Formerly Utilized Sites
Remedial Action Program
(FUSRAP)

Maywood Chemical Company Superfund Site

ADMINISTRATIVE RECORD

Operable Unit 1 – Soils and Buildings

Document Number

MISS-142

US Army Corps
of Engineers®
New York District

MATERIALS HANDLING/TRANSPORT AND DISPOSAL PLAN

FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, NEW JERSEY

SITE-SPECIFIC ENVIRONMENTAL RESTORATION
CONTRACT NO. W912DQ-13-D-3016 TASK ORDER 001

Prepared for

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January 2014
Revision 1

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Submitted to:

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January 2014

Revision 1

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REVISIONS

Revision No.	Description of Revision	Date
0	Transition to new remediation contractor	November 2013
1	Revised plan per USACE comments to include USACE railcar label, reinserting text on hotspots and 49 CFR regulations, including additional disposal facility WAC and waste profiles. Added Figure 2-2 USACE " Open Only at Location [facility name] label. Added Chemtrec account number.	January 2014

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ACRONYMS AND ABBREVIATIONS

AEA	Atomic Energy Act
APP	Accident Prevention Plan
ASTM	American Society for Testing and Materials
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
cm^2	square centimeters
COC	chain of custody
DOT	U.S. Department of Transportation
DQO	data quality objective
dpm/100 cm^2	disintegrations per minute/100 square centimeters
FMSS	FUSRAP Maywood Superfund Site
FSP	Field Sampling Plan
FSS	Final Status Survey
FUSRAP	Formerly Utilized Sites Remedial Action Program
GEPP	General Environmental Protection Plan
LSA	Low-Specific Activity
MCW	Maywood Chemical Works
MHTDP	Materials Handling/Transportation Disposal Plan
MISS	Maywood Interim Storage Site
mrem/hr	millirem per hour
MSDS	Material Safety Data Sheet
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NRC	Nuclear Regulatory Commission
NYS&W	New York, Susquehanna, and Western
OSHA	Occupational Safety and Health Administration
PPE	personal protective equipment
Ra-226	Radium-226
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation Recovery Act
ROD	Record of Decision
RQ	Reportable Quantity
RSO	Radiation Safety Officer
SSHO	Site Safety and Health Officer
Th-232	thorium-232
TAL	Total Analyte List
TCL	Target Compound List

ACRONYMS AND ABBREVIATIONS (Continued)

TDC	Transportation and Disposal Coordinator
TSDF	treatment, storage, and disposal facility
U-238	uranium-238
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USACE	U. S. Army Corps of Engineers
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
WMP	Water Management Plan
yd^3	cubic yards

1.0 INTRODUCTION

The scope of work for this task order is the remediation of the Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Site. The *Materials Handling/Transport and Disposal Plan* (*MHTDP*) addresses the necessary actions to ensure compliance for the management of waste generated from the FUSRAP Maywood Superfund Site (FMSS). All waste generated from the site will be disposed off-site in accordance with applicable local, state, and federal regulations. The procedures that encompass the managing, handling, profiling, and transportation and disposal of waste materials from the FMSS are described in this document.

The FMSS is located in a highly developed area of northeastern New Jersey in the Boroughs of Maywood and Lodi, and the Township of Rochelle Park. The FMSS consists of 88 designated residential, commercial, municipal, and government-owned properties in the Boroughs of Maywood and Lodi, and the Township of Rochelle Park in Bergen County, New Jersey. The majority of the remediation activities are conducted at the Maywood Interim Storage Site (MISS). The MISS is an 11.7-acre lot that previously was part of a 30-acre property owned by the Stepan Company. Remediation activities also will take place to a lesser degree on properties located within a few miles of the MISS. These off-site locations are known as Vicinity Properties. The U.S. Department of Energy (USDOE) began investigating the FMSS and surrounding areas in 1983, and subsequently acquired the MISS from the Stepan Company in 1985. In 2003, the U.S. Army Corps of Engineers (USACE) published the *Final Record of Decision for Soils and Buildings at the FUSRAP Maywood Superfund Site* (ROD) (USACE, 2003) to address soil and building contamination on the remaining 24 commercial and governmental FMSS properties. Contaminated groundwater is being addressed under a separate ROD (USACE, 2012b). **Figure 1-1** shows the location of the properties comprising the FMSS.

As of the date of this revision to the *MHTDP* (December2013), remedial excavation and restoration of the remaining vicinity properties has been completed in accordance with the ROD, except for the following properties and the MISS: 149-151 Maywood Avenue, New York, Susquehanna, and Western (NYS&W) Railroad, and 100 West Hunter Avenue. This revision to the *MHTDP* focuses on the materials handling, transport, and disposal of soil and other materials associated with the remedial excavation activities for these remaining properties.

This plan includes, but is not limited to the following:

- Types of Waste Generated
- Estimated Volumes of Material to be Handled+
- On-Site Locations of Waste Storage During Remediation
- General Backfill / Borrow Material Requirements
- Soil Load-out Operations
- Waste Characterization
- Profiling of Waste Material
- Transportation/Packaging, Labeling and Marking Waste Shipments
- Manifesting of Waste Shipments
- Tracking of Waste Shipments
- Certificates of Disposal
- Transportation and Disposal Options

Water control, wastewater handling and disposal are addressed in the *General Environmental Protection Plan* (*GEPP*) (USACE, 2014a) and the *Water Management Plan* (*WMP*) (USACE, 2014b).

Note, additional site-specific procedures and requirements are included in the *Remedial Action Work Plan*, (*RAWP*) (USACE, 2013a).

1.1 MANAGEMENT OF CONTAMINATED WASTE

The waste to be managed at the FMSS is identified as "FUSRAP Waste." In accordance with the USDOE and the U.S. Environmental Protection Agency (USEPA), "FUSRAP Waste" is defined in the ROD (USACE, 2003) as follows:

- All contamination, both radiological and chemical, whether mixed or not, on the MISS.
- All radiological contamination above cleanup levels related to past thorium processing from the Maywood Chemical Works (MCW) occurring on any of the Vicinity Properties.
- Any chemical or non-radiological contamination on Vicinity Properties that would satisfy either of the following requirements:
  - The chemical or non-radiological contaminants that are mixed or commingled with radiological contamination above cleanup levels.
  - The chemical or non-radiological contaminants that originated at the MISS or were associated with the specific thorium manufacturing or processing activities at the MCW that resulted in the radiological contamination.

Radiologically and/or chemically-contaminated soil and debris will be transported by rail to an appropriately licensed and permitted waste disposal facility in accordance with the USACE, local, state, and federal regulations. The major applicable regulations are listed in **Section 1.2**. A flowchart for off-site waste removal is provided as **Figure 1-2**.

1.2 WASTE MANAGEMENT CODES, STANDARDS, REGULATIONS, AND GUIDELINES

The project requires compliance with applicable portions of state, local and federal regulations that are incorporated into project plans, procedures, reports, and drawings. Several applicable regulations are listed below.

- New Jersey Administrative Code (NJAC) 7:26 G; New Jersey Department of Environmental Protection (NJDEP) Hazardous Waste Regulations
- 10 Code of Federal Regulations (CFR) 20; Standards for Protection Against Radiation, and Transfer and Disposal and Manifests
- 49 Code of Federal Regulations (CFR) Transportation
- 40 CFR CFR Environment

2.0 ON-SITE OPERATIONS

This section describes the general handling procedures for contaminated soils during remediation activities. Detailed descriptions of procedures for each remediation work area are provided in the *RAWP* (USACE, 2013a).

2.1 EXCAVATION AND HANDLING OF RADIOLOGICALLY CONTAMINATED SOILS

General procedures to be utilized for the removal of contaminated soils shall include the following:

- Soils will be excavated using the safest and most cost-effective means, including: excavators, backhoes, bobcats, or other heavy equipment. Factors to be considered for selecting excavation equipment will include: on-site conditions, access limitations, proximity to residential/commercial structures, volume of material to be removed, depth of excavation, surface/groundwater concerns, nearby utilities, soil consistency, and other pertinent factors.
- Reasonable effort will be made to minimize the impact of excavation activities on the surrounding community and businesses.
- Care will be used not to overload the buckets of the soil removal equipment in order to limit spillage and the spread of contamination.
- An excavator will be used for loading vehicles in each work area.
- Debris and soil in each work area will be excavated until contaminated debris and soil has been removed to acceptable levels.
- Excavated material will be loaded directly into transport vehicles at the point of excavation.
- Excavated material will be sampled and analyzed on an as needed basis, in accordance with the *Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP,* USACE, 2014c). Identified waste materials will be handled, transported, and disposed as described in this document, plans referenced herein, and in accordance with local, state, and federal regulations.
- Contaminated soil and debris will be excavated, stored and handled in such a manner that dust and the release of radioactive materials are minimized in accordance with the *GEPP* (USACE, 2014a), *Accident Prevention Plan* (*APP*) (USACE, 2013b), and the *UFP-QAPP* (USACE, 2014c).
- Following all excavation activities, and before backfilling operations, final status surveys (FSS) will be performed as described in the *Master Final Status Survey Plan* (USACE, 2014d).

Detailed descriptions of excavation activities and procedures are provided in the *APP* (USACE, 2013b) and the *RAWP* (USACE, 2013a) for each work area.

2.1.1 Liquids Handling and Treatment

It is anticipated that during excavation activities, groundwater, precipitation and surface runoff will collect in the excavation. Control measures to minimize surface runoff into contaminated areas will be implemented in accordance with the *GEPP* (USACE, 2014a). The removal, storage, and treatment of water from the excavation will be performed in accordance with the *GEPP* (USACE, 2014a) and the *WMP* (USACE, 2014b). The temporary storage of wastewater near the site of excavation will be accomplished using portable tanks, water-tight roll-offs, tank trucks, vacuum trucks or other suitable devices designed to hold water. Water will be pumped from the excavation into temporary wastewater

holding tanks or directly into vacuum trucks. Vacuum trucks will transport the liquid materials collected from the site of excavation to the construction water treatment system at the MISS in preparation for treatment and disposal. The vehicle and driver transporting liquid materials will have the appropriate licenses and permits necessary for transporting the materials.

2.1.2 Backfill

Once excavation, FSS, and topographic survey activities have been completed in an area, backfill activities will be performed as described below. These general descriptions may be modified by the site-specific *RAWP* (USACE, 2013a).

- Backfill will consist of non-impacted below criteria material and clean borrow material from an approved off-site source.
- Prior to backfilling borrow material, materials shall be determined "clean." Certificates from the off-site source shall be obtained and provided to the USACE. Additionally, analytical and geotechnical testing will be performed prior to the procurement of borrow material, as further described in **Section 3.0**.
- Prior to backfilling non-impacted below criteria material, testing shall be conducted to determine if the materials are "clean." "Clean" criteria values for the segregated backfill material are included in worksheet 15 of the *UFP-QAPP* (USACE, 2014c).
- Excavations will be backfilled and compacted with clean material and graded using earthmoving equipment such as bulldozers, loaders, backhoes, and skid steers.
- Backfill material will be moisture-conditioned. In general, backfill will be placed in 12-inch lifts and compacted in accordance with the specifications listed in Appendix A of the *RAWP* (USACE, 2013a).

In general, excavated areas will be restored to pre-remediation grades and/or sloped into adjacent existing topography.

2.1.2.1 Management of Non-Impacted Soils

Non-impacted soils excavated during remediation activities will have the potential for use as backfill material based on the results of analytical testing for radiological and chemical constituents. Non-impacted soil is defined as non-radiologically impacted soil that qualifies as backfill based on compliance with the chemical parameters established in the *RAWP* (USACE, 2013a). Non-radiologically impacted soil is defined as soil that has, on average, radiological activity less than background plus two standard deviations based on review of available data, on-going excavation gamma surveys, and stockpile verification sampling.

Following excavation, potential non-impacted soils will be placed on plastic sheeting and segregated from the impacted materials. Best management practices will be utilized for erosion and sediment controls as established in the *GEPP* (USACE, 2014a). The excavated materials will be at staged the site excavation unless site logistics do not allow for staging. If necessary, the material will be transported and staged at the MISS. Control of potentially non-impacted soil will be maintained until the status of the soil has been determined.

In order to confirm that the soils have not been impacted by radiological or chemical contamination, one composite soil sample will be collected per 100 cubic yards (yd^3) and analyzed for radiological constituents. Chemical sample frequency will be increased to a minimum of two (2) samples from each distinct property stockpile (or from the portion of pile material to be placed on a property), or 1 sample per 1,000 yd^3 (whichever is greater on an individual property basis), in accordance with the approved-

Engineering Specification (*RAWP* [USACE, 2013a], Appendix A, Section 02300, Part 2, Paragraph 2.1) for backfill material (i.e., NJAC 7:26D Residential Soil Screening Criteria). Additionally, staged material will be monitored with a photoionization detector and any excavated soils exhibiting elevated readings will be segregated and analyzed separately. Geotechnical testing is not required for potentially non-impacted soils that are to be re-used on the property/location of their origin.

Staged material may be used as backfill provided the material (to be placed on an individual property) has an average that is less than background plus 2 standard deviations of background. Any staged soils with results above property criteria will be segregated for disposal. Soil that is non-impacted will be placed in the bottom of the excavation from the same property and borrow material placed on top it in accordance with the backfill specification (*RAWP* [USACE, 2013a], Appendix A, Section 02300, paragraph 3.4). USACE approval is required to initiate backfill operations. Potential on-site backfill material that is non-radiologically impacted but does not pass as non-impacted will be staged and considered for possible alternative disposal options. Documentation of the conformance testing will be submitted to the USACE in accordance with Appendix A of the *RAWP* (USACE, 2013a), and added to the submittal register.

2.2 SOIL HANDLING AND TRANSPORT AT OFF-SITE LOCATIONS

In the event inaccessible soil becomes accessible at a former Vicinity Property, the past procedures described below shall be put into practice if remedial activities are required.

Remediation activities also have been performed at off-site locations (e.g. Vicinity Properties). Soil was transported from the Vicinity Properties and other off-site work areas to the MISS. Soils then were conditioned if necessary, and stored in designated areas on the MISS prior to being shipped off-site for disposal. Procedures for handling soil at these off-site locations included:

- An excavator or other suitable piece of heavy equipment was used to load transport vehicles.
- Materials transport from off-site work areas to the designated soil off-loading area on the MISS were performed using dump trucks, roll-off containers, conveyors or other suitable means.
- Before their initial use, transport vehicles new to the project site were surveyed for radioactive contamination and were visibly clean from debris and soil.
- During the loading of trucks, distances that soils were allowed to free fall from the excavator bucket were minimized.
- Dust control were accomplished by spraying potable water or calcium chloride solution onto soils or other suitable means as necessary to prevent the movement of soils.
- Land spreading or other mechanical aeration methods were applied to wet soils to aid with excess moisture removal.
- All transport vehicles were inspected prior to loading. The Radiation Safety Officer (RSO) determined if it is necessary to survey each transport vehicle prior to loading.
- Prior to transport, the bed of the soil transport vehicles were lined with poly sheeting, nylon tarps, or other suitable materials in order to contain the waste materials and minimize contamination to the vehicle.
- During transport on public roadways, loads were covered using nylon tarps, poly sheeting or other suitable materials in order to sufficiently contain the contents being transported.
- Transport vehicles dedicated to the project that were only used for the transportation of radiologically-contaminated waste material, were not required to be surveyed upon ***entering*** a work area unless requested by the USACE or the RSO.

- Before leaving the work area, the transport vehicle was screened for radiological contamination and the exterior decontaminated, if necessary.
- Transport vehicles traveling over public roads and/or highways complied with all Department of Transportation (DOT), federal and state regulations regarding placarding and marking. **Section 5.0** of this document provides information regarding the placarding of waste transport vehicles.
- The Transportation and Disposal Coordinator (TDC) or designee prepared the necessary shipping papers (e.g. manifests, bills-of-lading, etc.) for the transport of waste materials from off-site work areas. The shipping papers were submitted to the USACE for approval.

2.2.1 Saturated Soils

Excavation below the groundwater table will result in encountering saturated or nearly saturated soils. Moisture control of these soils is necessary to minimize the spread of contamination due to leakage of contaminated water. Moisture control methods to be used include:

- Stockpiling of saturated soils in bermed areas. The areas will either be lined with a suitable water-resistant material or located in a contaminated area;
- Conditioning saturated soils with similar drier soils; and
- Use of stabilization agents such as kiln dust, fly-ash or synthetic polymers.

These methods will be used for moisture control for soils located at the MISS.

Saturated soils will be transported in covered, watertight containers such as sealed roll-offs, or sludge boxes. The containers will be lined with an appropriate material to prevent water leakage, if required.

Wet or moist soil will be transported via dump trucks. The tailgates of the dump trucks will have foam pipe insulation wedged into them to prevent water from leaking out. All trucks traveling over public roadways will be lined with poly sheeting prior to being loaded with soil.

2.3 SOIL HANDLING AT THE MAYWOOD INTERIM STORAGE SITE (MISS)

The MISS will be utilized for temporary storage of excavated soils and debris and is the location from where contaminated soil will be shipped off-site. Additionally, the MISS will be utilized as the area where soil-conditioning activities such as the removal of excess moisture and petroleum products, and soil sorting will be performed. Such activities may be required to comply with approved disposal facility free liquid limits or to minimize soil management costs.

The soils should not contain freestanding liquids. The soils should contain only trace amounts of drainable liquid, and in no case may the volume of free liquid exceed the requirements of the designated disposal facility. In cases where soils exceed the defined free liquid limits, the procedures outlined in **Section 2.3.2.2** of this document will be employed.

2.3.1 Soil Load-Out Activities

Contaminated soils will be shipped off-site using rail shipment via lined gondola railcars. Each railcar can hold an average of 75 yd^3 of Maywood soil. A 300 yd^3 soil stockpile initially will be created for loading the railcars (approximately four cars/stockpile). Soil samples will be collected prior to railcar loading activities to characterize radiological concentrations and soil moisture content within the stockpile. A front-end loader equipped with a bucket scale will be used to weigh the soil from the stockpile, and the material will be loaded into the railcar with a front-end loader. An initial visual inspection of the soil stockpile will be performed to identify any over-sized debris or “wet spots” within the stockpile. Over-sized debris, debris not meeting the disposal facility size requirements, will be removed and staged

adjacent to the stockpile area for special handling. Soils that are too wet for load-out will either be stockpiled at an area adjacent to the load-out area to dry, or blended with drier soils. **Sections 2.3.2.1 and 2.3.2.2** detail the sampling procedure, and soil moisture control management plan, respectively.

The following steps will be used for load-out of soils in gondola railcars:

- All railcars shall be inspected and radiologically surveyed to verify they are free of debris prior to acceptance from the railroad. If the railcars are not clean, they will not be used.
- A railcar liner will be installed prior to loading each railcar. The liner shall guarantee that the soils will not be influenced by the elements and will meet disposal requirements. Currently, there are two railcar liners approved for use on the FMSS: RCL 313 (Modified Black Stallion Railcar Liner) by IWT/Cargo Guard and Super Load Wrapper (SLW 5310) by Transport Plastics, Inc. (owned by MHF Logistical Solutions).
- A front-end loader will be used for loading railcars.
- To assure maximum load capacity without exceeding regulatory weight limits of each railcar, a bucket scale will be used for weighing soils prior to shipment. The scale will have a printout identifying the weight of each bucket. The printout will be filed with the shipping paperwork for each railcar.
- Soil will be loaded into the car in a uniform manner and distributed over the full length of the car to a maximum of 107.5 tons for a 110-ton capacity railcar.
- After loading soils, the gondola liner will be closed over material and secured. Inspection will be performed to assure compliance to all regulatory requirements.
- Before shipment, the railcar will be screened for removable surface contamination and decontaminated, if necessary.
- The TDC will prepare all shipping paperwork and notifications to be submitted to the USACE for approval and signature.
- Additional non-DOT specification labels shall be affixed to the container, intermodal end-gate or top of gondola liners "burrito bags." Refer to **Figure 2-1**. The color will be purple, pink or chartreuse.
- Additional USACE "Open Only at Location [facility name] labels will be affixed to each outgoing railcar. Refer to **Figure 2-2.** The color will be magenta/pink.

2.3.2 Waste Profile and Characterization Verification Sampling and Analysis

Sampling and analysis for waste profiling and characterization will rely primarily on available analytical data from site characterization and pre-design investigations. Additional sampling and analysis activities will depend on the disposal facility requirements. Any additional sampling will be approved by the USACE.

