutions disposal facility for review and distribution. Upon arrival, manifests are imported directly into EnergySolutions' waste tracking system. Manifest information is checked against the information contained in the generators Waste Profile. Any discrepancy will be automatically flagged, allowing potential problems to be fixed well in advance of shipment arrival.

Electronic manifest submittal has numerous benefits for both the generator and EnergySolutions which include:

- Generators are able to e-mail their shipping manifests directly to the site, reducing the time and expense of express mailing or faxing copies to the disposal facility.
- The generator can use the electronic signature feature, eliminating the need for any advance hard copies to be sent to EnergySolutions.
- EnergySolutions personnel can print the required copies of the manifest, including electronic signature, and distribute for proper review.
- The import of manifest information directly to EnergySolutions' waste tracking system will eliminate manual data entry.
- Electronic submittal will significantly reduce the time it takes EnergySolutions personnel to process the advanced paperwork.

5.5 90-DAY SHIPPING FORECAST

The 90-Day Shipping Forecast is used by EnergySolutions to properly staff and ensure adequate resources are available to ensure efficient and timely management of waste shipments. Generators are strongly encouraged to provide EnergySolutions with a 90-Day Shipping Forecast for all upcoming shipments. Current shippers will receive a fax or email from EnergySolutions every month and are requested to return the shipping forecast to EnergySolutions within three working days of receipt. The forecast can also be emailed to the appropriate Client Service Manager.

SECTION 6

PACKAGING AND TRANSPORTATION

6.1 COMPLIANCE WITH TRANSPORTATION REGULATIONS

Each shipment of waste material sent to EnergySolutions for disposal must be properly classed, described, packaged, marked, labeled, and in condition for transport as required by the Department of Transportation (DOT) Hazardous Materials Regulations (HMR) contained in 49 CFR Parts 171 through 180. Shipments of radioactive waste that are exempt from DOT regulations must be shipped to EnergySolutions' disposal site in packages that prevent release of the waste during transit. Specifically, all waste packages must be secure to 1) prevent rain or snow from entering the manifested waste package and 2) prevent waste from being exposed to the environment at any time during transit. Shippers should review NRC IE Bulletin No. 79-19 for training requirements applicable to radioactive waste management.

EnergySolutions will inspect each shipment arriving at its disposal facility for compliance with the applicable licenses and/or permits including compliance with DOT HMR requirements. EnergySolutions will notify the generator of a non-compliant shipment and determine the best course of action to resolve the discrepancy in a safe, compliant, and timely manner.

6.2 WASTE PACKAGING GUIDELINES

EnergySolutions receives waste for disposal either in bulk or in non-bulk packages. The packaging used must be authorized for the specific material being shipped by the HMR. Each generator is responsible for ensuring that the packaging used meets the appropriate regulations. The shipper of waste material is responsible for the certification of the packaging as meeting the DOT requirements. The DOT and NRC have published a joint guidance document to assist shippers of LSA and SOC material. The title of this document is "Categorizing and Transporting Low Specific Activity Materials and Surface Contaminated Objects" (NUREG-1608 or RSPA Advisory Guidance 97-005). The document is available from either agency. The following minimum packaging requirements must be met for all packages received at EnergySolutions.

6.2.1 Bulk Packaging

Generators are able to minimize packaging and transportation costs by utilizing bulk packages that are intended for re-use. EnergySolutions receives various bulk packages illustrated in Figure 6-1 which include gondola railcars with either hard-top lids or super-load wrappers, intermodals, sealands, cargo containers, roll-offs, etc. Bulk packages are unloaded at EnergySolutions and then decontaminated, surveyed, and returned in accordance with the requested radiological release criteria specified in Section 6.5. Bulk packaging must conform to the following requirements:

- Bulk packaging must, at a minimum, meet the applicable requirements contained in 49 CFR 173.24, General Requirements for Packagings and Packages and in 49 CFR 173.410, General Design Requirements.
- Bulk packaging must be covered. The top must be completely enclosed with no opening along the sides or openings in the top.