2.3.2.1 Waste Manifesting Sampling and Analysis

Representative soil samples will be collected from the soil stockpile prior to load-out activities in order to classify the material and determine the moisture content prior to disposal. The samples will be analyzed using gamma spectroscopy by the on-site laboratory. The analytical results for Radium-226 (Ra-226), Thorium-232 (Th-232), and Uranium-238 (U-238) will support the calculation of the specific activity of the railcar and the appropriate DOT shipping classification.

Prior to loading soil into each gondola railcar, a gamma scan of the soil stockpile will be performed and composite sampling will be conducted. A gamma scan will be performed once the face of the designated stockpile that will be used for loading is identified. The purpose of the scan is to ensure uniformity of the activity within the stockpile. If "hot spots," small areas having significantly higher readings than the surrounding areas, are found within the stockpile, the soil will be blended using heavy equipment or the hot spots removed and segregated to ensure uniformity.

Following the gamma scan, ten grab samples will be collected from random points along the face of the stockpile and composited and homogenized into one soil sample. The composite sample generated by this procedure will be used for characterizing up to a maximum of approximately 300 yd^3 of soil (approximately four railcars). The sample will be analyzed by gamma spectroscopy for Ra-226, Th-232, and U-238 by the on-site radio-analytical laboratory. "Wet non-equilibrated counts" (analysis of samples that have not been dried or held for Ra-226 daughter equilibration) will be used for characterizing the soil for DOT classification. Wet counts are used since this is more representative of the state in which the material is shipped plus the laboratory can provide timely analytical results. Sample results will be documented on the manifests. Railcar soil sampling will be performed in accordance with Maywood Loadout Soil Stockpile Sampling Procedure (Shaw, 2012), which is provided in **Appendix A** of this report and Appendix B of the *Construction Load-Out, Transportation and Disposal Plan* (USACE, 2014e). This procedure serves as general guidance on the proper methods of collecting discrete and composite soil samples from the soil stockpiled for railcar load-out. Sample collection shall be recorded in field notebooks and on Chain-of-Custody (COC) documents in accordance with the *UFP-QAPP* (USACE, 2014c). Field notebooks shall be completed in accordance with the *UFP-QAPP* (USACE, 2014c). Sampling equipment will be decontaminated in accordance with the Maywood Loadout Soil Stockpile Sampling Procedure (Appendix A).

2.3.2.2 Moisture Control Management

Soil moisture management is necessary to prevent free liquids in the railcar liner within the gondola railcars. Disposal facility requirements prohibit free liquids from being present in shipments of solid waste material and require that no free liquid be present when the shipment arrives at the facility.

In order to implement moisture control management procedures, the soil moisture-density relationship must be determined. A portion of the composite soil sample generated for radiological analysis will be used to determine soil moisture content. Because the composite sample consists of the ten grab samples collected from the face of the stockpile to be actively loaded, the sample results for moisture content will be used to characterize approximately four gondola railcars (approximately 300 yd^3 of soil). The sample will be evaluated using an infra-red moisture balance, microwave oven, or other suitable means to determine the moisture content of the sample. The moisture result then will be compared to the optimum soil moisture content previously determined using the modified Proctor Test. If the soil moisture content is too high, pooled water is present, or wet spots are noted on the stockpile, a pre-determined amount of absorbent based upon the soil moisture content of the soil will be added to the gondola car. The absorbent, CETCO Liqui-Sorb 200, or a similar absorbent, is a non-hazardous polymer that absorbs and retains water. A Material Safety Data Sheet (MSDS) for this material will be kept on-site in the construction trailer.

2.4 DRUM HANDLING AND TRANSPORT OF IDW CONTAINERS

The handling, movement and transport of drums and other containers will be performed in accordance with policies and procedures outlined in this document and the *APP* (USACE, 2013e). Drum handling will be performed by use of mechanical equipment as much as possible. Remote drum handling equipment may include grappler-equipped backhoes or front-end loaders, forklifts with special drum handling attachments or drum forks and slings. Drum transportation should be by forklifts, front-end

loaders or other pieces of equipment suitable for the transportation of drummed material. If possible, those portions of equipment that contact drums or canisters should be constructed of non-ferrous metals or be coated/lined with non-sparking material to preclude spark generation when possible..

2.4.1 Primary Staging of Drums

The staging configuration must allow reasonable access to each drum for inspection, sampling, and overpacking, if necessary, while economizing on space. Drums shall be staged in accordance with the Occupational Safety and Health Administration (OSHA) Guidance Manual for Hazardous Waste Site Activities.

Drums shall be appropriately labeled and stored in accordance with New Jersey State and Federal Regulations. Drums shall be segregated by waste type and stored in such a manner as to minimize the possibility of incompatible materials coming in contact. Secondary containment shall be provided as required.

2.5 NON-HAZARDOUS WASTE

2.5.1 Potentially Contaminated / NJDEP Non-Hazardous Soils

At a minimum, potentially contaminated soils must be kept segregated. The segregation must be maintained for the duration of the staging period.

Soils which are determined as non-hazardous waste shall be segregated at the time of excavation to facilitate soil reuse and minimize the need for off-site disposal. Non-hazardous soils may be re-used as backfill on-site and shall be re-used in accordance with N.J.A.C. 7:26E-6.4(d). If soils are not re-used, classification ID 27 solid waste shall be utilized for storage and/or disposal options.

2.5.2 Concrete Rubble and Debris

Anticipated construction debris, such as asphalt, concrete, rebar, and piping may be generated during the remediation of the FMSS. All construction debris will be surveyed for radioactive contamination as directed by the RSO. Items found to be less than background shall be considered radiologically non-contaminated. If non-contaminated, material will be recycled or disposed of at a permitted facility. If contaminated, an evaluation will be completed to determine whether decontamination or disposal at a facility permitted for radioactive waste is appropriate.

Segregation of contaminated and non-contaminated concrete via radiological survey will take place during the initial demolition step. When necessary, concrete will be sized using hydraulic hammers mounted on a track excavator or similar suitable means. Steel rebar and piping may be segregated prior to crushing.

2.5.3 Non-Hazardous Solid and Liquid Waste

Non-hazardous wastes will be segregated as paper, cardboard, aluminum, steel, or other recyclable materials. A dumpster will be provided for trash and garbage that cannot be recycled. Garbage will be disposed of in a municipal landfill.

2.6 SITE GENERATED WASTE

All field activities will be conducted to minimize waste generation during remediation activities on-site.

The substantive requirements of state (N.J.A.C. 7.26G) and federal standards (40 CFR 262.34) for waste accumulation will be followed at the site as they apply to facilities permitted to store hazardous waste. The accumulation point will be clearly posted “Hazardous Waste Storage Area,” if applicable.

All containers used will be compatible with the waste to be stored. Containment will be provided to prevent the release of waste in the event of a spill. Containers holding liquid waste will be placed on pallets for visual inspection within the containment.

2.6.1 Used Oil and Antifreeze

If generated during construction activities, used oil and antifreeze will be segregated, containerized, and labeled "Used Oil" and "Used Antifreeze," respectively. These materials will be stored in compatible DOT containers at the accumulation point. All containers holding liquids will be placed on wood pallets to allow inspection for potential leaks.

2.6.2 Used Batteries

If automotive or heavy equipment battery waste is generated, it will be exchanged through purchase at a local parts service store. Dry cell batteries, if generated, will be collected, placed in a compatible container, and managed as universal waste in accordance with 40 CFR 273.13 and N.J.A.C. 7.26.

2.6.3 Personal Protective Equipment

Personal protective equipment (PPE) used in support of field operations will be considered contaminated unless field screened by the RSO, or designee, and determined to be clean. Clean PPE will be disposed of as solid waste. Contaminated PPE will be transported to the excavated soil storage area and managed as contaminated debris.

2.6.4 USACE FUSRAP Maywood Laboratory Waste

Waste generated from the USACE FUSRAP Maywood Laboratory may be considered hazardous wastes. It is anticipated that the quantities will be limited and the generation category will be conditionally exempt small quantity generator (CESQG). This waste will be scanned for radiation and handled appropriately in accordance with all state and federal regulations.

2.7 HAZARDOUS AND COMMINGLED WASTE SAMPLING AND ANALYSIS

Generated hazardous and commingled waste will be tested as specified in the *UFP-QAPP* (USACE, 2014c). Storage and handling of the waste will be in accordance with all state and federal regulations.

3.0 OFF-SITE BORROW SOIL

Procurement of borrow soil from off-site sources is anticipated for backfill. Borrow soil shipped to the site will either be unloaded directly to the specific excavation areas or temporarily stockpiled in a non-contaminated area, as directed by the Project Superintendent, or designee.

3.1 BORROW SOIL ANALYSIS AND CLASSIFICATION

Prior to procuring borrow soil from a vendor, analytical and geotechnical testing of the soil will be conducted to ensure that the soils are both environmentally non-contaminated and meet geotechnical American Society for Testing and Materials (ASTM) criteria. Borrow material, comprised of clean gravels and sands, will be analyzed for radiological, chemical, and geotechnical parameters. A borrow source will be certified as clean by the supplier (not varying significantly from background levels), and will meet the data quality objectives specified in the *UFP-QAPP* (USACE, 2013d) and *Master Final Status Survey Plan* (USACE, 2014d). Chemical samples shall be below NJDEP Residential Soil Cleanup Criteria and Impact to Groundwater Criteria and radiological samples shall be below site-specific established cleanup criteria. Soil samples will be analyzed for the chemical and radiological constituents listed in **Table 1**.

Table 1 – Sample Analyses for Borrow Soil

Chemical Analyses	Radiological Analyses
Target Compound List (TCL) Volatile Organic Compounds (SW 8260)	Radium-226 (Gamma Spectroscopy)
TCL Semivolatile Organic Compounds (SW 8270)	Thorium-232 (GS)
TCL Pesticides (SW 8081)	Uranium-238 (GS)
TCL PCBs (SW 8082)	
Total Analyte List (TAL) Metals (SW 6010, 6020, 7471)*	
Cyanide, SW 9010	

Notes:

** Arsenic and thallium are analyzed by Method SW 6020 and mercury is analyzed by Method SW 7471.*

In addition to chemical and radiological analyses, each borrow sample will undergo geotechnical testing performed by the following ASTM methods (depending on applicable soil type):

- ASTM D2487, *Classification of Soils for Engineering Purposes (Unified Classification System)*
- ASTM D422, *Particle-Size Analysis of Soils*
- ASTM D4318, *Liquid Limit, Plastic Limit, and Plasticity Index of Soils*
- ASTM D1557, *Laboratory Compaction Characteristics of Soil Using Modified Effort*
- ASTM D2216, *Laboratory Determination of Water (Moisture) Content of Soil, and Rock*
- ASTM D5084, *Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter*

A sample of the borrow material (structural fill, common fill, etc.) initially will be collected from the source (i.e., quarry) prior to being placed on-site. For every 5,000 yd^3 of each type of fill material received after the initial sample, a sample of that material type will be collected. The sample will be analyzed for radiological, chemical, and geotechnical parameters, as detailed previously. The first sample (5,000 yd^3) will be collected from a shipment of the material delivered to the FMSS. The second sample (10,000 yd^3) will be collected from the material's source (i.e., quarry). Thereafter, the sample location will alternate between a shipment delivered to the FMSS and the material's source. Finally, a soil sample will collected on-site every 1,000 yd^3 and analyzed solely for radiological constituents. If a change in the material is visually identified, the borrow material will be resampled at the source to verify the absence of chemical and radiological contamination. **Table 2** depicts the sampling frequency and scheme for borrow material testing.

Table 2 – Sampling Frequency and Scheme for Borrow Material Testing

Sample Type	Sampling Location	Analysis
Initial	Source	Radiologicals/Chemical/Geotechnical
1,000 yd^3	On-site	Radiologicals
5,000 yd^3	On-site	Radiologicals/Chemical/Geotechnical
10,000 yd^3	Source	Radiologicals/Chemical/Geotechnical

Notes:

** yd^3 denotes cubic yards.*

4.0 WASTE CHARACTERIZATION

4.1 PROFILING

The objective of waste stream characterization is to accurately characterize and classify the waste streams when evaluated against criteria established by the Nuclear Regulatory Commission (NRC), Atomic Energy Act (AEA), DOT, USEPA, state regulations, and disposal facility permits.

Existing waste profiles or profiles newly completed will accurately depict the waste being managed. It is imperative that the information communicated during the profile and approval process is consistent with the information used to manage the waste on the site and also during manifesting of the waste.

The TDC will perform the following steps:

- Prior to profiling, develop a comprehensive understanding of the waste material.
- Communicate this information to the disposal facility so that they can be prepared to assist during the profile process.
- Prior to obtaining laboratory analytical testing for the waste stream, (1) read the profile forms and instruction; (2) determine what specific analytical testing is necessary; and (3) discuss this determination with the disposal facility prior to requesting the work from a laboratory.
- During the process, keep in regular contact with the approved disposal facility to ensure an incident free operation. Assure that the disposal facility understands the expectations in terms of project management.

4.2 DISPOSAL/PROFILE ANALYSIS AND SAMPLING REQUIREMENTS

It is anticipated that five types of waste requiring transportation and disposal may be generated during remediation activities. They are as follows:

- Radiologically Contaminated Soils or Materials,
- Commingled Waste,
- Hazardous Waste,
- Non-Hazardous Waste (soil, solid, and liquid), and
- Special Waste (New Jersey Recyclable Class D Waste Materials)

4.2.1 Radiologically Contaminated Soils or Materials

In order to determine the waste characteristics and ensure acceptance of the wastes by the permitted disposal facility (refer to **Appendix B**), site characterization results from each work area will be submitted as part of the profile package. Additional samples will be analyzed for a limited number of parameters to ensure acceptance, if necessary. The sampling to be performed will be determined by the Contractor, USACE, and Health Physicists. Radiologically contaminated soils or materials specified in the *UFP-QAPP* (USACE, 2014c,) will meet the data quality objectives (DQOs) and analysis will be performed as described in the *QAPP*. The radioactive waste profile for the FMSS is provided as **Appendix C**.

Waste from each work area will be sampled to meet the acceptance requirements of the approved disposal facility. The analyses will be performed as described in the *UFP-QAPP* (USACE ,2014c).

4.2.2 Commingled Waste

Commingled waste will be tested for hazardous characteristics and appropriately handled and disposed of as required by federal, state, and local regulations. Analysis will be performed as described in, and will meet the DQOs as specified in the *UFP-QAPP* (USACE. 2014c).

4.2.3 Hazardous Waste

Hazardous waste will be tested for hazardous characteristics and appropriately handled and disposed of as required by federal, state, and local regulations. Analysis will be performed as described in, and will meet the DQOs specified in, the *UFP-QAPP* (USACE. 2014c).

4.2.4 Non-Hazardous Waste

4.2.4.1 NJDEP Non-Hazardous Soils (ID 27 Solid Waste)

Pursuant to N.J.A.C. 7:26G-5.2(b), the Generator determines whether soil is hazardous. Classification shall be performed upon, or before excavation, to minimize on-site handling and storage time. Excavated soils are considered to be non-hazardous when they are not a hazardous waste as defined in Title 40 CFR Part 261 Subpart C (261.21-261.24).

NJDEP non-hazardous soils shall be segregated at the time of excavation to facilitate soil reuse and minimize the need for off-site disposal, if desired. NJDEP non-hazardous soils may be re-used as backfill on-site and shall be re-used in accordance with N.J.A.C. 7:26E-6.4(d). If NJDEP non-hazardous soils are determined for off-site disposal, classification of ID 27 solid waste shall be utilized for storage and/or disposal options.

4.2.4.2 Non-Hazardous Solid and Liquid Waste

Non-hazardous solid waste generated on-site will include office waste, trash, garbage, and construction debris from uncontaminated portions of the site(s). Non-hazardous wastes will be segregated as paper, aluminum, steel, or other recyclable materials. A dumpster will be provided for non-recyclable trash and garbage. A separate dumpster will also be provided for non-contaminated construction debris. Garbage and construction debris will be disposed of in a municipal landfill. Separate containers for cardboard, aluminum, plastic, and office paper will be provided for recycling.

4.2.5 Special Waste (New Jersey Recyclable Materials Class D)

New Jersey Class D recyclable materials are generated wastes such as used oil and antifreeze, oily filters, batteries, etc. Such waste shall be defined and handled in accordance with the Recycling and Waste Minimization Plan, included as part of the *GEPP* (USACE, 2014a).

5.0 TRANSPORTATION AND DISPOSAL OF RADIOLOGICAL WASTE

5.1 CLASSIFICATION OF MATERIAL FOR TRANSPORTATION

5.1.1 Definitions

Classification of material will be used to determine packaging, labeling and marking requirements. The following are the possible shipping DOT classes:

Class 7	Any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in Table 49 CFR 173.436 or values derived according to the instructions in 49 CFR 173.433.
Class 9	Class 9 material per 49 CFR 173.140 (miscellaneous hazardous material) means a material which presents a hazard during transportation but which does not meet the definition of any other hazard class. Material that meets the definitions in 49 CFR 171.8 for an elevated temperature material, a hazardous substance, a hazardous waste, or a marine pollutant is considered a Class 9 material. If the material does not meet the definition of any Hazard Class, the package activity by radionuclide should be compared against the reportable quantity limits in 49 CFR 172.101, Table 2. If the bulk shipment exceeds the reportable quantity for a given radionuclide or the sum of the ratios for the radionuclides exceeds 1, then this material is a Hazardous Material Class 9. Its proper shipping name is RQ, UN3077, Environmentally Hazardous Substance, solid, N.O.S., PG III.
Hazard Material, Class 1-6, 8	Radioactive material may be contaminated with hazardous materials. For waste material that meets the definition of more than one hazard class, the order of precedence established by DOT in 49 CFR 173.2a will be used. Although Radioactive Material Hazard Class 7 has the highest precedence, material shipped as Radioactive Limited Quantity is not included. For Radioactive Material Limited Quantity the specific order of precedence in 49 CFR 173.423 should be used. Even though a shipment may not exceed the limits of Hazard Class 7, mixed waste material may meet the definition of another Hazard Class. Hazardous material shipments are discussed in **Section 6.0**.
NJDEP Non-Hazardous Waste	(*ID 27 Solid Waste*) Contaminated soils are considered to be non-hazardous when the soil contaminants exceed the NJDEP's soil cleanup criteria, or exceed the site-specific cleanup criteria and are not a defined Hazardous material.

Not classified	49 CFR does not apply. The "Not Classified" classification is used for materials not meeting any description for any DOT hazard class. This material may be shipped as general cargo providing it does not meet the definition of any DOT Material Hazard Class or NJDEP non-hazardous or recyclable waste. A COC form shall be prepared for all shipments of Non-DOT, Non-USEPA and Non-NRC regulated waste materials sent off-site for disposal from FUSRAP sites.

5.1.2 Class 9 Material

It is anticipated that Class 9 Material will be shipped for this project. Class 9 Material is defined as a shipment determined to be a RQ in accordance with paragraph 7 of the note preceding Table 1 to 49 CFR 172.101.

5.1.3 Reportable Quantities

The total activity of the radiologically contaminated soil will be calculated to determine Reportable Quantities (RQ), as described in the subsections below.

5.1.3.1 Principle of Total Activity and Reportable Quantities

The radionuclides of concern identified in the soil at several of the commercial / industrial properties at the FMSS are Ra-226, Th-232, and U-238. The concentrations of the individual isotopes vary from property to property and there is a possibility that the site may have a RQ of radioactive material if the specific activity is at or above the maximum specific activities obtained from on-site samples.

A total activity (total number of disintegrations per unit time) calculation is required to determine whether there is a RQ for transportation purposes of radiologically contaminated soils. To determine whether a package contains an RQ of radionuclides, the activities of all daughter products must be included in the calculation.

- The decay chain of Ra-226 includes: Rn-222; Po-218; Pb-214; Bi-214; Po-214; Pb210; Bi-210; and Po-210 to stable Pb-206
- The decay chain of Th-232 includes: Ra-228; Ac-228; Th-228; Ra-224; Rn-220; Po-216; Pb-212; Bi-212; Po-212; Tl-208 to stable Pb-208
- The decay chain of U-238 includes: Th-234; Pa-234m; Pa-234; U-234, Th-230; Ra-226; and daughters of Ra-226.

For the analysis herein, the parent isotopes and their daughters are assumed to be in secular equilibrium.

5.1.3.2 Determination of Reportable Quantities

To use the RQ values from 49 CFR 172.101, secular equilibrium is assumed for Ra-226, Th-232, and U-238 and their progeny. Therefore, the activity from Ra-226 and its daughters has been included in the U-238 value RQ value. In addition, the U-235 concentration and its progeny also is included in the calculation. The U-235 concentration is considered to be 0.046 of the U-238 concentration. The total activity for each radionuclide of a shipment carrying contaminated waste is calculated by multiplying the specific activity (Ci/g) of each radionuclide by the total mass of the shipment. The ratio of the total activity to the RQ value for each radionuclide is calculated by dividing the activity for each radionuclide by the RQ value for that specific radionuclide. The ratio of the total activity to the RQ value for each

radionuclide are then summed. If the result is greater than 1, then the container contains an RQ in accordance with 49 CFR 172.101, Appendix A.

5.1.4 Class 7 Material

It is anticipated that the bulk of the Class 7 material for this project will be classified as Low Specific Activity (LSA) material. LSA material means Class 7 material with limited specific activity. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents.

LSA material must be in one of three groups: LSA-I, LSA-II, LSA-III. It is anticipated that Class 7 waste generated at the FMSS primarily will be classified as LSA-I. As of May 2013 (the latest revision of the MHTDP), all Class 7 waste shipped from the FMSS has been classified as LSA-I. LSA-I includes mill tailings, contaminated earth, concrete, rubble, other debris, and activated material in which Class 7 (radioactive) material is essentially uniformly distributed and the average specific activity does not exceed 30 times the values for activity concentration specified in 49 CFR 173.436 or 30 times the default values listed in Table 8 of 173.433.

5.2 PACKAGING, LABELING AND MARKING

Each shipment of contaminated soil shipped to the approved disposal facility must be properly classified, described, packaged, marked, labeled, and in condition for transport as required in DOT *Hazardous Materials Regulations*, 49 CFR 171 through 178 and the requirements of the facility. Packaging, labeling and marking requirements vary according to classification of material and radioactivity level.

5.3 LOW SPECIFIC ACTIVITY MATERIALS – PACKAGING, BULK PACKAGING AND EXCLUSIVE USE

5.3.1 Low Specific Activity Materials – Packaging

LSA materials must be packaged in accordance with 49 CFR 173.427.

The packaging must comply with either section 5.3.2 or 5.3.3 below. In addition, the following conditions apply:

The external dose rate must not exceed an external radiation level of 10 mSv/h (1rem/h) at 3 meters from the unshielded material;

The quantity of LSA in any single conveyance must not exceed the limits specified below:

Nature of material Activity Limit for Conveyance

LSA-I No limit

Packages must meet the contamination control limits specified in 49 CFR 173.443.

External radiation limits must comply with 49 CFR 173.441.

Except for the bulk packaging and exclusive use provisions described below, LSA material must be packaged as follows:

In an industrial package (IP-1, IP-2, or IP-3, 49 CFR 173.411), subject to the limitations listed in **Table 3**.

Table 3 – LSA-I Shipment Limitations

Contents	Exclusive Use Shipment	Non- Exclusive Use Shipment
LSA-I Solid	IP-1	IP-1
LSA-I Liquid	IP-1	IP-2

Domestic transportation of DOT Specification 7A (49 CFR 178.350) Type A package. The requirements of 49 CFR 173.412 (a), (b), (c) and (k) do not apply;

Domestic transportation, in a strong tight package that prevents leakage of radioactive content under normal conditions of transport. In addition to the requirements listed above, the following conditions must be met:

The shipment must be exclusive use;

The quantity of Class 7 (radioactive) material in each packaging may not exceed an A_2 quantity;

Domestic transportation of Type B packaging authorized pursuant to 49 CFR 173.416.

5.3.2 Low Specific Activity Materials - Bulk Packaging

LSA-I material unless packaged as described above in **Section 5.3.1**, must be packaged in bulk packaging in accordance with the following:

1. The shipment must be exclusive use;
2. *Solids* – Radiologically impacted waste materials shipped in bulk from the FMSS will be packaged as an Industrial Package-I (IP-I) so as to comply with 49 CFR 173.410 and 49 CFR 173.411.
3. *Liquids* – Liquids must be transported in the following packaging;
    - Specification 103CW, 111A60W7 tank cars. Bottom openings in the tanks are prohibited; or
    - Specification MC 310, MC 311, MC 312, MC 331, or DOT 412 cargo tank motor vehicles. Bottom outlets are not authorized. Trailer-on-flat-car service is not authorized.

5.3.3 Low Specific Activity Materials - Exclusive Use

Exclusive Use: means the sole use of a conveyance by a single consignor and for which all initial, intermediate, and final loading are carried out in accordance with the direction of the consignor or consignee. Any loading or unloading must be performed by personnel having radiological training and resources appropriate for safe handling of the consignment. Specific instructions for maintenance of exclusive use shipment controls must be issued in writing and included with the shipping paper information provided to the carrier by the consignor.

For LSA material to be consigned as exclusive use the following conditions must be met:

1. Shipments must be loaded by the consignor and unloaded by the consignee from the conveyance or freight container in which originally loaded;
2. There must be no loose Class 7 (radioactive) material in the conveyance, however, when the conveyance is the packaging, there must be no leakage of Class 7 (radioactive) material from the conveyance;

3. Packages must be braced so as to prevent shifting of lading under conditions normally incident to transportation;
4. Specific instructions for maintenance of exclusive use shipment controls must be provided to the carrier. Such instructions must be included with the shipping paper; and
5. For domestic transportation only, packages are excepted from the marking and labeling requirements. However, the exterior of each non-bulk package must be stenciled or otherwise marked "Radioactive-LSA" and non-bulk packages that contain a hazardous substance must be also stenciled or otherwise marked with the letters "RQ" in association with the above description.

5.4 OTHER CLASS 7 AND CLASS 9 HAZARDOUS MATERIALS

For other Class 7 and Class 9 Hazardous Materials, the following minimum requirements apply and should be modified as necessary to meet any specific requirements dictated by the waste disposal facilities.

Manifests

The following minimum information is required on manifests:

- Basic shipping description
- Proper shipping name (from 49 CFR 172.101)
- Hazard Class (from 49 CFR 172.101)
- ID # (from 49 CFR 172)
- Total quantity of material by weight or volume
    a. The quoted certification statement from 49 CFR 172.204.
    b. If mixed waste, hazardous waste manifests must also be utilized.

5.4.1 Labeling

Based on information from soils previously excavated and shipped to date, it is expected that a limited quantity of DOT Class 7 material will be shipped from the FMSS. The Class 7 material to be shipped will most likely be classified as LSA-I and shipped in bulk as "exclusive use" shipments. According to 49 CFR 173.427, these bulk, "exclusive use" shipments are excepted from the marking and labeling requirements of 49 CFR 173. However, the exterior of each package must be stenciled or otherwise marked "Radioactive-LSA" and packages containing a hazardous substance must be stenciled or otherwise marked with letters "RQ" in association with the above description.

5.4.2 Bulk Packaging

The following minimum packaging requirements must be met for all packages (i.e., railcars):

- Bulk packaging must, at a minimum, meet the applicable requirements for packaging.
- Bulk packaging (railcars) must be sealed to prevent wastes leaking out or water leaking into the wastes during transportation.
- Each railcar is required to be properly marked on both sides (see 49 CFR 172.302, General Marking Requirements for Bulk Packages 49 CFR 173.427, if applicable.

5.5 RAIL TRANSPORT

Rail transport of materials (whether Class 7 or Class 9) shall be performed in accordance with 49 CFR 174.700. Since the Bill-of-Lading and *Uniform Low-Level Radioactive Waste Manifest* (Forms 540, 541, and 542) do not travel with the railcars during transport, the generator will be required to email, fax, or mail a copy of the shipping papers to the approved disposal facility. The documents must arrive prior to receipt of the rail shipment. Pre-notification of shipment must be given to the waste disposal contractor. The draft manifest may be faxed to the waste disposal firm for approval.

To assure that all packaging and loading requirements are met, the following form (see **Appendix E**) must be completed for each railcar loaded:

- Soil Load-out Surveillance Checklist

Each rail transport vehicle must be properly placarded in accordance with requirements of 49 CFR 172, Subpart F.

5.6 TRUCK TRANSPORT

5.6.1 Definitions

Closed Transport Vehicle: means a transport vehicle equipped with a securely attached exterior enclosure that during normal transportation restricts the access of unauthorized persons to the cargo space containing the radioactive materials. The enclosure may be either temporary or permanent, and in the case of packaged materials may be of the "see through" type, and must limit access from the top, sides and ends.

Non-Fixed Radioactive Contamination (Class 7 only): means radioactive contamination that can be readily removed from a surface by wiping with an absorbent material. Non-fixed (removable) radioactive contamination is not significant if it does not exceed the limits specified in 49 CFR 173.443.

5.6.2 General Shipment Requirements

Shipments by truck (whether Class 7 or Class 9) must be accompanied by a shipping paper that is prepared in accordance with 49 CFR 172.200- 172.203.

Each shipment of radioactive materials shall be secured in order to prevent shifting during normal transportation conditions.

5.6.2.1 Truck Shipment Radiation Limitations

The following radiation limits shall be obeyed for truck transport:

- The dose rate from the truck shall not exceed 200 millirem per hour (mrem/hr) at any point on the outer surfaces of the truck, including the top and underside of the vehicle.
- The dose rate from the truck shall not exceed 10 mrem/hr at any point 2 meters from the outer lateral surfaces of the vehicle.
- The dose rate in the truck shall not exceed 2 mrem/hr in any normally occupied space except for private carriers whose exposed personnel wear radiation dosimetry devices and operate under a state or federally regulated radiation protection program.

In addition, there shall be no significant removable / Non-Fixed Radioactive Surface Contamination which will exceed 90% of the values specified in EM 385-1-80, Table 6-4, USACE Radiation Protection Manual, "Acceptable Surface Contamination Levels." Table values are 200 disintegrations per minute per

100 square centimeters (dpm/100 cm^2) alpha and 1000 dpm/100 cm^2 beta, gamma. Maximum removable contamination values are 180 dpm/100 cm^2 alpha and 900 dpm/100 cm^2 beta, gamma.

5.6.2.2 Truck Shipment Placarding

Each transport vehicle containing any quantity of hazardous material must be placarded on each end and each side with the type of placards specified in 49 CFR

Each placard on a motor vehicle must be readily visible from the direction of another motor vehicle to which the motor vehicle is coupled. Placarding may be on the front of a truck-tractor instead of or in addition to, the placarding on the front of the cargo body to which a truck-tractor is attached.

Each placard must:

- Be securely attached
- Be placed in a clear location
- Be located so that dirt or water is not directed to it from the wheels of the transport vehicle.
- Be located away from any markings; at least 3 inches (76.0 millimeters) from other markings
- Have identification numbers and/or words printed on it horizontally
- Be maintained by the carrier

5.6.3 Exclusive Use Shipments Requirements for Truck Transport

5.6.3.1 General Requirements

For Exclusive use shipments, the shipper shall provide specific written instructions for maintenance of exclusive use shipment controls to the carrier as specified below.

Written instructions required for exclusive use shipments must be sufficient so that, when followed, they will cause the carrier to avoid actions which will unnecessarily delay delivery or unnecessarily result in increased radiation levels or radiation exposures.

5.7 RADIATION LEVEL LIMITATIONS

Radiation levels for all shipments shall be limited so as not to exceed the limits set forth in 49CFR173.441.

5.7.1 Contamination Controls

There shall be no significant removable (non-fixed) Radioactive Surface Contamination which will exceed 90% of the values specified in EM 385-1-80, Table 6-4, USACE Radiation Protection Manual, "Acceptable Surface Contamination Levels." Table values are 200 dpm/100 cm^2 alpha and 1,000 dpm/100 cm^2 beta, gamma. Maximum removable contamination values are 180 dpm/100 cm^2 alpha and 900 dpm/100 cm^2 beta, gamma.

Vehicles used to transport radioactive materials under exclusive use conditions must be checked after each use with radiation detection instruments. These vehicles may not be returned to use until the radiation dose at every accessible surface is 0.5 mrem/hr or less, and the removable radioactive surface contamination is not greater than prescribed in the truck shipment contamination control section below.

If a Closed Transport Vehicle used solely for the transportation by public highway of radioactive material packages does not exceed 90% of the values specified in EM 385-1-80, Table 6-4, USACE Radiation Protection Manual, "Acceptable Surface Contamination Levels." (Table values are 200 dpm/100 cm^2

alpha and 1000 dpm/100 cm^2 beta, gamma. Maximum removable contamination values are 180 dpm/100 cm^2 alpha and 900 dpm/100 cm^2 beta, gamma.), and complies with the below requirements, the contamination control requirements 1 and 2 above do not apply.

- Interior surface shows a radiation dose of no more than 10 millirem per hour
- Dose is no more than 2 millirem per hour at a distance of 1 meter (3.3 feet) from any interior surface
- The vehicle must be stenciled with "For Radioactive Materials Use Only" in letters at least 7.6 cm (3 inches) high in a conspicuous location, on both sides of the exterior of the vehicle, and
- Vehicles must be kept closed at all times except during loading and unloading.

5.8 CERTIFICATE OF DISPOSAL

A Certificate of Disposal is required from the waste disposal facility to verify that the waste materials were received by the disposal facility and disposed of in accordance with federal, state, local regulations and the permit/license requirements of the disposal facility. Additionally, the certificate will identify shipment quantities and allow for direct comparison of individual shipments of materials. A Certificate of Disposal is required from the waste disposal facility for each individual shipment and will be provided to the USACE following disposal.

6.0 TRANSPORTATION AND DISPOSAL OF HAZARDOUS WASTE

6.1 PACKAGING, LABELING, AND MARKING

Before the waste is offered for shipment off-site, all hazardous waste containers will be clearly labeled "Hazardous Waste" in accordance with applicable USEPA and DOT regulations. The USEPA classification code and the DOT identification shipping name as listed in 40 CFR 262, 49 CFR 172, 49 CFR 173, will be placed on the appropriate container that is to be disposed off-site..

The following information is required to be on each container (drum) that contains hazardous waste (40CFR262.32):

- "Hazardous Waste Federal Law Prohibits Improper Disposal. If found contact the nearest police or public safety authority or the US Environmental Protection Agency.
- The Generators Name and address,"
- Generator's USEPA identification number,
- Manifest Tracking Number
- DOT shipping name (as referenced in 49 CFR 172.101), and
- Accumulation start date (if applicable)

Note: Volume and weight of the container is required for the manifest

6.2 PACKAGING CERTIFICATION

Before hazardous waste can be approved for off-site transport, all completed manifests, shipping documents, waste profiles, or other transportation documents will be submitted to the USACE for review and approval. The generator/shipper must certify packaging requirements as set forth in 49 CFR 172.204.

6.3 HAZARDOUS WASTE MANIFEST

The Uniform Hazardous Waste Manifest (USEPA Form 8700-22A) will be used for shipping and tracking all hazardous waste off-site. The TDC will be responsible for completing and submitting the manifest and other necessary shipping papers (e.g., waste profiles, Land Disposal Restriction certification [if required], and instructions for shipment). Waste Manifests will show the USACE as generator, and all manifests will be signed by the USACE after review and approval.

As required by 40 CFR 262.42, if a manifest copy documenting receipt of shipment at the approved Treatment, Storage, and Disposal Facility (TSDF) is not received within 35 days of initiation, the TDC will prepare and submit an exception report to the USEPA with a copy to the USACE. All necessary actions will be taken to track and obtain receipts of manifests.

6.4 TRANSPORTER OF HAZARDOUS WASTES

Before hazardous waste is offered for off-site shipment, a permitted transporter will be selected based on the requirements of 40 CFR 263. Notification of the transporter(s) to be used will be sent to the USACE for approval prior to shipment.

6.5 TREATMENT, STORAGE, AND DISPOSAL FACILITY

Before initiation of hazardous waste shipments, the USEPA Off-Site Coordinator (In USEPA Region which the disposal facility is located) will be contacted as specified in 40 CFR 300.440 to determine the pre-selected TSDF status with USEPA off-site policy and submit the information to the USACE for review and approval. Upon approval by the USACE, the TDC will coordinate with the TSDF to ensure waste profiles, pre-notification, and any special requirements are submitted to the TSDF.

6.6 RECORD KEEPING AND REPORTING

All manifests, record of analysis, inspection logs, and other pertinent records will be maintained by the TDC in keeping with the requirements of 40 CFR 262.40.

6.7 TRAINING REQUIREMENTS

Any person who directly affects hazardous materials transportation safety, which includes both Class 7 and Class 9 materials, is defined as a Hazmat Employee. This definition applies to any person(s) who perform the following:

- Loads, unloads, or handles hazardous materials
- Tests, reconditions, repairs, modifies, marks , or represents containers, drums or packaging as qualified in the use of transportation
- Prepares hazardous materials for transportation
- Is responsible for safety of transporting hazardous materials; or,
- Operates a vehicle used to transport hazardous materials.

In compliance with 49 CFR 172, training is required of Hazmat employees by the Hazmat employer.

6.7.1 General Awareness Training

Employees shall be trained to recognize and identify hazardous materials consistent with DOT hazard communication standards. Employees must be familiar with DOT requirements and hazards communicated by placards, labels, markings, and shipping papers.

6.7.2 Job Specific Training

Employees shall receive training that is specific and appropriate to the employee function.

6.7.3 Safety Training

Employees shall receive training to protect themselves from the hazards to which they may be exposed in the workplace. This includes measures of personal protection, engineering controls or employer protection measures, and procedures for safe handling practices. Emergency response training for employees is also required.

OSHA or USEPA Training: Training conducted by employers to comply with the hazard communications programs required by OSHA of the Department of Labor or the USEPA to the extent that training addresses the training specified above may be used to satisfy the training requirements of 49 CFR 172 in order to avoid unnecessary duplication of training.

6.7.4 Recurrent Training

The employee shall receive additional training, at a minimum, every three years, to ensure that employee knowledge is maintained. In addition, Hazmat employees shall be tested by appropriate means on the training subjects covered in 49 CFR 172.704.

6.7.5 Recordkeeping

Training records for each employee must be kept on file by the Hazmat employer throughout the employee's employment and for seven years thereafter. The record shall include the following information:

- The Hazmat employee's name;
- The most recent training completion date of the Hazmat employee's training;
- A description, copy, or the location of the training materials used to meet the requirements of 49 CR 172;
- The name and address of the person providing the training; and
- Certification that the Hazmat employee has been trained and tested.

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7.0 CERTIFICATION OF WASTE

Upon receipt of return manifest and certification of disposal for radiological waste shipped or any hazardous waste shipments sent to a Resource Conservation Recovery Act (RCRA) TSDF, the USACE will document all manifests and certifications to complete the shipping record and submit the original certificates of disposal. The TDC will prepare all shipping paperwork and notifications for USACE approval, and assist the USACE with certifications, as needed.

USACE shall be responsible for the formal submittal of the original certificates to the appropriate regulatory agencies within 180 days of each shipment in accordance with NJDEP requirements.

Biennial reports are required by NJDEP every even year and shall document the previous odd year's manifest activities.

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8.0 EMERGENCY CONTACTS AND EMERGENCY RESPONSE

8.1 EMERGENCY CONTACTS

In the event that an emergency situation arises, the appropriate immediate response must be taken by the first person to recognize the situation. The field crew will immediately notify the site management of the incident, and the appropriate emergency service organization will be contacted. A list of emergency contacts and telephone numbers is provided in **Table 4** and a copy of the emergency telephone numbers and directions to Hackensack Medical Center will be posted in all field and office trailers.

The Project Manager, Corporate Occupational Health and Safety Manager, Project Site Safety and Health Officer (SSHO), and USACE will be notified immediately (within one hour of occurrence) of any accident, injury, or illness. Additionally, site management shall be notified immediately in the cases of fires, spills, near misses, vehicle accidents, release of site contaminants, unknown visitors and trespassers, and site visits from regulators. In the case of injury or illness, a trained person will render the proper emergency first aid care. First aid equipment and an emergency eyewash will be available in all field and office trailers. Personnel will be notified as to the locations of first aid equipment during the initial safety briefing session.

If the injury or illness is from exposure to a hazardous substance, rapid identification of that substance should be attempted. This information must be provided to medical personnel. MSDSs will be kept on-site in the office trailer. The MSDS details first aid procedures to follow in the event an exposure occurs.

Unless the emergency event is extreme and obvious, the decision to cease all field activities and evacuate the site will be made by the Project Manager and the SSHO. Field personnel will report to the Stepan Company guard house or other designated location to sign-out, if possible. Local authorities (Police Department, Fire Department, or Civil Defense) will decide if the emergency requires evacuation of the surrounding community. Responsibility for community evacuations will be with the local authority in charge of the emergency.