- Bulk packaging (e.g., railcars, trucks, trailers, etc.) must also be tightly sealed to prevent waste from leaking out or water from leaking in to the package. Packages containing unauthorized free liquids will be considered non-compliant.
- Bulk packaging must be clean. It must not have any waste material, or other material that could be mistaken for waste material, on the outer surface. EnergySolutions will perform contamination surveys on suspect areas of the package to ensure compliance with DOT regulations.
- Bottom dump railcars and end-dump trucks are not permitted unless approved in writing by EnergySolutions.
- Bulk packaging in intermodals, sealands, cargo containers, roll-offs, etc. must have ISO connectors on the top corners as illustrated in Figure 6-1 to allow the containers to be lifted from the top unless approved in writing by EnergySolutions.
- Friable asbestos is prohibited in bulk packages unless approved in writing by EnergySolutions.
- Each bulk container, which requires marking, will be properly marked in accordance with 49 CFR 172 Subpart D.
- Bulk packaging may not contain a mixture of bulk, unpackaged waste and manifested packaged waste (e.g., an intermodal containing loose unpackaged soil with manifested disposal containers within the same intermodal).

6.2.2 Non-Bulk Packaging (Disposal Containers)

EnergySolutions receives non-bulk packages (disposal containers) including boxes, drums, super sacks, etc. The disposal container is generally disposed of with the waste contents and will not be returned to the generator. EnergySolutions recommends drums be palletized to reduce the amount of time required to offload drum shipments. Palletized drums are also safer to manage at the disposal site. Generators may be charged extra for shipments containing non-palletized drums. Contact EnergySolutions to request approval to ship non-palletized drums prior to shipment. Non-Bulk packaging must conform to the following requirements:

- Non-Bulk packaging must, at a minimum, meet the applicable requirements contained in 49 CFR 173.24, General Requirements for Packagings and Packages and in 49 CFR 173.410, General Design Requirements.
- Containers must be properly sealed to prevent load movement from "pumping" dust-laden air out of the container.
- Containers must be clean. They must not have any waste material, or other material, which could be mistake for waste material, on the outer surface. EnergySolutions will perform contamination surveys on suspect areas of the package to ensure compliance with DOT regulations.
- Containers in a shipment must be properly loaded and blocked and braced securely to prevent shifting and damage during transport. The specific transport loading requirements contained in 49 CFR 174 for rail and 49 CFR 177 for highway should be examined as well as 49 CFR 393 Subpart I, Protection Against Shifting and Falling Cargo.
- Although preferred, containerized rail shipments are not required to be enclosed or covered.
- Do not have unnecessary container closures; e.g., welding of drum rings or box lids.
- Non-bulk packages will not be returned to the generator.
- Overpack containers only when necessary (e.g., to meet DOT requirements) for shipment.
- EnergySolutions prefers drums to be palletized to reduce the amount of time required to offload drum shipments. Palletized drums are also safer to manage at the disposal site. The pallets must

be strong enough to withstand collapse during transit. The drums should be securely banded to the pallet.

- Truck or railcar beds used to transport containers must be free of all loose material, waste or otherwise.
- Each container that is required to be labeled will be properly labeled in accordance with the requirements of 49 CFR 172 Subpart E and UAC R313-15-1008.

Each container that is required to be marked will be properly marked in accordance with the requirements of 49 CFR 172 Subpart D and/or 49 CFR 173.421 and Subpart 425.

Figure 6-1. Bulk Shipping Containers

6.3 HIGHWAY TRANSPORTATION

For highway shipments (Figure 6-2), EnergySolutions is located just three miles south of Interstate 80 at the Clive Exit (Exit 49). Highway shipments should arrive for receipt and acceptance between 7:00 AM to 12:00 PM MST, Monday through Friday only. Shipments that arrive after 12:00 PM may not be accepted until the next day unless special handling arrangements have been previously approved.

Figure 6-2. Truck Highway Shipments

Shipments are generally unloaded on a first-come, first-served basis. Non-compliant shipments may result in unexpected delays. Shipments may take up to four hours to be checked in, inspected, surveyed, evaluated,

and unloaded. Consequently, drivers should be informed that there are no eating facilities within the vicinity of the site.

6.4 RAIL TRANSPORTATION

Rail shipments will be delivered to the EnergySolutions' rail siding by the Union Pacific railroad on a predetermined schedule (Figure 6-3). Once at EnergySolutions' siding, they will be moved into the disposal site by EnergySolutions' equipment.