Table 4 – FMSS Emergency Contacts and Telephone Numbers

CONTACT NAME	TELEPHONE NUMBER
Cabrera Personnel	
Project Manager; *Andy Mills*	201.982.7886 (w); 716.374.1501 (c)
Site Superintendent; *Mike Farrell*	201.226.6617
Corporate Occupational Health and Safety and Health Manager, *Sean Liddy*	410-982-0726 (w)
Site Safety and Health Officer; *Chad Miller*	201.982.7895 (w); 570.872.4711 (c)
Radiation Safety Officer; *Dennis Whitlock*	201.982.7898 (w); 716.374.0895 (c)
Transportation and Disposal Coordinator; *Jim Imbornoni*	
USACE PERSONNEL	
Programs and Project Site Manager; *Jim Moore*	201.226.6608
FUSRAP Team Leader/Resident Engineer; *Kam Yin Chan*	201.226.6643
Project Engineer; *Ken Maley*	201.226.6635
Health Physicist; *Dave Hays*	816.585.5110
EMERGENCY RESPONSE CENTERS	
Fire/Police/Rescue Unit	911
Hackensack Medical Center	201.996.2000
Poison Control Center	1.800.336.8888
National Response Center	1.800.424.8802
Garden State Underground Plant Location Service	1.800.272.1600

The information provided to the emergency contact should include the nature of the incident and the exact location. Specifically, the information includes the following:

- Name and telephone number of the individual reporting the incident
- Location and type of incident
- Nature of the incident (fire, explosion, spill, or release) and substances involved
- Number and nature of medical injuries
- Potential for additional risks or dangers
- Potential off-site risks or dangers
- Movement or direction of spill/vapor/smoke
- Response actions currently in progress
- Estimate of quantity of any released materials
- Status of incident and other pertinent information

8.2 CHEMTREC

A subcontractor such as Chemtrec will be used as a 24-hour live number on manifest forms and other shipping documents in cases of emergency. Shipping papers, emergency procedures, etc. will be supplied to the subcontractor for each shipment.

Chemtrec will serve as a resource for obtaining immediate critical response information for incidents involving chemical, biological, and radiological waste shipments. The emergency number for Chemtrec is 1.800.424.9300. The customer identification number for Chemtrec is CCN 3584.

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9.0 TRANSPORTATION AND DISPOSAL

The Materials Handling/Transport and Disposal of FMSS waste involves three separate tasks including material excavation and handling; transportation; and disposal. The materials handled will primarily consist of radiologically contaminated soils or materials. However, solid and hazardous wastes (RCRA Subtitle D and C, respectively) may also be encountered at the site.

9.1 TRANSPORTATION

9.1.1 Off-Site Rail Transportation

Due to the large volume of radiologically contaminated materials generated at the FMSS, rail transportation is the most economical, and feasible form of transportation. Lined gondola railcars will be utilized to transport contaminated soil off-site to one of two disposal facilities currently under contract. EnergySolutions in Utah and U.S. Ecology in Idaho will accept radiologically contaminated materials from the FMSS. Additionally, U.S. Ecology Idaho also will have the capability to accept chemically contaminated soil for disposal. Other disposal facilities are currently under consideration, but have not yet been contracted. Prior to execution of a contract with a disposal facility, an approval letter from the disposal facility regulator shall be obtained stating that the material from the FMSS is acceptable to the facility. This requirement shall be in addition to the facility's review of the waste profiles for compliance with the facility permit/license. NYS&W is the railroad providing rail transportation services to the FMSS as NYS&W has the right-of-way for site access, storage capabilities for railcars/gondolas on sidings when preparing shipments, and other similar benefits. A subcontractor will be used to provide railcars and handle the logistics for the transport of railcars. The subcontractor will act as a liaison between the prime contractor and the railroads and will prepare rail waybills.

9.1.2 On-Site Transportation

Dump trucks will be utilized to transport soils from the site of excavation to the MISS, and vacuum trucks will transport liquid materials to the construction water treatment system.

9.1.3 Trucking Routes

Trucks will be utilized to transport both radiologically and non-radiologically contaminated and hazardous and non-hazardous solid wastes from off-site work areas to the MISS. Specific trucking routes will be developed based on the location of the off-site work areas. Site specific routes have been identified during development of the site-specific *RAWP* (USACE, 2013a).

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10.0 REFERENCES

(ASTM, 1997) *D2487-93 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System),* West Conshohocken, Pennsylvania.

(Cabrera, 2013) *Maywood Loadout Soil Stockpile Sampling Procedure, FUSRAP Maywood Superfund Site*. November 2013.

(USACE, 2003) *Record of Decision for Soils and Buildings at the FUSRAP Maywood Superfund Site*. Prepared by

(USACE, 2013a) *Remedial Action Work Plan, FUSRAP Maywood Superfund Site,* Prepared by Prepared by Cabrera Services, December. .

(USACE, 2013b) *Accident Prevention Plan , FUSRAP Maywood Superfund Site,* Prepared by Cabrera Services, January .

(USACE, 2014a) *General Environmental Protection Plan, FUSRAP Maywood Superfund Site, Revision 0.* Prepared by by Cabrera Services, January.

(USACE, 2014b) *Water Management Plan, FUSRAP Maywood Superfund Site,* Prepared by Prepared by Cabrera Services, January.

(USACE, 2014cd) *Uniform Federal Policy-Quality Project Plan, FUSRAP Maywood Superfund Site,* Prepared by Cabrera Services, January.

(USACE, 2014d) *Final Master Final Status Survey Plan, FUSRAP Maywood Superfund Site,* Prepared by Cabrera Services, January.

(USACE, 2014e) *Construction Load-Out, Transportation and Disposal Plan, FUSRAP Maywood Superfund Site, .* Prepared by Cabrera Services, Inc., Inc., January

(USDOE et al., 1997) U.S. Department of Defense, U.S. Department of Energy, U.S. Environmental Protection Agency, U.S. Nuclear Regulatory Commission, *Multi-Agency Radiological Survey and Site Investigation Manual,* NUREG-1575, EPA 402-R-97-016. Washington D.C.

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FIGURES

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Area Surveys

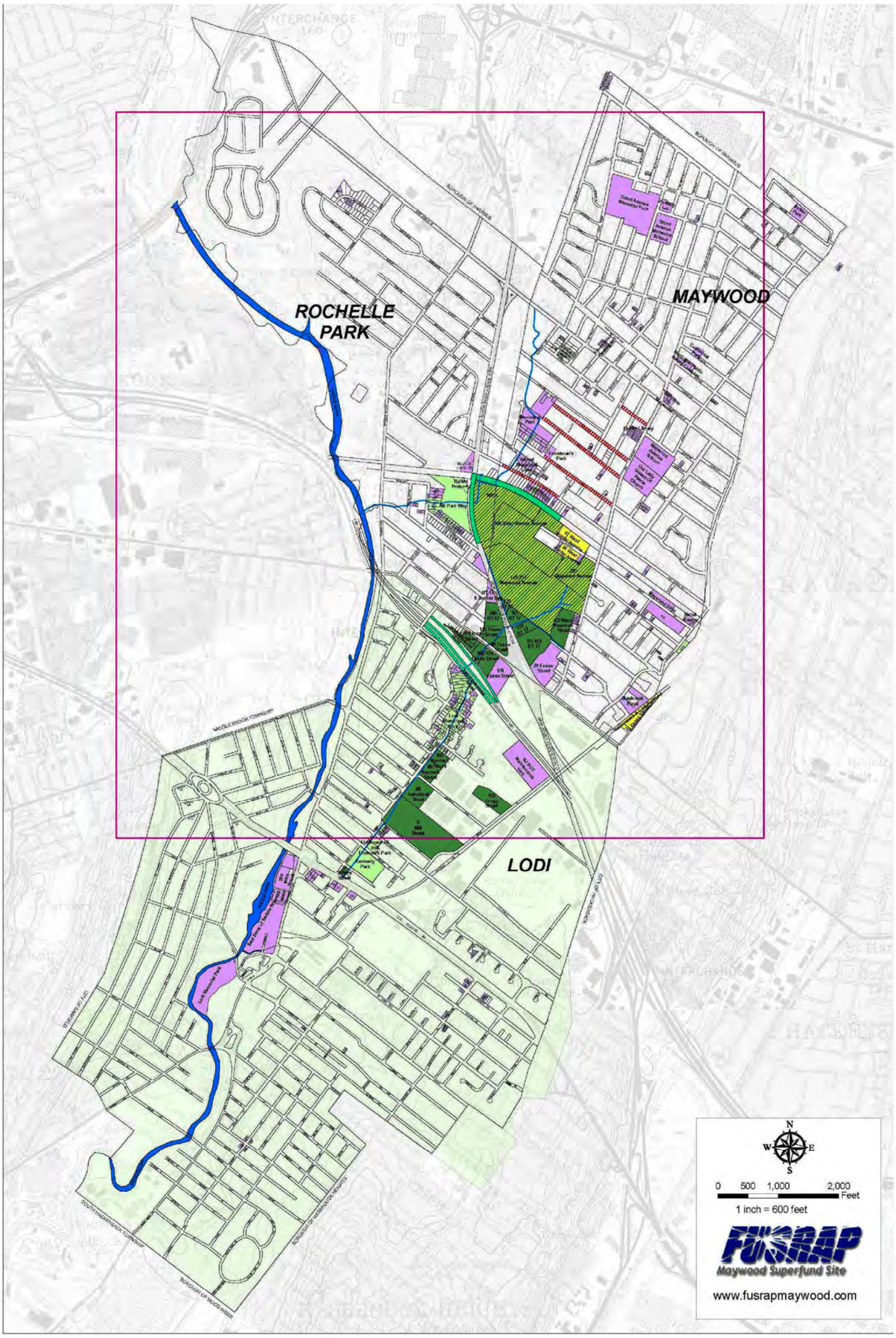
- 1981 Aerial Survey
- 1984 Mobile Gamma Scan
- 1991 Gamma Survey
- Surveyed - Not contaminated

Phase I Properties

- Remediated

Phase II Properties

- Fully Remediated
- Active Remediation
- Scheduled for Remediation
- Inaccessible Contamination, not scheduled for remediation until made accessible by property owner (boundaries based on available data)



Note: The location and status of the vicinity properties shown on this map are for general reference only. The USACE is reviewing historical archives to confirm the accuracy of the property locations and status depicted on the map. If you have specific questions about a particular property, please contact the USACE Public Information Center at 75A West Pleasant Avenue, Maywood, New Jersey or call 201-843-7466. Or, visit the FUSRAP Maywood Superfund Site website at <www.fusrapmaywood.com>.

Stream and drainage information compiled from field surveys, U.S.G.S. Quad sheets and aerial photographs/surveys.

The Formerly Utilized Sites Remedial Action Program (FUSRAP) was established by the federal government in 1974 to identify and clean up contaminated sites from the early years of the nation's atomic energy program. The Maywood Site was not associated with that program. It was added to FUSRAP because it formerly housed a commercial operation that extracted thorium (a naturally-occurring radioactive ore) from monazite sand. The site was added to the Environmental Protection Agency's National Priorities List of hazardous waste sites in 1983. The U.S. Army Corps of Engineers assumed responsibility for FUSRAP in 1997.

CABRERA SERVICES
1106 N. CHARLES ST.
SUITE 300
BALTIMORE, MD 21201

U.S. ARMY CORPS OF ENGINEERS

FUSRAP MAYWOOD SITE LOCATION MAP

FUSRAP Maywood Superfund Site
Material Handling/Transportation and Disposal Plan
Maywood, New Jersey

Project: 13-3900.01	Date: 11/18/2013	Figure 1-1
Prepared By: KW	Reviewed By: JB	Rev 1

C:\Users\kjackson\Desktop\GIS files 11_18\Maywood\MXD\Work Plans Nov 2013\MHTDP\Figure 1-1 Site Location.mxd 11/18/2013 kwheatley

FIGURE 1 - 2
FLOWCHART FOR OFF-SITE WASTE REMOVAL

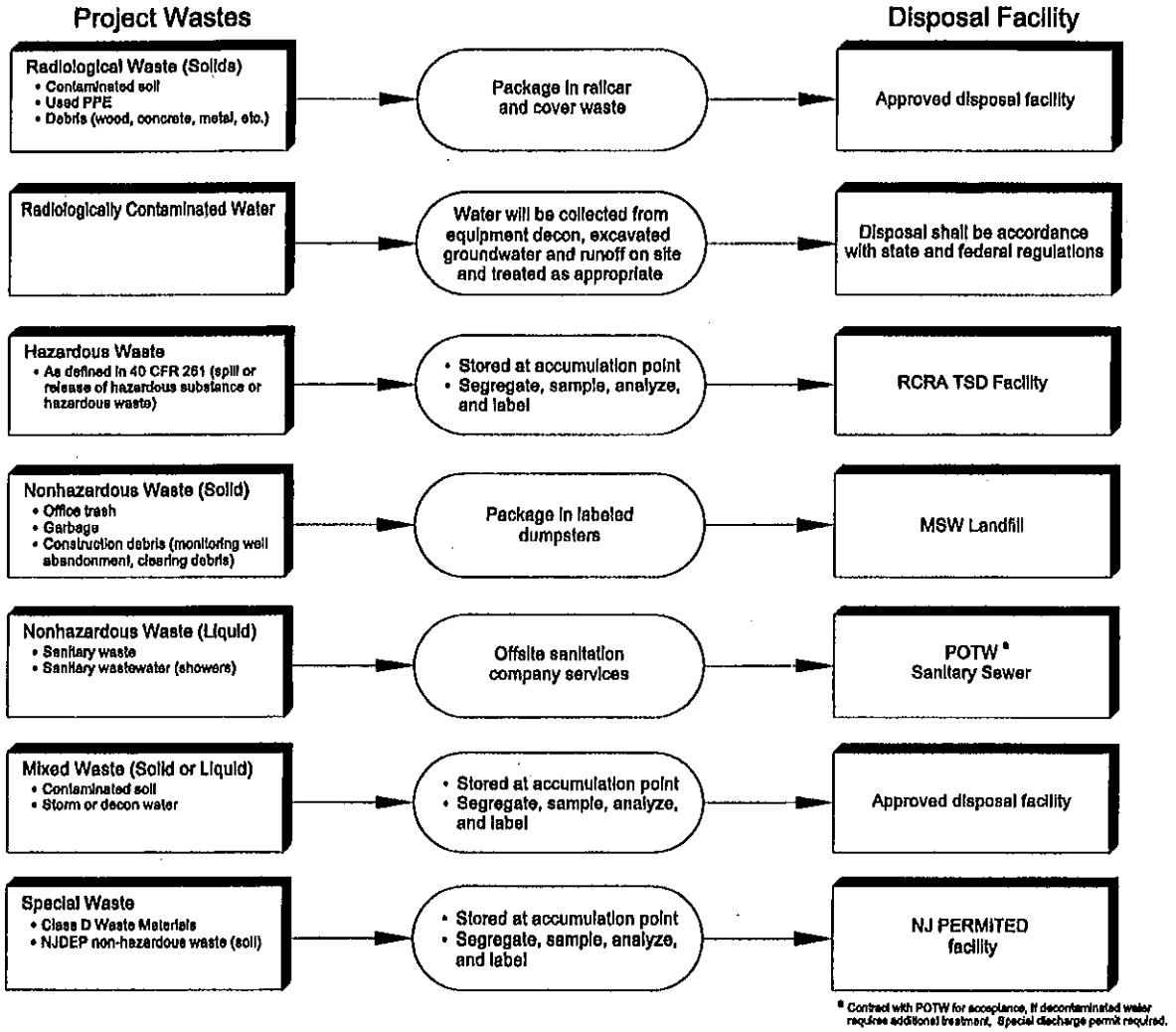


FIGURE 2-1
NON-DOT SPECIFICATION LABEL FOR HAZARDOUS MATERIAL SHIPMENTS

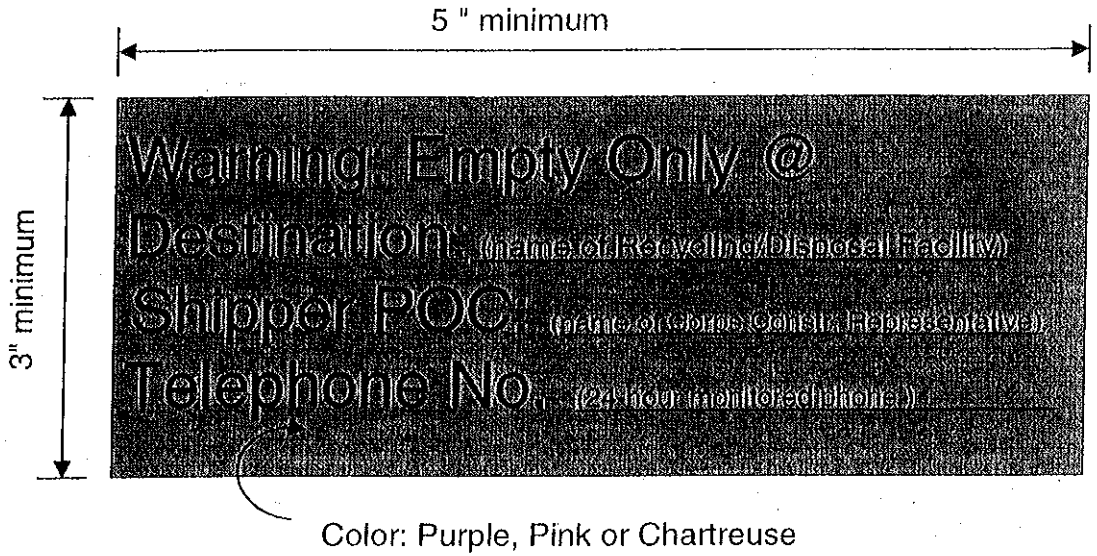
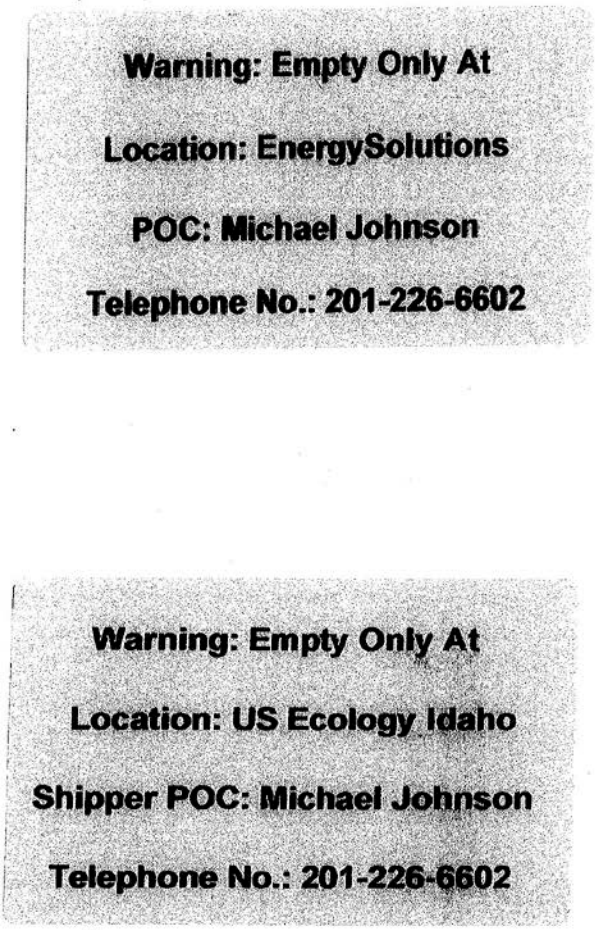


FIGURE 2-2

USACE “OPEN ONLY AT LOCATION [FACILITY NAME] LABEL



Color: Magenta/Pink

APPENDIX A

MAYWOOD LOAD-OUT SOIL STOCKPILE SAMPLING PROCEDURE

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TITLE:	NO.:	
MAYWOOD LOADOUT SOIL STOCKPILE SAMPLING PROCEDURE	PAGE:	Page 1 of 7
	DATE:	November 14, 2013

APPROVED:

Joseph Gurda_____
Project Engineer

1.0 PURPOSE

This Loadout Soil Stockpile Sampling Standard Operating Procedure (SOP) has been developed to ensure that stockpiled soil has been properly characterized for purposes of off-site transportation prior to being loaded into railcars. The samples will undergo radiological analysis to determine the activities of the radiological contaminants of concern for the Maywood Site: thorium-232, radium-226 and uranium-238 and their decay products. A portion of the soil stockpile samples will also be used to determine the moisture content of the soil. The following sections describe the methods, personnel, materials and equipment that may be required to collect soil samples. This sampling will provide data for each rail car and sufficient data to revise this procedure as necessary.

2.0 SCOPE

This procedure serves as general guidance on the proper methods for collecting grab and composite soil samples from stockpiled soils. This procedure will be used to generate the following samples:

- **Soil Stockpile Composite Samples** – each sample will be used to characterize the radiological content of approximately 300 cubic yards of soil (enough soil to fill 4 gondola railcars).
- **Soil Moisture Content Samples** - part of each of the Soil Stockpile Composite Samples will be used to determine the moisture content of the soil.
- **Soil Stockpile Bias Grab Samples** – will be used to quantify the radiological content of the area of highest activity ("hot spot") within each 300 cubic yard stockpile
- **Railcar Soil Composite Sample** – will be used to characterize the radiological content of the soil loaded into each individual railcar

Soil excavated from the site is sent to a central soil stockpile located on the MISS. The soil is temporarily stockpiled in this central soil stockpile as it awaits off-site shipment for disposal. When railcars are available and the loading of railcars has been approved, then railcar loading activities can begin. Each soil stockpile composite sample that will be taken is sufficient to characterize approximately 300 cubic yards of soil. Each railcar of Maywood soil contains an average of 75 cubic yards of soil. Therefore, the analytical results from this sample will be used to characterize approximately 4 gondola railcars.

A front end loader equipped with a bucket scale is used to weigh the soil and load it into the railcars.

The face of the soil stockpile from which soil will be removed for loading into railcars will be identified by the Field Supervisor (FS) or his designee. A gamma scan of the face of the soil stockpile will be performed. The purpose of the scan is to ensure uniformity of the activity within the loaded soil. The locations of "hot spots", small areas having significantly higher readings than the surrounding areas, will be noted. The stockpile will then be subjected to random and biased sampling as discussed in section 4.3. Samples will be analyzed by gamma spectroscopy for Th, Ra, and U in the on-site radio-analytical laboratory. "Wet non equilibrated counts" (analysis of samples that have not been dried or held for radium-226 daughter equilibration) will be used for characterizing the soil for DOT classification. Wet counts are more representative of the activity concentrations of the soil and this method is used by the disposal site(s) to determine compliance with the WAC.

3.0 RESPONSIBILITIES

3.1 Site Safety & Health Officer (SSHO)

All project activities must be carried out in accordance with the Site-Specific Safety & Health Plan (SSHP). The SSHO is responsible for ensuring that all site workers (Shaw and its subcontractors) have read, signed and are familiar with the requirements of the SSHP and that the requirements of the SSHP are met during site activities.

3.2 Project Chemist (PC)

The PC shall ensure that the activities outlined in this SOP correspond to and are performed in accordance with the policies and procedures outlined in the Chemical Data Quality Management Plan for this project.

3.3 Transportation & Disposal Coordinator (TDC)

The TDC ensures that the necessary soil samples are collected and that the analytical results are properly reported on shipping papers and supporting documents. The TDC will inform the onsite laboratory in advance of the railcar loading schedule and the number of samples to be generated. The TDC will also act as an interface between site personnel and the onsite laboratory.

3.4 Field Supervisor (FS)

The FS on the MISS reports to the Project Superintendent and is responsible for the direct supervision of field personnel assigned to the MISS. This includes personnel responsible for performing activities outlined in this SOP. The FS, or his designee, is responsible for designating from which stockpile(s) soil will be removed for each day's railcar loading activities.

3.5 MISS Field Engineer (FE)

The FE is responsible for documenting field activities performed on the MISS including the activities outlined in this SOP. The FE is responsible for ensuring that the appropriate sample numbers are assigned to each soil sample and for coordinating the flow of information from the field to the TDC. The designated MISS FE may vary depending upon other project activities.

3.6 Radiation Protection Technician (RPT)

An RPT is assigned to each specific field activity and is responsible for implementation of the SSHP for that activity. An RPT is responsible for collection of soil samples per this SOP and for determination of the soil moisture content. The RPT also completes the chain-of-custody for the soil samples and transports them to the onsite lab for analysis. The RPT or the FE may print the necessary labels for each sample.

3.7 Additional Field Personnel

Various types of additional field personnel will be involved in implementing the activities outlined in this SOP. The types of field personnel that may be required include but are not limited to:

- Equipment Operators
- Laborers

4.0 PROCEDURE

Site personnel involved in soil stockpile sampling activities are required to have read and signed the SSHP and to perform activities in accordance with the SSHP, this SOP and any other site work plan or procedure that may apply.

4.1 Equipment and Material Requirements for soil stockpile sampling

The following is a list of equipment and materials that may be used for soil stockpile sampling activities.

- Personal Protective Equipment (as outlined in the SSHP)
- Loadout and RPT Field logbook(s)
- Decontamination supplies (Alconox detergent, DI water, etc.)
- Sample Containers (marinellis) and labels
- Indelible markers
- 2”x2” Sodium-Iodide Portable Radiation Survey Instrument
- Stainless steel or disposable spoon, trowel, or shovel or other suitable sampling device
- Stainless steel mixing bowls, plastic re-sealable bags or other suitable mixing/collection container
- Chain-of-Custody forms
- Duct tape
- Paper towels

4.2 Pre-Sampling Activities

All non-disposable sampling equipment should be decontaminated prior to each sampling episode. Sample container labels will be prepared ahead of time. The sample numbers to be assigned will be determined by the Project Chemist and once established will continue sequentially.

4.2.1 Equipment Decontamination

The 5-step decontamination procedure listed below is the generic standard procedure for small equipment (e.g. spatulas, hand augers, etc.) decontamination which combines both physical and chemical removal steps. This procedure may be modified to address site-specific chemicals of concern and media being sampled. There is no solvent rinse because solvent rinses are not necessarily required when organics are not a contaminant of concern. The decontamination procedure is as follows:

- Remove any solid particles from the equipment or material by brushing and then rinsing with available tap water. This initial step is performed to remove gross contamination.
- Wash equipment with a non–phosphate detergent solution.
- Rinse with distilled/deionized water.
- Air dry the equipment completely.
- Rinse again with distilled/deionized water.

Dispose of all rinse and decontamination fluids in an appropriate manner in accordance with specifications in the Remedial Action Work Plan.

4.3 Soil Stockpile Sampling

4.3.1 Soil Stockpile Composite Sampling

The following sampling procedure will be used to obtain a representative soil stockpile composite sample:

1. The FS designates the location of the soil stockpile(s) from which soil will be removed and loaded into the railcars during railcar loading activities.

2. An RPT scans the accessible surfaces of the identified soil stockpile to identify “hot spots” within the soil stockpile.

3. Using an appropriate sampling implement, the RPT obtains ten random grab soil samples from the face of the stockpile.

4. Place the grab samples into a suitable vessel/bag/bowl. Inspect the material for large stones and other debris which are not representative of the sample matrix and remove them from the bowl. Homogenize the sample by breaking up any large clumps and thoroughly mix the soil with a stainless steel spatula or other suitable device.

5. Place approximately 500g of the sample into a suitable sample container and secure the top.

6. Label the sample with the appropriate sample label. Complete all chain-of-custody documents.

7. Record sampling event in the RPT field logbook and in the Loadout Field Logbook. Information to be recorded includes: date, sample number, type of sample, location of the stockpile, stockpile ID number and the rail car numbers associated with each soil sample.

8. Submit samples to onsite laboratory for analysis.

9. Decontaminate equipment after use and between samples or discard disposable equipment.

10. One composite sample will be generated for approximately every 300 cubic yards (approximately 4 railcars) that will be loaded.

4.3.2 Soil Moisture Content Sampling

Approximately 100-200 g of each soil stockpile composite sample (see section 4.3.1) will be set aside in a separate sample container and the lid tightly closed. This soil sample will be analyzed using a soil moisture analyzer. The percentage of moisture in the sample will be used to determine the quantity of absorbent to be added to the top of each railcar into which soil from this stockpile is loaded.

4.3.3 Soil Stockpile Biased Grab Sample

The following sampling procedure will be used to obtain a representative soil stockpile composite sample:

1. The FS designates the location of the soil stockpile(s) from which soil will be removed and loaded into the railcars during railcar loading activities

2. An RPT scans the accessible surfaces of the identified soil stockpile to identify “hot spots” within the soil stockpile. The location of the highest area of radiological activity will be noted.

3. Using an appropriate sampling implement, the RPT obtains a grab soil sample from the location of the “hot spot” noted in step 2 above.

4. Place the grab sample into a suitable vessel/bag/bowl. Inspect the material for large stones and other debris which are not representative of the sample matrix and remove them from the bowl. Homogenize the sample by breaking up any large clumps and thoroughly mix the soil with a stainless steel spatula or other suitable device.

5. Place a portion of the sample into a suitable sample container and secure the top.

6. Label the sample with the appropriate sample label. Complete all chain-of-custody documents.

7. Record sampling event in the RPT field logbook and in the Loadout Field Logbook. Information to be recorded includes: date, sample number, type of sample, location of the stockpile, stockpile ID number and the soil stockpile composite sample number associated with this soil stockpile

8. Submit sample to onsite laboratory for analysis.

9. Decontaminate equipment after use and between samples or discard disposable equipment.

4.3.4 Railcar Soil Composite Sample

The following sampling procedure will be used to obtain a representative soil stockpile composite sample:

1. The FE designates which soil stockpiles will be used to load railcars on each day that railcar loading activities take place. Only soil stockpiles which have been previously sampled will be used for railcar loading.

2. An RPT, using an appropriate sampling implement, obtains a grab soil sample from the face of the soil stockpile from which the front end loader will remove soil for loading into railcars. The grab sample is taken from a random location on the active face of the stockpile. Place the grab sample into a suitable vessel/bag/bowl.

3. Prior to the front end loader removing each bucket of soil from the face of the soil stockpile, the RPT will take a grab sample from a random location on the face of the soil stockpile. Each grab sample will be placed in the same vessel/bag/bowl. This process continues until the railcar is loaded.

4. Once the railcar is loaded, the RPT inspects the material in the vessel/bag/bowl for large stones and other debris which is not representative of the sample matrix and remove them from the bowl. Homogenize the sample by breaking up any large clumps and thoroughly mix the soil with a stainless steel spatula or other suitable device.

5. Place a portion of the sample into a suitable sample container and secure the top.

6. Label the sample with the appropriate sample label. Complete all chain-of-custody documents.

7. Record sampling event in the RPT field logbook and in the Loadout Field Logbook. Information to be recorded includes: date, sample number, type of sample, location of the stockpile, stockpile ID number and the identification number of the railcar into which the soil was loaded.

8. Submit sample to onsite laboratory for analysis.

9. Decontaminate equipment after use and between samples or discard disposable equipment.

5.0 SAMPLE ANALYSIS

The samples will be analyzed by gamma spectroscopy for thorium-232, radium-226 and uranium-238 in the on-site radio-analytical laboratory.

Wet non equilibrated counts" (analysis of samples that have not been dried or held for radium-226 daughter equilibration) will be used for characterizing the soil for DOT classification.
Wet counts are more representative of the activity concentrations of the soil and this method is used by the disposal site(s) to determine compliance with the WAC.
Radium 226 results will be corrected for daughter equilibrium by use of the lab correction factor.

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APPENDIX B

APPROVED WASTE DISPOSAL FACILITIES ACCEPTANCE AND REJECTION CRITERIA

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C.3 WASTE ACCEPTANCE CRITERIA

C.3.1 Pre-acceptance Review

The preacceptance protocol has been designed to ensure that only hazardous and radioactive material that can be properly and safely stored, treated and/or disposed of by USEI are approved for receipt at the facility. A two-step approach is taken by USEI. The first step is the chemical and/or radiological and physical characterization of the candidate waste stream by the generator. The second step is the preacceptance evaluation performed by USEI to determine the acceptability of the waste for receipt at the facility. Figure C-2 presents a logic diagram of the preacceptance protocol that is utilized at the facility.

C.3.2 Radioactive Material Waste Acceptance Criteria

The following waste acceptance criteria are established for accepting radiological contaminated waste material that is generally or specifically exempted from regulation by the Nuclear Regulatory Commission (NRC) or an Agreement State under the Atomic Energy Act of 1954 ("AEA"), as amended. Material may also be accepted if it is not regulated or licensed by the NRC or has been authorized for disposal by the IDEQ and is within the numeric waste acceptance criteria. Waste acceptance criteria are consistent with these restrictions.

The following five tables establish types and concentrations of radioactive materials that may be accepted. These tables are based on categories and types of radioactive material not regulated by the NRC based on statute or regulation or specifically approved by the NRC or and Agreement State for alternate disposal. The criteria are consistent with these restrictions and detailed analyses set forth in *Waste Acceptance Criteria and Justification for FUSRAP Material*, prepared by Radiation Safety Associates, Inc. (RSA) as subsequently refined, expanded and updated in *Waste Acceptance Criteria and Justification for Radioactive Material*, prepared by USEI.

Material may be accepted if the material has been specifically exempted from regulation by rule, order, license, license condition, letter of interpretation, or specific authorization under the following conditions: Thirty (30) days prior to intended shipment of such materials to the facility, USEI shall notify IDEQ of its intent to accept such material and submit information describing the material's physical, radiological, and/or chemical properties, impact on the facility radioactive materials performance assessment, and the basis for determining that the material does not require disposal at a facility licensed under the AEA. The IDEQ will have 30 days from receipt of this notification to reject USEI's determination or require further information and review. No response by IDEQ within thirty (30) days following receipt of such notice shall constitute concurrence. IDEQ concurrence is not required for generally exempted material as set forth in Table C.4a.

Based on categories of waste described in the waste acceptance criteria, the concentration of the various radionuclides in the conveyance (e.g., rail car gondola, other container etc.) shall not exceed the concentration limits established in the WAC without the specific written approval of the IDEQ unless generally exempted as set forth in Table C.4a. Radiological surveys will be performed as outlined in ERMP-01 to verify compliance with the WAC. If individual "pockets" of activity are detected indicating the limits may be exceeded, the RSO or RPS shall investigate the discrepancy and estimate the extent or volume of the material with the potentially elevated

radiation levels. The RPS or RSO shall then make a determination on the compliance of the entire conveyance load with the appropriate WAC limits. If the conveyance is determined not to meet the limits, USEI will notify IDEQ's RCRA Program Manager within 24 hours of a concentration based exceedance of the facility WAC to evaluate and discuss management options. The findings and resolution actions shall then be documented and submitted to the IDEQ.

The radioactive material waste acceptance criteria, when used in conjunction with an effective radiation monitoring and protection program as defined in the USEI *Radioactive Material Health and Safety Plan* and *Exempt Radioactive Materials Procedures* provides adequate protection of human health and the environment. Included within this manual are requirements for USEI to submit a written summary report of Table C.1 through C.2 radioactive material waste receipts showing volumes and radionuclide concentrations disposed at the USEI site on a quarterly basis. USEI will also submit a Table C.3 through C.4b annual report of exempted products devices, materials or items within 60 (sixty) days of year end (December 31st). The annual report will provide total volumes or mass of isotopes and total activity by isotope listing the activity of each radionuclide disposed during the preceding year, and the cumulative total of activity for each radionuclide disposed at the facility. The report will include an updated analysis of the impact on the facility performance assessment.

These criteria and procedures are designed to assure that the highest potential dose to a worker handling radioactive material at USEI shall not exceed 400 mrem/year TEDE dose, and that no member of the public is calculated to receive a potential dose exceeding 15 mrem/year TEDE dose, from the USEI program. TEDE is defined as the "Total Effective Dose Equivalent", which equals the sum of external and internal exposures. The public dose limit during operation activities is limited to 100 mrem/yr TEDE dose. An annual summary report of environmental monitoring results will be submitted to IDEQ by June 1st for the preceding year.

Materials that have a radioactive component that meets the criteria described in Tables C.1 through C.4b and are RCRA regulated material will be managed as described within this WAP for the RCRA regulated constituents.

Table C.1: Unimportant Quantities of Source Material Uniformly Dispersed* in Soil or Other Media**

	Status of Equilibrium	Maximum Concentration of Source Material	Sum of Concentrations Parent(s) and all progeny present***
a	Natural uranium in equilibrium with progeny	<500 ppm / 167 pCi/g (^{238}U activity)	≤ 3000 pCi/g
	Refined natural uranium (^{238}U, ^{235}U, ^{234}U; ^{234Th}, ^{234m}Pa, ^{231}Th)	<500 ppm / 333 pCi/g	≤ 2000 pCi/g
	Depleted Uranium (^{234Th}, ^{234m}Pa)	<500 ppm / 169 pCi/g	≤ 2000 pCi/g
b	Natural thorium (^{232}Th + ^{228}Th)	<500 ppm / 110 pCi/g	≤ 2000 pCi/g
	^{230}Th in equilibrium with progeny	<0.01 ppm / 200 pCi/g	≤2000 pCi/g
	^{230}Th (with no progeny)	0.1 ppm / ≤2000 pCi/g	
	Any mixture of Thorium and Uranium	Sum of ratios ≤ 1****	≤2000 pCi/g

Table C.2: Naturally Occurring Radioactive Material Other Than Uranium and Thorium Uniformly Dispersed* in Soil or Other Media**

	Status of Equilibrium	Maximum Concentration of Parent Nuclide	Sum of Concentrations of Parent and All Progeny Present***
a	^{226}Ra or ^{228}Ra with progeny in bulk form [1]	500 pCi/g	≤ 4500 pCi/g
b	^{226}Ra or ^{228}Ra with progeny in reinforced IP-1 containers [1]	1500 pCi/g	13,500 pCi/g
c	^{210}Pb with progeny(Bi & ^{210}Po)	1500 pCi/g	4500 pCi/g
	^{40}K	818 pCi/g	N/A
	Any other NORM		≤3000 pCi/g

[1] Any material containing ^{226}Ra greater than 222 pCi/g shall be disposed at least 6 meters from the external point on the completed cell.

Table C.3: Non-Production Particle Accelerator Produced Radioactive Material*****

Acceptable Material	Activity or Concentration
Any non-production particle accelerator produced radionuclide.	All materials shall be packaged in accordance with USDOT packaging requirements. Any packages containing iodine or volatile radionuclides will have lids or covers sealed to the container with gaskets. Contamination levels on the surface of the packages shall not exceed those allowed at point of receipt by USDOT rules. Gamma or x-ray radiation levels may not exceed 10 millirem per hour anywhere on the surface of the package. All packages received shall be directly disposed in the active cell. All containers shall be certified to be 90% full.

*Average over conveyance or container. The use of the phrase "over the conveyance or container is meant to reflect the variability on the generator side. The concentration limit is the primary acceptance criteria.

**Unless otherwise authorized by IDEQ, other Media does not include radioactively contaminated liquid (except for incidental liquids in materials). See radioactive contaminated liquid definition (definition section of Part B permit).

*** Diffuse waste with a total concentration (sum of concentrations of all radionuclides present) which is 2000 pCi/g or less may be accepted at the site (i.e., the controlling limit is 2000 pCi/g).

**** $\frac{\text{Conc. of U in sample}}{\text{Allowable conc. of U}} + \frac{\text{Conc. of Th in Sample}}{\text{Allowable conc. of Th}} \leq 1$

***** Any material that has been made radioactive by use of a non-production particle accelerator as set forth in Federal Register, Vol. 72, No. 189, Monday October 1, 2007, page 55868.

Table C.4a: NRC Exempted Products, Devices or Items

Exemption 10 CFR Part*	Product, Device or Item	Isotope, Activity or Concentration
30.15	As listed in the regulation	Various isotopes and activities as set forth in 30.15
30.14, 30.18	Other materials, products or devices specifically exempted from regulation by rule, order, license, license condition, concurrence, or letter of interpretation	Radionuclides in concentrations consistent with the exemption
30.19	Self-luminous products containing tritium, ^{85}Kr, ^{3}H or ^{147}Pm	Activity by Manufacturing license
30.20	Gas and aerosol detectors for protection of life and property from fire	Isotope and activity by Manufacturing license
30.21	Capsules containing ^{14}C urea for *in vivo* diagnosis of humans	^{14}C, one µCi per capsule
40.13(a)	Unimportant quantity of source material: see table above	≤0.05% by weight source material
40.13(b)	Unrefined and unprocessed ore containing source material	As set forth in rule
40.13(c)(1)	Source material in incandescent gas mantles, vacuum tubes, welding rods, electric lamps for illumination	Thorium and uranium, various amounts or concentrations, see rules
40.13(c)(2)	(i)Source material in glazed ceramic tableware (ii)Piezoelectric ceramic (iii) Glassware not including glass brick, pane glass, ceramic tile, or other glass or ceramic used in construction	≤20% by weight ≤2% by weight ≤10% by weight
40.13(c)(3)	Photographic film, negatives or prints	Uranium or Thorium
40.13(c)(4)	Finished product or part fabricated of or containing tungsten or magnesium-thorium alloys. Cannot treat or process chemically, metallurgically, or physically.	≤4% by weight thorium content.
40.13(c)(5)	Uranium contained in counterweights installed in aircraft, rockets, projectiles and missiles or stored or handled in connection with installation or removal of such counterweights.	Per stated conditions in rule.
40.13(c)(6)	Uranium used as shielding in shipping containers if conspicuously and legibly impressed with legend "CAUTION RADIOACTIVE SHIELDING – URANIUM" and uranium incased in at least 1/8 inch thick steel or fire resistant metal.	Depleted Uranium
40.13(c)(7)	Thorium contained in finished optical lenses	≤30% by weight thorium, per conditions in rule.
40.13(c)(8)	Thorium contained in any finished aircraft engine part containing nickel-thoria alloy.	≤4% by weight thorium, per conditions in rule.