Figure 6-3. Rail Shipments

Since the signed copies of the Uniformed Low-Level Radioactive Waste Manifest or Uniform Hazardous Waste Manifest forms do not travel with the railcars during transport, the original signed manifest must be mailed or electronically transferred to the Clive Disposal Facility. The documents must arrive at the Clive Disposal Facility a minimum of 3 working days prior to the receipt of the rail shipment.

6.5 RELEASE OF SHIPPING CONVEYANCES

The timeframe for the release of shipping conveyances (e.g., trucks, intermodal containers, railcars, etc.) is based on the specific contractual arrangements that have been established between each generator and EnergySolutions. Generators must request the type of radiological release prior to the shipment's arrival and must be allowed under the Terms and Conditions of the disposal agreement. The requested release types must be authorized by EnergySolutions' Business Development Department. Containers released to the Unrestricted Use criteria require significantly more time and expense due to the resources needed to meet these release criteria. EnergySolutions performs the following types of radiological releases as listed in the following table.

EnergySolutions Radiological Release Criteria

Release Type	Criteria	Reference
Unrestricted Use	Removable and fixed surface contamination levels are isotope specific. The most restrictive isotopic removable surface contamination levels are less than 20 dpm α/100 cm^2 and 200 dpm β-γ/100 cm^2. The most restrictive isotopic total surface contamination levels are less than 100 dpm α/100 cm^2 and 1,000 dpm β-γ/100 cm^2. The contamination levels apply to all internal and external surfaces. Contact EnergySolutions' Business Development Department to make contractual arrangements for this type of release.	US NRC Regulatory Guide 1.86, June 1974 (Consistent with EnergySolutions' RML Condition 27)
Return to Service	Removable surface contamination levels must be less than 220 dpm α/100 cm^2 and 2,200 dpm β-γ/100 cm^2. The radiation dose rate at each accessible surface must be less than 0.5 mrem/hr. The contamination levels apply to all internal and external surfaces of the transport vehicle.	49 CFR 173.443(c)
DOT Empty	Removable surface contamination levels on the outside of the package must be less than 220 dpm α/100 cm^2 and 2,200 dpm β-γ/100 cm^2. Removable surface contamination levels on the inside of the package must be less than 22,000 dpm α/100 cm^2 and 220,000 dpm β-γ/100 cm^2. The package must be emptied of contents to the extent practical.	49 CFR 173.428
Sole Use	Removable surface contamination levels on the outside of the transport vehicle must be less than 220 dpm α/100 cm^2 and 2,200 dpm β-γ/100 cm^2. The radiation dose rate on the internal surfaces must be less than 10 mrem/hr or 2 mrem/hr at one meter from the surface.	49 CFR 173.443(d)

APPENDIX A

CONTACT INFORMATION

EnergySolutions

Corporate Office Phone:	(801) 649-2000	Fax: (801) 537-7345
Technical Service Fax:	(801) 413-5664	
Shipment Scheduling Phone:	(435) 884-0155	Fax: (435) 884-3549 Email: scheduling@energysolutions.com
Transportation Dept Phone:	(435) 884-0155	Fax: (801) 413-5643 Email: manifest@energysolutions.com

EnergySolutions Website: www.energysolutions.com

State of Utah

Utah Dept of Environmental Quality:	www.deq.state.ut.us
Utah Division of Radiation Control (DRC) Email:	drcadmin@utah.gov
Utah Division of Radiation Control Website:	www.radiationcontrol.utah.gov
Utah DRC – Generator Site Access Permit:	(801) 536-0077
Utah DRC – Generator Site Access Permit:	www.radiationcontrol.utah.gov/DRC_prmt.htm
Utah DRC Rules:	www.radiationcontrol.utah.gov/rules.htm
Utah Division of Solid and Hazardous Waste:	www.hazardouswaste.utah.gov
Utah DSHW Rules:	www.hazardouswaste.utah.gov/rpc.htm
Utah Dept of Health – Lab Certification:	health.utah.gov/els/labimp/envlabcert.html
EnergySolutions RCRA Part B Permit:	www.hazardouswaste.utah.gov/envirocare.htm