Table C.4b: Materials Specifically Exempted by the NRC Or NRC Agreement State

Exemption	Materials	Isotope, Activity or Concentration*
10 CFR 30.11***	Byproduct material including production particle accelerator material exempted from NRC or Agreement State regulation by rule, order, license, license condition or letter of interpretation may be accepted as determined by specific NRC or Agreement State exemption.****	Byproduct material at concentrations consistent with the exemption**
10 CFR 40.14***	Source material exempted from NRC or Agreement State regulation by rule, order, license, license condition or letter of interpretation may be accepted as determined by specific NRC or Agreement State exemption.****	Source material at concentrations consistent with the exemption.
10 CFR 70.17	Special Nuclear Material (SNM) exempted from NRC regulation by rule, order, license, license condition or letter of interpretation may be accepted as determined by specific NRC or Agreement State exemption.****	SNM at concentrations consistent with the exemption.

*Sum of all isotopes up to a maximum concentration of 3,000 pCi/gm.

**Specifically exempted production beam accelerator may be received under Table C.3 provisions [10 CFR 20.2008 (b)]

***Also includes equivalent Agreement State regulation where applicable.

**** Similar material not regulated or licensed by the NRC may also be accepted. Sum of all isotopes up to a maximum concentration of 3,000 pCi/gm. IDEQ shall be notified prior to the receipt of Special Nuclear Material not regulated or licensed by the NRC.

Additional Information for USEI's Waste Analysis Plan

1. US Ecology Idaho, Inc. (USEI) may receive contaminated materials or other materials as described in Tables C.1 - C.4b above. USEI may not accept for disposal any material that by its possession would require USEI to have a radioactive material license from the Nuclear Regulatory Commission (NRC).

2. Unless approved in advance by USEI and IDEQ, average activity concentrations may not exceed those concentrations enumerated in Tables C.1 and C.2. Additionally, for Tables C.1 and C.2, individual pockets of material may exceed the WAC for the radionuclides present as long as the average concentration of all radionuclides within the package or conveyance remains at or below the WAC and the highest dose rate measured on the outside of the unshielded package or conveyance does not exceed those action levels enumerated in ERMP-01.

3. Other items, devices or materials listed in Table C.4a, which are exempted in accordance with 10 CFR Parts 30, 40 or equivalent Agreement State regulations or 10 CFR Part 70 may be accepted at or below the activities (per device or item) or concentrations specified in those exemptions.

4. The generator of the exempted or non-production particle accelerator produced waste must specify that the waste meets applicable acceptance criteria and/or exemption requirements.

5. In accordance with permit requirements, notification of any exceedance of the WAC will be provided to the RCRA Program Manager within 24 hours, in accordance with the permit.

USEcology
an American Ecology company

☐ US Ecology Nevada (Beatty) Fax (775) 553-2125
☐ US Ecology Texas (Robstown) Fax (361) 387-0794
☑ US Ecology Idaho (Grand View) Fax (208) 834-2919
Profile #:

A. CUSTOMER INFORMATION

*Waste as shipped will be : ☐ Industrial ☐ NON - Industrial *(Texas customers only)*

Generator: US Army Corps of Engineers, Maywood Chemical CERCLA and FUSRAP site
Facility Address : (No PO Box) 100 West Hunter Ave/Maywood/NJ/07607
Mailing Address: 100 West Hunter Ave
City/State/Zip: Maywood/NJ/07607
Technical Contact: John Kenney
Phone: 201-226-6628 Fax: 201-843-5749

☐ Check if Billing is Same
Billing Company: US Army Corps of Engineers
Billing Address: 601 East 12th
City/State/Zip: Kansas City/ MO/ 64106
Billing Contact: JOSEPHINE NEWTON - USACE
Phone No.: 816-389-3912 Fax No.: 816-389-2008
Email:

NAICS# ☐ CESQG ☐ SQG ☐ LQG EPA ID: NYD 14 861 2922 State ID#

B. SHIPPING INFORMATION

1. US DOT Shipping Name: RQ, Radioactive material, low specific activity (LSA-1), N.O.S., 2. Hazard Class: 7
3. UN/NA #: UN 2912 4. Packaging Group: 5. RQ: for mixture of radionuclides of thorium, radium and uranium
6. Container Type: ☑ Bulk ☐ Totes ☐ Pallet Size: 110-tons 7. Frequency: ☑ Year ☐ QTR ☐ Month
☐ Boxes ☐ Bags ☐ Drums ☐ Other Quantity: up to 52,000 tons ☐ 1 Time ☐ Other

C. GENERAL MATERIAL & REGULATORY INFORMATION

1. Common name for this waste: Remediated soils and debris wastes contaminated with <0.05% Thorium and Uranium
2. Process generating the material (include additional sheets as necessary): The Maywood Chemical Site processed rare earth monsonite sands. The residues from this process were stored and disposed of at the Maywood site and surrounding properties, such as the Maywood Interim Storage Site (MISS) and the (what is now) the Stepan property
3. Describe Physical Appearance of Waste: Soils and Debris
4. Describe odor of waste: ☑ None ☐ Slight ☐ Strong Describe:
5. Knowledge is from: ☑ Lab Analysis ☐ MSDS ☑ Process/Generator knowledge ☐ Other (specify)

☑ Yes ☐ No Is the material <500 PPMW VOC as generated
☐ Yes ☑ No Is the waste restricted under EPA Land Disposal Restrictions (40 CFR 268), if yes please complete LDR form
☐ Yes ☑ No Waste Subject to Benzene NESHAP regulations
☐ Wastewater ☑ Non-wastewater ☑ Debris
☐ Yes ☑ No State waste codes
☑ Yes ☐ No CERCLA Regulated (Superfund) Waste
☐ Yes ☑ No Exempt Waste: If yes, list ref. 40 CFR
☐ Yes ☑ No EPA Haz. Waste (list codes) None
☐ Yes ☑ No Contains UHCs/Constituents of Concern: List in section D
☐ Yes ☑ No Has the waste been treated after the initial point of generation?
☐ Yes ☑ No Subpart XX
☐ Yes ☑ No Alternative standards for Soil ?

Source Code G Form Code W Mgt. Method H

D. MATERIAL COMPOSITION (Physical/Chemical)

(Range Total > or = 100%) Values are ☐ TCLP ☑ TOTALS (include additional sheets as necessary)

	typical value	unit	range
Soils	95	%	90-100
Debris (wood, rocks, PPE, etc)	5	%	0-10
Thorium 232	40	pCi/g	0-54
Thorium 230	20	pCi/g	0-55
Thorium 228	40	pCi/g	0-54
Uranium 238	20	pCi/g	0-55
Uranium 234	20	pCi/g	0-55
Uranium 235	1	pCi/g	0-2
Radium 226	14	pCi/g	0-55
Sum of All radionuclides	<2000	pCi/g	0-2000

E. Does the waste exhibit or contain the following:

☐ Yes ☑ No Oxidizer
☐ Yes ☑ No Explosive
☐ Yes ☑ No Organic Peroxide
☐ Yes ☑ No Shock Sensitive
☐ Yes ☑ No Tires
☐ Yes ☑ No Pyrophoric
☐ Yes ☑ No Radioactive**
☑ Yes ☐ No Exempt RAD**
☐ Yes ☑ No Halogenated Organic Compounds? (per 40 CFR 268, Appendix III)

☐ Yes ☑ No React. Sulfides ppm
☐ Yes ☑ No React. Cyanides ppm
☐ Yes ☑ No Water/Air (Pyrophoric) React.
☐ Yes ☑ No Thermally Unstable
☐ Yes ☑ No TSCA Regulated PCB Waste
☐ Yes ☑ No Regulated Medical/Infectious Waste
☐ Yes ☑ No Compressed Gasses

**Additional Radiological info is provided in USEI's WAC Addendum

F. PHYSICAL CHARACTERISTICS

1. Flash Point: N/A °F (if <140°F) 2. Typical pH: 8 pH Range: ☐ ≤2 ☑ >2, <12.50 ☐ ≥12.5
☐ Yes ☑ No Possibility of incidental liquids from transportation?
☑ Yes ☐ No Does waste pass the EPA specified paint filter test?

G. GENERATOR'S CERTIFICATION

☑ Yes ☐ No **I certify this material may be disposed of without further treatment.**

Certification Statement: I certify under penalty of law that I am familiar with this waste stream through analysis and/or process knowledge, and that all information provided is true, accurate, representitive and complete, and that all known or suspected hazards have been disclosed. Furthermore, I certify that this form was completed in accordance with the instructions provided.

Print Name: COSTAS T. LYMBERIS
Signature: [signature] Title: PROJECT ENGINEER Date: 03/05/2008

Facility use only
First review Second review Final review:
Date approved: Date Denied:

WASTE ACCEPTANCE CRITERIA ADDENDUM

Generator: US Army Corps of Engineers **Date:** 19 Feb 2008

Contact: John Kenney **Phone:** 201-226-6628

100 WEST HUNTER AVENUE, MAYWOOD, N.J., 07607

Common Name of Material: Ore processing residuals generated prior to 1978 (pre-1978 11e2)

Description: Maywood Site remdiation waste soils and debris. FUSRAP SUPERFUND SITE CERCLIS, ID No.# NJD980529762

Identify which table applies to the material (see below): _____

Comments: Waste contains primarily Th-232 and U-238 and their progeny. Th-230 is typically depleted due to historical Th processing, but is conservatively estimated in Equilibrium with U-238 or Ra-226 (higher value)

Determine which table, from the USEI Waste Acceptance Criteria (WAC), applies to the waste you intend to ship to USEI. (Tables 1 - 4).

1. **If Table 1 applies, does the material only contain U_{238} or only Th_{232} or both?**

a.) **If only U_{238} or only Th_{232},** is present, then use the value/concentration listed under Table 1 for Natural Uranium and Natural Thorium as the limit.

b.) **If both are present,** then use the following formulas as appropriate:

For natural uranium and natural thorium mixture:
{Conc. U / 141 pCi/g + Conc. Th / 110 pCi/g} ≤ 1 and {(pCi/g U x 14) + (pCi/g Th x 10)} = $\leq$ 2000 pCi/g

For refined uranium and thorium mixture:
{Conc. U / 333 pCi/g +Conc Th/110} ≤ 1 and {(pCi/g U x 5) + (pCi/g Th x 10)} = $\leq$ 2000 pCi/g

For depleted uranium and thorium mixture:
{Conc. U / 169 pCi/g + Conc Th / 110 pCi/g} ≤ 1 and {(pCi/g U x 4) + (pCi/g Th x 10)} = $\leq$ 2000 pCi/g

Note: Absent strong evidence to the contrary, Th-232 will routinely be considered to be in 100% equilibrium with its progeny.

Calculations (add extra sheets as necessary)
See attached spreadsheet tab C.

c.) **If Th-230 is the only source material present,** then choose the appropriate limit from the two available selections.

2. **If Table 2 applies then choose one of the following:**

a) Is the material Radium 226 or 228?

Note: Ra-226 and Ra-228 will routinely be considered completely in equilibrium with their progeny.

If yes, use Table 2 directly

b) Is the material Lead 210?
Note: Lead-210 will routinely be considered completely in equilibrium with its progeny.

If yes, use Table 2 directly

c) Is the material anything other than NORM?

If yes, use Table 2 directly

3. If Table 3 applies , then

Use Table 3 directly

Note: You must provide an inventory estimate of the radioactive content of each container. (Please list by isotope.)

Radioactive Estimate by Container and Isotope:_____

_____

_____

Note: You can add additional sheets, if necessary

4. If Table 4 applies, then

Use Table 4 directly

Note: You must provide an inventory estimate of the radioactive content of each container. (Please list by isotope.)

Radioactive Estimate by Container and Isotope:_____

_____

_____

When using Table 4 please note the following:

1. Material must be transported in accordance with DOT rules and regulations
2. Individual packages can bear White I or Yellow II Labels but no Yellow III Labels(surface dose rate > 50 mrem/hr). Contact a Customer Service Representative or Sales Representative if you need help with packaging requirements. Depending on the scope, USEI may charge for this service.
3. Provide specific reference for NRC exemption

NRC Exemption: Material is less than 0.05% Source Material by weight.

Placarding Required?_____ If yes, what type_____

Certification Statement: I certify that the contents of the packages being shipped to US Ecology Idaho (USEI) are exempt from regulation by the US Nuclear Regulatory Commission in accordance with 10CFR (list each section of the NRC regulations that contains an exemption for each type of device or item in the shipment)

03/12/08

COSTAS. T. LYMBERIS PROJECT ENGINEER
Name/Title (Please Print)

Signature

03/12/2008
Date

FUSRAP MAYWOOD SUPERFUND SITE HISTORY & REMEDIAL INVESTIGATION SUMMARY

The FUSRAP portion of the Maywood Chemical Company Site consists of 88 designated properties: the Stepan property, which includes all of the contaminated buildings, and the three NRC-licensed burial pits; Maywood Interim Storage Site (MISS); 59 residential properties; 3 properties owned by the state or federal government; 4 municipal properties; and 20 commercial properties. Of the 88 properties, 64 Phase I properties (including all residential and municipal properties) have already been cleaned up by DOE or the USACE. During cleanup actions on these properties, additional properties were remediated. This occurred if the contamination extended on to an adjacent undesignated property.

Radioactive contamination at the FUSRAP Maywood Superfund Site resulted from rare earth and thorium processing operations conducted by the Maywood Chemical Works (MCW) and associated material storage and waste disposal practices. Historical records indicate that processing of thorium from monazite sands may have begun as early as 1895; other records indicate that thorium processing was initiated in 1916, and continued until 1957. Processing operations created wastes containing thorium and lesser amounts of radium and uranium as well as rare earths. (Rare earths are defined as oxides of metals in the lanthanide series of elements, plus the elements of yttrium and scandium.) Some of these process wastes and residues were stored, treated, or disposed on the original processing site where MISS and Stepan are now located. In addition, radioactivity was spread to nearby properties by the use of the waste materials as mulch and fill or through soil and sediment transport along Lodi Brook. Although currently an underground culvert, Lodi Brook was formerly an open channel. The only contaminated buildings at the FUSRAP Maywood Superfund Site are located on the MISS or Stepan property and are associated with the original processing facility.

In 1959, MCW sold the plant to the Stepan Company. In the late 1960s, Stepan Company took corrective measures at some of the former disposal areas located on the original MCW plant site property both east and west of NJ State Route 17. (NJ Route 17 was built in the early 1930's over and through the MCW's thorium waste lagoons.) Stepan's corrective measures included relocation and burial of approximately 19,100 yd^3 of excavated waste materials. These waste materials were relocated to three burial areas on property currently owned by Stepan Company. Stepan sold the portion of the original plant property located west of NJ Route 17 after relocation of the waste materials. Stepan currently holds an NRC license for the storage of thorium-bearing materials in Burial Pits 1, 2, and 3.

EPA listed the Maywood Chemical Company on the Superfund NPL in 1983. In late 1983, Congress assigned DOE a research and development project to clean up the radioactive wastes at the Maywood Chemical Company Site (via the FY84 Energy and Water Appropriations Act). DOE then assigned the site to FUSRAP. In 1997, the FY98 Energy and Water Development Appropriations Act transferred responsibility for the execution and administration of FUSRAP from DOE to the USACE. The inclusion of chemical contaminants under the FUSRAP Maywood Superfund Site's definition of

FUSRAP waste is limited to chemicals on the MISS or chemicals on vicinity properties that are commingled with or related to the radioactive waste, chemicals associated with thorium processing at MCW, and chemicals on or migrating from the MISS. The Stepan Company, which operates an active chemical manufacturing facility at the Maywood Chemical Company Site, is conducting an RI/FS on chemical, non-radiological contamination on its facility and on the adjacent property at 149-151 Maywood Avenue. The EPA is overseeing the Stepan RI/FS and is coordinating that RI/FS and cleanup, with USACE's FS and Proposed Plan and other USACE actions related to environmental cleanup at the Site.

DOE began investigating the FUSRAP Maywood Superfund Site and surrounding area in 1983 and, during 1984-1985, cleaned up 25 residential properties and a portion of one commercially zoned property. Due to the limited commercial disposal capacity for radiological wastes, the excavated materials from these cleanups were stored on property that was a part of the original MCW processing site. DOE acquired this property from Stepan Company and named it the MISS. During a cleanup action conducted by DOE in 1995 and 1996, these stored materials were removed from MISS and sent to a permanent, off-site commercial disposal facility. Also during 1995, the cleanup of the remaining residential properties, four municipal properties (three parks and a fire station), and one commercially zoned property was initiated. These interim property cleanups were implemented as removal actions as proposed in DOE's September 1995 EE/CA under CERCLA. These interim cleanup actions were completed in 2000 by the USACE.

The Remedial Investigation (RI) report (December 1992) was prepared to evaluate the nature and extent of radioactive constituents and related chemical contaminants at the FUSRAP Maywood Superfund Site. Eighty-eight properties have been designated for cleanup based on radiological surveys and soil sampling. The primary radioactive contaminants of concern (COCs) have been identified as thorium-232, radium-226, uranium-238, and their radioactive decay products present in soils and other wastes at the FUSRAP Maywood Superfund Site.

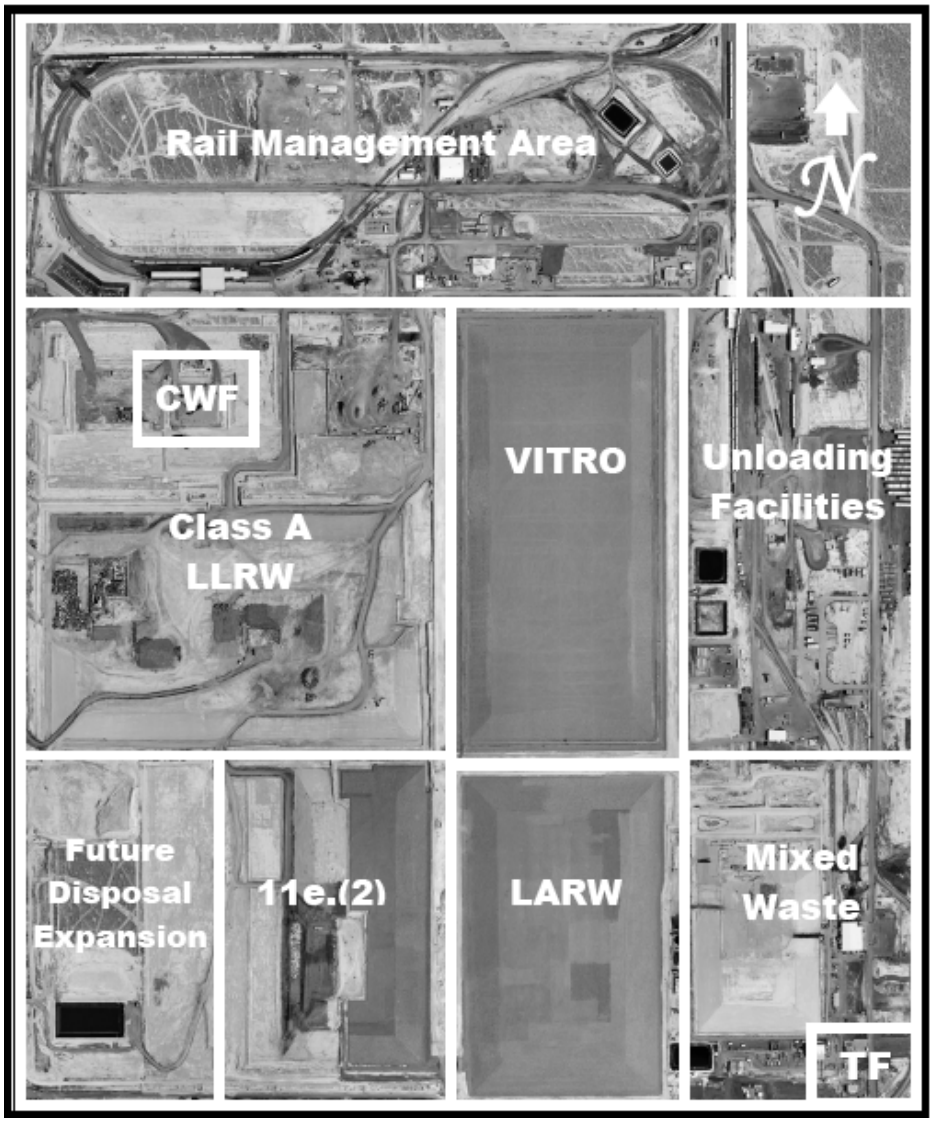
Metals and organic chemicals are also present in soils at MISS, Stepan, and nearby vicinity properties above site-specific background levels. Some of these metals and organic chemicals are not associated with specific thorium processing activities at MCW, nor have they been shown to originate from the MISS. No chemical COCs were identified for soil based on the risk analysis in the Baseline Risk Assessment of the RI.

ENERGYSOLUTIONS

Bulk Waste Disposal and Treatment Facilities Waste Acceptance Criteria

Revision 7

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



Corporate Office
423 West 300 South, Suite 200
Salt Lake City, UT 84101
Phone: (801) 649-2000
Fax: (801) 537-7345

Disposal and Treatment Facility
Interstate 80, Exit 49
Clive, UT 84029
Phone: (435) 884-0155
Fax: (435) 884-3549

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SECTION 1

INTRODUCTION

1.1 PURPOSE

Energy*Solutions* 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 Energy*Solutions*' disposal and treatment facilities. Energy*Solutions* 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 Energy*Solutions*' 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 Energy*Solutions*' Containerized Waste Facility (CWF). Please refer to the CWF WAC which can be downloaded from Energy*Solutions*' 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. This document provides guidance on Energy*Solutions*' waste acceptance process and should be used in conjunction with current copies of Energy*Solutions*' licenses, permits and applicable state and federal regulations. These license, permits, and regulations take precedence over any information contained in this document. Generators may request variances from the BWF WAC on a case-by-case basis. Energy*Solutions* will evaluate such requests and provide written notification to the generator if the variance is approved.

Energy*Solutions*' licenses and permits along with links to applicable parts of the Utah Radiation Rules are included on Energy*Solutions*' website at www.energysolutions.com. In addition, Appendix A of this document contains a list of contact information for both Energy*Solutions* and the State of Utah. For additional information, representatives of Energy*Solutions*' 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 Energy*Solutions*' 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 to Energy*Solutions* 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.

Energy*Solutions* is responsible to safely and compliantly receive, treat (if applicable), and dispose of waste shipments in accordance with all applicable permits, licenses, and regulations. Energy*Solutions* will provide disposal and/or treatment certificates upon request from the generator. In addition, Energy*Solutions* 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 SELECTION OF THE CLIVE DISPOSAL SITE LOCATION

The initial selection of the Energy*Solutions* 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 DOE 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.

Since acquiring land adjacent to the Vitro disposal embankment and obtaining a disposal license, the vision of Energy*Solutions*' Clive facility has been to provide a private disposal option for material from cleanups and generators of radioactive waste in separate disposal embankments similar to those used for DOE's Vitro project. The Clive site has received waste from cleanups carried out across the country including projects by the Environmental Protection Agency (EPA), DOE, Department of Defense, and private companies. The initial disposal license was for Naturally Occurring Radioactive Material (NORM). Since 1988, Energy*Solutions*' 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

Energy*Solutions* 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

- State-Issued 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 Energy*Solutions*. Waste streams that are subject to multiple regulations must meet the requirements for each applicable regulation.

2.3 SITE LOCATION AND ACCESS

Energy*Solutions*' operations are conducted on and adjacent to Section 32, Township 1 South, Range 11 West, SLM, Tooele County, Utah. The facility is about 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 mailing address is:

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

Energy*Solutions* receives waste shipped via bulk truck, containerized truck, enclosed truck, bulk railcars, rail boxcars, and rail intermodals. The transportation access allows Energy*Solutions* to operate throughout the entire year. The disposal site is accessed by the Union Pacific Railroad at Energy*Solutions*' private siding. Energy*Solutions* uses more than ten miles of track and three locomotives for railcar management. Covered railcar rotary dumper 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 Energy*Solutions* disposal site provides a long-term disposal solution with a minimal need for active maintenance after closure. Energy*Solutions* 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.

Figure 2-1 shows the locations of Energy*Solutions*' waste treatment, disposal, and operations areas at the Clive facility. Energy*Solutions*' waste operations are managed as three facilities:

- "Bulk Waste Facility" (BWF) – including Mixed Waste, LARW, 11e.(2) and Class A LLRW
- "Containerized Waste Facility" (CWF) – located within the Class A LLRW area
- "Treatment Facility" (TF) – located in the southeast corner of the Mixed Waste area

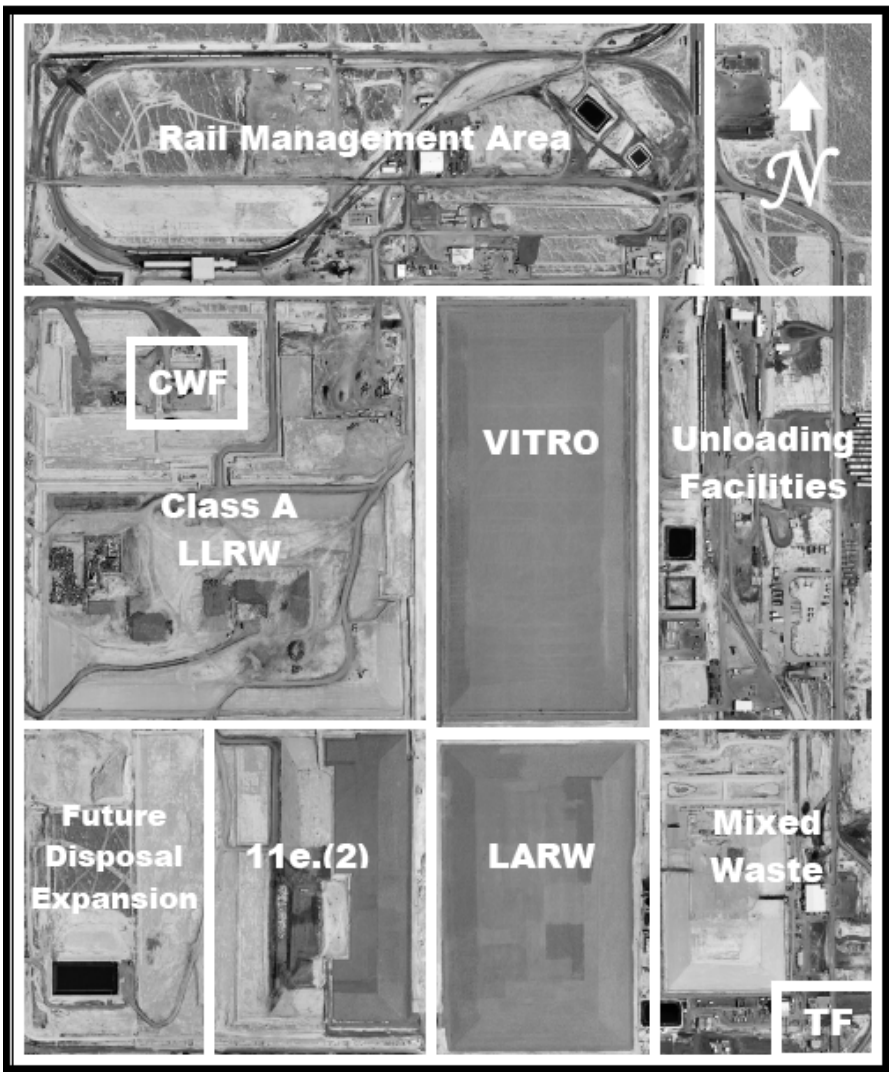


Figure 2-1. Energy*Solutions*' Disposal and Treatment Facilities

Bulk Waste Facility

Waste shipped for direct disposal that is compliant with the ALARA Criteria described below is managed at Energy*Solutions*' Bulk Waste Facility (BWF). Such waste is either removed from the container or filled 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 BWF. 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 BWF.

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

Containerized Waste Facility

Waste shipped for direct disposal exceeding Energy*Solutions*' 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 Energy*Solutions* will not remove such waste from its container due to the elevated dose rates. Please refer to Energy*Solutions*' CWF WAC for information on shipping waste to the CWF.

Shipments to the CWF typically are shipped in a shielded transportation package such as a cask as illustrated in Figure 2-2.

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

Treatment Facility

Waste shipped to Energy*Solutions* for treatment or liquid solidification prior to disposal is managed at Energy*Solutions*' Treatment Facility. The Treatment Facility is shown in Figure 2-1 as "TF". The

Treatment Facility is designed for radioactive waste that requires treatment for RCRA constituents and for liquid radioactive wastes requiring solidification prior to disposal. Energy*Solutions*' Mixed Waste treatment and solidification capabilities 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 including wastes with PCBs. Waste containing PCB liquids is also acceptable for VTD treatment. The organic liquid condensate must be treated prior to final disposal. The non-liquid waste residue will be further treated for metal contaminates (if required) and disposed at the Mixed Waste embankment.
- Debris Spray Washing – To remove contaminants from applicable hazardous debris.

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

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

2.5 ALARA CRITERIA FOR THE BULK WASTE AND TREATMENT FACILITIES

Energy*Solutions* 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 BWF.

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 bulk 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.). For example, 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 Energy*Solutions* 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

Resins shipped in bulk containers must comply with the ALARA Criteria. This is due to the required resin blending process that necessitates worker proximity to the waste. Resins shipped in disposal containers such as drums, boxes, liners, etc. may be acceptable at the BWF for grouting if the container is compliant with the ALARA Criteria for non-bulk packages. Resins shipped to the BWF must be shipped under a Waste Profile specific for resins unless specifically approved in writing by Energy*Solutions*. 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

Requested 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.

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 Energy*Solutions* can receive for treatment and disposal is governed by the various licenses and permits under which Energy*Solutions* operates. Energy*Solutions* 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 Energy*Solutions* to receive Class A LLRW, NORM, and NARM waste. Energy*Solutions* 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 Energy*Solutions* a State-Issued 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, Energy*Solutions* received a Permit modification which authorized the receipt and disposal of PCB Radioactive and PCB Mixed wastes. In 2002, Energy*Solutions* 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

Energy*Solutions* 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 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 Energy*Solutions*. Further guidance is provided in NRC's "Branch Technical Position on Concentration Averaging and Encapsulation", as amended (BTP). All generators shipping LLRW to Energy*Solutions* 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. Energy*Solutions* 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 Energy*Solutions* 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 Energy*Solutions*. 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 (refer to the "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

Energy*Solutions*' 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 Energy*Solutions* 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, Energy*Solutions* is not authorized to receive LLRW from the Northwest Compact. Please contact Energy*Solutions* for assistance in complying with this license condition.

3.1.2 NORM/NARM Waste

Energy*Solutions*' 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

Energy*Solutions* 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 Energy*Solutions*' State-Issued 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 Energy*Solutions* are identified in its Statue-Issued Part B Permit. A copy of this permit is included on Energy*Solutions*' web site at www.energysolutions.com or on the Utah Division of Solid and Hazardous Waste web site at www.hazardouswaste.utah.gov/HWBranch/CFFSection/EnvirocarePermit.htm. The following Utah Hazardous Waste Codes are not acceptable at Energy*Solutions*: 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 Energy*Solutions*' Mixed Waste disposal embankment. Energy*Solutions* is required to verify LDR compliance for all Mixed Waste streams prior to disposal.

Condition 14.B of the Radioactive Material License prohibits Energy*Solutions* from disposing of characteristic Mixed Waste after treatment in the LLRW disposal embankment. Energy*Solutions* 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

Energy*Solutions* may also receive Mixed Waste that requires treatment in order to comply with LDR treatment standards. Energy*Solutions* is approved under the State-Issued Part B Permit to operate a mixed waste treatment facility. Mixed Waste that is not LDR compliant may be treated by Energy*Solutions* 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 Energy*Solutions*' 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. In order to evaluate chemical compatibility with the stabilization treatment process, generators shipping waste with Hazardous Waste Codes D001, D002, or D003 must provide a list of specific chemicals in each container with the shipping paperwork.

Macroencapsulation of Hazardous Debris and Radioactive Lead Solids

Mixed Waste consisting of hazardous debris may be macroencapsulated in accordance with the "Alternative Treatment Standards for Hazardous Debris" as specified in 40 CFR 268.45. Figure 3-1 illustrates macroencapsulation of hazardous debris in a container using a polymer or performed in-cell using pozzolanic material. 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.

Energy*Solutions*' 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 Energy*Solutions* 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 Energy*Solutions* 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.

Energy*Solutions* utilizes Vacuum-Assisted Thermal Desorption technology (VTD) to treat organic contaminated waste streams including waste streams containing PCBs. Waste containing PCB liquids is also acceptable for VTD treatment.

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 Energy*Solutions*' Treatment Facility or treated at another facility and shipped to Energy*Solutions* for disposal. Generators may ship elemental mercury contaminated with radioactive materials to Energy*Solutions* for treatment and disposal.

Energy*Solutions* 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). Energy*Solutions* 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

Energy*Solutions* 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

Energy*Solutions* 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. Energy*Solutions*' 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, Energy*Solutions* 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 12 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 Energy*Solutions*' Customer Service representative to make necessary arrangements for Energy*Solutions* to size the debris upon receipt.

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

3.1.4.3 Certification of 11e.(2) Byproduct Material

Energy*Solutions* 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. Energy*Solutions* 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; Energy*Solutions* 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 Material License incorporates the Special Nuclear Material Exemption issued by the NRC. Under specified conditions, the exemption allows Energy*Solutions* 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 Energy*Solutions*' SNM Exemption Certification form 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 Energy*Solutions* 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. Energy*Solutions* 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 Energy*Solutions*. 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

Energy*Solutions* 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 Energy*Solutions* a TSCA Coordinated Approval for receipt and disposal of drained PCB Articles and PCB Containers that contained PCBs at 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. As required by 40 CFR 761, the Uniform Hazardous Waste Manifest must include the date the PCB waste was removed from service. Articles and containers of PCB waste must also be dated with the removed from service date per 40 CFR 761.65(c)(8). Empty PCB containers that contained PCBs at concentrations less than 500 ppm may be disposed in the Class A LLRW Facility; however, this waste will require a Uniform Hazardous Waste Manifest and include the removed from service date on each outer container. A Uniform Hazardous Waste Manifest is not required for any other PCB wastes disposed at the Class A LLRW Facility.

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 Energy*Solutions*' Mixed Waste disposal embankment.

Energy*Solutions*' Ground Water Quality Discharge Permit (GWQDP) and State-Issued Part B 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 unauthorized free liquids will not be accepted by Energy*Solutions* unless re-profiled to a VTD waste stream. 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 Energy*Solutions*' 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 Energy*Solutions*' 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.

Energy*Solutions* 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 (e.g., PCB Transformers). Energy*Solutions* is also able to process PCB Large Capacitors and leaking PCB Small Capacitors through VTD.

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.	Yes*
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 Energy*Solutions*' 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 be emptied to the extent practical and not contain any free standing liquid. All PCB Containers received for disposal require a Uniform Hazardous Waste Manifest and removed from service dates. Waste containing PCBs in a liquid or solid phase is acceptable for VTD treatment (refer to Section 3.1.3.3).

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 Energy*Solutions*' Mixed Waste disposal embankment.

3.1.7 UCNI and Export Controlled Waste

Energy*Solutions* 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 Energy*Solutions* prior to shipping UCNI and Export Controlled radioactive waste.

3.1.8 Chelating Agents

Energy*Solutions* 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 Energy*Solutions*' Treatment Facility once approved during the waste profiling process. Energy*Solutions* will treat waste containing greater than 22 percent chelating agents prior to disposal in order to comply with this requirement.

3.1.9 Asbestos and Beryllium

Energy*Solutions* 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 Energy*Solutions*.

Asbestos waste that requires wetting to prevent dispersion must be inspected to minimize free liquids. However, unless the waste is to be solidified at the Treatment Facility, the free liquid may not 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 Energy*Solutions*' Treatment Facility for solidification prior to disposal. Contact Energy*Solutions* prior to shipping waste streams that contain free liquids.

Waste containing other potential inhalation hazards such as beryllium must be described in the Waste Profile and documented on the 5 Working-Day Advanced Shipment Notification form. A quantitative description of potential beryllium surface contamination and air monitoring measurements both before and after any fixatives or wrapping are applied should be included in the Waste Profile for beryllium contaminated waste. The description should also include information about the current management of the beryllium contaminated waste including specific work control procedures in handling and packaging the waste for shipment, details of the beryllium protection program as applicable, and air monitoring measurements, etc. Beryllium contaminated waste must be packaged in 55-gallon or smaller drums unless approved in writing by Energy*Solutions*.

3.1.10 Lab Packs

Lab packs are described as small containers of liquid with varying hazardous waste codes that are placed in a larger shipping or storage container. Energy*Solutions* is authorized to receive lab packs in which all of the contents are known and acceptable for treatment or disposal. Lab packs require a specific Waste Profile that must be approved by Energy*Solutions* prior to shipment. Generators must provide a description of unused chemicals within containers with the shipping paperwork.

3.2 ACCEPTABLE FORMS OF RADIOACTIVE WASTE

Energy*Solutions*' 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.). Energy*Solutions* 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 Energy*Solutions*' 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

Energy*Solutions* 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 Energy*Solutions*
- Maximum dry density and optimum moisture must be determined by Standard Proctor Method ASTM D-698

Energy*Solutions* 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 Energy*Solutions* and require additional handling prior to disposal. Contact Energy*Solutions*' 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 Energy*Solutions*. 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. Energy*Solutions* 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. Energy*Solutions* 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 Energy*Solutions* 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 Energy*Solutions*. Containers of oversize debris must exclude soil or soil-like waste due to placement criteria.

Energy*Solutions* 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. Although ion-exchange media (resin) meets the standard size debris criteria, resins are not emptied from the container but grouted to minimize void spaces. Consequently, resin waste streams must be shipped under a resin specific waste profile unless approved in writing by Energy*Solutions*. 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

Energy*Solutions* 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. Energy*Solutions* 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.

Energy*Solutions* 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. Energy*Solutions* 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 Energy*Solutions*' 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, Energy*Solutions* is required to promptly notify the generator and the Utah DRC. Energy*Solutions* 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 Energy*Solutions*' 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. Energy*Solutions* 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. Sharps including needles, scalpels, knives, syringes, pipettes, and similar items having a point or sharp edge or that are likely to break during transportation must not be packaged in bulk containers unless written approval is given by Energy*Solutions*. When these items are used in the medical industry or related research, they must be treated to remove the biohazard. Documentation of such treatment must be included in the Waste Profile.

The following Mixed Wastes are <u>not</u> 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
- 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 Energy*Solutions*' waste characterization and profiling process. Profiling a waste stream involves collecting samples and obtaining analytical results for the parameters specified on Energy*Solutions*' Radioactive Waste Profile Record (Waste Profile). The Waste Profile serves the following functions: (1) enables Energy*Solutions* 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 Energy*Solutions*' licenses and permits. The Waste Profile and related instructions can be downloaded from Energy*Solutions*' web site at www.energysolutions.com. An Energy*Solutions* 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:

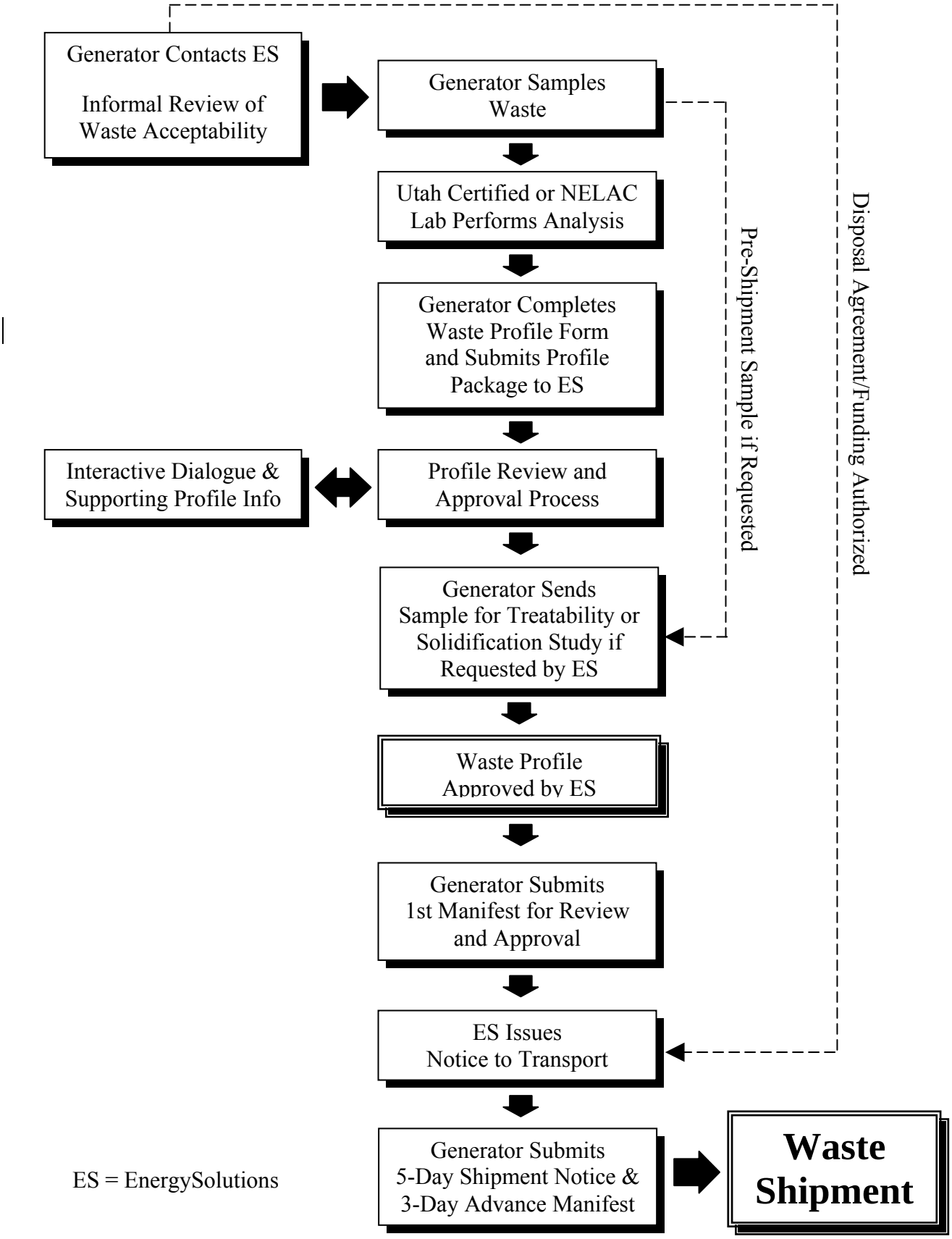
- Initial discussions
- Waste characterization
- Waste Profile Record completion and submittal
- Treatability and/or solidification study sample submitted, if requested
- Profile review and approval
- Notice to Transport

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 Energy*Solutions*' 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 Energy*Solutions*. 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 Energy*Solutions* with the Waste Profile.

- SNM Exemption Certification
  This form requests the radiological information to evaluate waste containing SNM with respect to the SNM Exemption issued by the NRC and incorporated into Energy*Solutions*' 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
  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. Energy*Solutions* uses this form and supporting information to evaluate PCB waste streams with respect to Energy*Solutions*' 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 Energy*Solutions*
- 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 Energy*Solutions* under existing license/permit requirements and in accordance with Energy*Solutions*' 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 Energy*Solutions* disposal site. Waste streams containing PCBs must not contain any free liquids unless shipped for VTD treatment.

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 Energy*Solutions*. 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 Energy*Solutions*.

Energy*Solutions* 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 Energy*Solutions* 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 Energy*Solutions*' Radioactive Materials License:

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

Energy*Solutions* 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, Energy*Solutions* 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 Energy*Solutions* that exceeds the limits in the radiological information section of the Waste Profile, the generator may submit a revised Waste Profile to Energy*Solutions* 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.

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

Analysis	EPA SW-846 Method(s)
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 Energy*Solutions*.

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. Energy*Solutions*' licenses and permits require the results of the following analyses be provided with the Waste Profile:

Analysis	EPA SW-846 Method
pH (liquids only)	Method 9045
TCLP Metals	Method 6010/7470
TCLP Herbicides	Method 8151
TCLP Pesticides	Method 8081
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.

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 Energy*Solutions* may be acceptable for waste profiling purposes upon investigation of associated quality control sample data.

Energy*Solutions* 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 SNM Exemption Certification 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

Energy*Solutions*' Statue-Issued Part B Permit and Groundwater Quality Discharge Permit include the authorizations and requirements for Energy*Solutions* to receive PCB waste regulated for disposal under 40 CFR 761. The PCB waste types acceptable at Energy*Solutions* 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 Energy*Solutions* during the Waste Profile approval process.

4.4 TREATABILITY AND SOLIDIFICATION STUDY SAMPLES

For waste streams requiring treatment or solidification, Energy*Solutions* will request a preshipment sample to perform a treatability and/or solidification study during the waste profiling approval process. This allows Energy*Solutions* 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. Energy*Solutions* 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 Energy*Solutions*. 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 Energy*Solutions*. The samples should contain the highest anticipated levels of chemical contaminants in the waste steam to ensure that Energy*Solutions* can develop a treatment formula that is adequate for the entire waste stream. Energy*Solutions* 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.

Preshipment samples may not be shipped to Energy*Solutions* without prior authorization. At a minimum, a preliminary Waste Profile will need to be created that describes the waste and its generation. This preliminary Waste Profile must include both chemical and radiological assessments and must be approved by Energy*Solutions* prior to shipment of the sample. When approved for shipment, Energy*Solutions* will provide a Preshipment Sample Authorization Record to the generator.

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 Energy*Solutions* 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:

Energy*Solutions*
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 Energy*Solutions* if a rush treatability study is required to meet a disposal schedule.

4.5 WASTE PROFILE REVIEW AND APPROVAL

Energy*Solutions* 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, Energy*Solutions* requests that the Waste Profile forms and analytical reports be provided as far in advance of the anticipated shipping date as possible. Upon receipt, Energy*Solutions* will complete a preliminary review of the waste profile information provided. Comments concerning the Waste Profile will usually be provided within two weeks of Energy*Solutions*' receipt of the profile information. If additional information is required for pre-acceptance, Energy*Solutions* 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, Energy*Solutions* has developed a two-phase review process. During the first phase, an Energy*Solutions* Technical Services Representative will review and assess the Waste Profile, accompanying documentation, and analytical data for acceptability. If necessary, Energy*Solutions* 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 Energy*Solutions* and found to be satisfactory, phase 2 of the process begins.

The second phase involves and independent evaluation of the Waste Profile by Energy*Solutions*' Compliance and Operations representatives. Energy*Solutions* 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 Energy*Solutions*, since the waste has been shown to be in compliance with all waste acceptance criteria. Energy*Solutions* 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

Energy*Solutions* will issue a Notice to Transport 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 Energy*Solutions*. 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 Energy*Solutions*' 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 Energy*Solutions*, 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 Energy*Solutions*' waste acceptance process. Energy*Solutions*' 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. Energy*Solutions* 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 Energy*Solutions* Scheduling Department to establish an arrival date for each shipment. This form may be downloaded from Energy*Solutions*' 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 Energy*Solutions* 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 Energy*Solutions*.
  Energy*Solutions*' 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: Energy*Solutions*, LLC
  Clive Disposal Site
  Interstate 80, Exit 49
  Clive, UT 84029

  Contact: Shipping and Receiving
  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 Energy*Solutions*' "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 Energy*Solutions* prior to disposal.
- ☐ Submitted manifests to Energy*Solutions* **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. If applicable, include the 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). If applicable, include the LDR Notification/Certification forms and Hazardous Waste Manifest for each shipment.
- ☐ 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

Shipments containing radionuclides with total activities exceeding the limits listed below must be specified on the 5 Working-Day Shipment Notification form and approved prior to waste shipment.

- Californium-252 (in excess of 5.4 Ci)
- Co-60 (in excess of 8.1 Ci)
- Cs-137 (in excess of 27 Ci)
- Gd-153 (in excess of 270 Ci)
- Ir-192 (in excess of 22 Ci)
- Pm-147 (in excess of 11,000 Ci)
- Se-75 (in excess of 54 Ci)
- Tm-170 (in excess of 5,400 Ci)
- Yb-169 (in excess of 81 Ci)

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 Energy*Solutions* **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 "Shipping and Receiving – Manifest" at (801) 413-5643. Energy*Solutions* 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, 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 Energy*Solutions*. Multiple waste streams on a single conveyance must include a unique set of shipping paperwork for each manifested shipment. The following paperwork may also need to accompany the shipping paperwork as applicable:

- SNM Exemption Certification form. 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. Energy*Solutions* 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, Energy*Solutions* 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. Energy*Solutions* requires shippers to include information in both metric units and English units following the International Standard of Units (SI). Additionally, Energy*Solutions* 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 Energy*Solutions* 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 Energy*Solutions*' disposal site address as shown below, contact name and telephone number. The address must specify Energy*Solutions*' "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 Energy*Solutions* prior to disposal.

  Energy*Solutions*, LLC
  Clive Disposal Site – Bulk Waste Facility
  Interstate 80, Exit 49
  Clive, UT 84029

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 Energy*Solutions*. Energy*Solutions* 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

Energy*Solutions* 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 Energy*Solutions* disposal facility for review and distribution. Upon arrival, manifests are imported directly into Energy*Solutions*' 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 Energy*Solutions* 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 Energy*Solutions*.
- Energy*Solutions* personnel can print the required copies of the manifest, including electronic signature, and distribute for proper review.
- The import of manifest information directly to Energy*Solutions*' waste tracking system will eliminate manual data entry.
- Electronic submittal will significantly reduce the time it takes Energy*Solutions* personnel to process the advanced paperwork.

5.5 90-DAY SHIPPING FORECAST

The 90-Day Shipping Forecast is used by Energy*Solutions* to properly staff and ensure adequate resources are available to ensure efficient and timely management of waste shipments. Generators are strongly encouraged to provide Energy*Solutions* with a 90-Day Shipping Forecast for all upcoming shipments. Current shippers will receive a fax or email from Energy*Solutions* every month and are requested to return the shipping forecast to Energy*Solutions* 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 Energy*Solutions* 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 Energy*Solutions*' 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.

Energy*Solutions* will inspect each shipment arriving at its disposal facility for compliance with the applicable licenses and/or permits including compliance with DOT HMR requirements. Energy*Solutions* 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

Energy*Solutions* 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 Energy*Solutions*.

6.2.1 Bulk Packaging

Generators are able to minimize packaging and transportation costs by utilizing bulk packages that are intended for re-use. Energy*Solutions* 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 Energy*Solutions* 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. Energy*Solutions* 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 Energy*Solutions*.
- 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 Energy*Solutions*.
- Friable asbestos is prohibited in bulk packages unless approved in writing by Energy*Solutions*.
- 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)

Energy*Solutions* 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. Energy*Solutions* 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. Drums on one pallet must be from the same waste stream unless approved in writing by Energy*Solutions*. Contact Energy*Solutions* 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. Energy*Solutions* 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.
- Energy*Solutions* 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), Energy*Solutions* 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 Energy*Solutions*' rail siding by the Union Pacific railroad on a predetermined schedule (Figure 6-3). Once at Energy*Solutions*' siding, they will be moved into the disposal site by Energy*Solutions*' 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 Energy*Solutions*. 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 Energy*Solutions*' 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. Energy*Solutions* performs the following types of radiological releases as listed in the following table.

Energy*Solutions* 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 Energy*Solutions*' Business Development Department to make contractual arrangements for this type of release.	US NRC Regulatory Guide 1.86, June 1974 (Consistent with Energy*Solutions*' 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

Energy*Solutions*

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
Shipping & Receiving Phone:	(435) 884-0155	Fax: (801) 413-5643 Email: manifest@energysolutions.com

Energy*Solutions* 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
State-Issued Part B Permit:	www.hazardouswaste.utah.gov/HWBranch/CFFSection/EnvirocarePermit.htm

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APPENDIX C

FMSS WASTE PROFILES

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USEcology
an American Ecology company

☐ US Ecology Nevada (Beatty) Fax (775) 553-2125 ☐ US Ecology Texas (Robstown) Fax (361) 387-0794 Profile #:
☑ US Ecology Idaho (Grand View) Fax (208) 834-2919

A. CUSTOMER INFORMATION

*Waste as shipped will be : ☐ Industrial ☐ NON - Industrial *(Texas customers only)*

Generator: US Army Corps of Engineers. Maywood Chemical CERCLA and FUSRAP site
Facility Address : (No PO Box) 100 West Hunter Ave/Maywood/NJ/07607
Mailing Address: 100 West Hunter Ave
City/State/Zip: Maywood/NJ/07607
Technical Contact: John Kenney
Phone: 201-226-6628 Fax: 201-843-5749

☐ Check if Billing is Same
Billing Company: US Army Corps of Engineers
Billing Address: 601 East 12th
City/State/Zip: Kansas City/ MO/ 64106
Billing Contact: JOSEPHINE NEWTON-LUND
Phone No.: 816-389-3912 Fax No.: 816-389-2008
Email:

NAICS# ☐ CESQG ☐ SQG ☐ LQG EPA ID: NYD148612922 State ID#

B. SHIPPING INFORMATION

1. US DOT Shipping Name: RQ, Radioactive material, low specific activity (LSA-1), N.O.S., 2. Hazard Class: 7
3. UN/NA #: UN 2912 4. Packaging Group: 5. RQ: for mixture of radionuclides of thorium, radium and uranium
6. Container Type: ☑ Bulk ☐ Totes ☐ Pallet Size: 110-tons 7. Frequency: ☑ Year ☐ QTR ☐ Month
☐ Boxes ☐ Bags ☐ Drums ☐ Other Quantity: up to 52,000 tons ☐ 1 Time ☐ Other

C. GENERAL MATERIAL & REGULATORY INFORMATION

1. Common name for this waste: Remediated soils and debris wastes contaminated with <0.05% Thorium and Uranium
2. Process generating the material (include additional sheets as necessary): The Maywood Chemical Site processed rare earth monsonite sands. The residues from this process were stored and disposed of at the Maywood site and surrounding properties, such as the Maywood Interim Storage Site (MISS) and the (what is now) the Stepan property
3. Describe Physical Appearance of Waste: Soils and Debris
4. Describe odor of waste: ☑ None ☐ Slight ☐ Strong Describe:
5. Knowledge is from: ☑ Lab Analysis ☐ MSDS ☑ Process/Generator knowledge ☐ Other (specify)

☑ Yes ☐ No Is the material <500 PPMW VOC as generated
☐ Yes ☑ No Is the waste restricted under EPA Land Disposal Restrictions (40 CFR 268), if yes please complete LDR form
☐ Yes ☑ No Waste Subject to Benzene NESHAP regulations
☐ Wastewater ☑ Non-wastewater ☑ Debris
☐ Yes ☑ No State waste codes
☑ Yes ☐ No CERCLA Regulated (Superfund) Waste
☐ Yes ☑ No Exempt Waste: If yes, list ref. 40 CFR
☐ Yes ☑ No EPA Haz. Waste (list codes) None
☐ Yes ☑ No Contains UHCs/Constituents of Concern: List in section D
☐ Yes ☑ No Has the waste been treated after the initial point of generation?
☐ Yes ☑ No Subpart XX
☐ Yes ☑ No Alternative standards for Soil ?

Source Code G Form Code W Mgt. Method H

D. MATERIAL COMPOSITION (Physical/Chemical)

(Range Total > or = 100%) Values are ☐ TCLP ☑ TOTALS (include additional sheets as necessary)

	typical value	unit	range
Soils	95	%	90-100
Debris (wood, rocks, PPE, etc)	5	%	0-10
Thorium 232	40	pCi/g	0-54
Thorium 230	20	pCi/g	0-55
Thorium 228	40	pCi/g	0-54
Uranium 238	20	pCi/g	0-55
Uranium 234	20	pCi/g	0-55
Uranium 235	1	pCi/g	0-2
Radium 226	14	pCi/g	0-55
Sum of All radionuclides	<2000	pCi/g	0-2000

E. Does the waste exhibit or contain the following:

☐ Yes ☑ No Oxidizer
☐ Yes ☑ No Explosive
☐ Yes ☑ No Organic Peroxide
☐ Yes ☑ No Shock Sensitive
☐ Yes ☑ No Tires
☐ Yes ☑ No Pyrophoric
☐ Yes ☑ No Radioactive**
☑ Yes ☐ No Exempt RAD**
☐ Yes ☑ No Halogenated Organic Compounds? (per 40 CFR 268, Appendix III)
☐ Yes ☑ No React. Sulfides ppm
☐ Yes ☑ No React. Cyanides ppm
☐ Yes ☑ No Water/Air (Pyrophoric) React.
☐ Yes ☑ No Thermally Unstable
☐ Yes ☑ No TSCA Regulated PCB Waste
☐ Yes ☑ No Regulated Medical/Infectious Waste
☐ Yes ☑ No Compressed Gasses

**Additional Radiological info is provided in USEI's WAC Addendum

F. PHYSICAL CHARACTERISTICS

1. Flash Point: N/A °F (if <140°F) 2. Typical pH: 8 pH Range: ☐ ≤ 2 ☑ >2, <12.50 ☐ ≥ 12.5
☐ Yes ☑ No Possibility of incidental liquids from transportation?
☑ Yes ☐ No Does waste pass the EPA specified paint filter test?

G. GENERATOR'S CERTIFICATION:

☑ Yes ☐ No **I certify this material may be disposed of without further treatment.**

Certification Statement: I certify under penalty of law that I am familiar with this waste stream through analysis and/or process knowledge, and that all information provided is true, accurate, representitive and complete, and that all known or suspected hazards have been disclosed. Furthermore, I certify that this form was completed in accordance with the instructions provided.

Signature: Costas T. Lymberis Print Name: COSTAS T. LYMBERIS
Title: PROJECT ENGINEER Date: 03/05/2008

Facility use only
First review Second review Final review:
Date approved: Date Denied:

WASTE ACCEPTANCE CRITERIA ADDENDUM

Generator: US Army Corps of Engineers **Date:** 19 Feb 2008

Contact: John Kenney **Phone:** 201-226-6628

100 WEST HUNTER AVENUE, MAYWOOD, N.J., 07607

Common Name of Material: Ore processing residuals generated prior to 1978 (pre-1978 11e2)

Description: Maywood Site remdiation waste soils and debris, FUSRAP SUPERFUND SITE CERCLIS, ID No.# NJD980529762

Identify which table applies to the material (see below): _____

Comments: Waste contains primarily Th-232 and U-238 and their progeny. Th-230 is typically depleted due to historical Th processing, but is conservatively estimated in Equilibrium with U-238 or Ra-226 (higher value)

Determine which table, from the USEI Waste Acceptance Criteria (WAC), applies to the waste you intend to ship to USEI. (Tables 1 - 4).

1. If Table 1 applies, does the material only contain U_{238} or only Th_{232} or both?

a.) If only U_{238} or only Th_{232}, is present, then use the value/concentration listed under Table 1 for Natural Uranium and Natural Thorium as the limit.

b.) If both are present, then use the following formulas as appropriate:

For natural uranium and natural thorium mixture:
{Conc. U / 141 pCi/g + Conc. Th / 110 pCi/g} ≤ 1 and {(pCi/g U x 14) + (pCi/g Th x 10)} = $\leq$ 2000 pCi/g

For refined uranium and thorium mixture:
{Conc. U / 333 pCi/g +Conc Th/110} ≤ 1 and {(pCi/g U x 5) + (pCi/g Th x 10)} = $\leq$ 2000 pCi/g

For depleted uranium and thorium mixture:
{Conc. U / 169 pCi/g + Conc Th / 110 pCi/g} ≤ 1 and {(pCi/g U x 4) + (pCi/g Th x 10)} = $\leq$ 2000 pCi/g

Note: Absent strong evidence to the contrary, Th-232 will routinely be considered to be in 100% equilibrium with its progeny.

Calculations (add extra sheets as necessary)
See attached spreadsheet tab C.

c.) If Th-230 is the only source material present, then choose the appropriate limit from the two available selections.

2. If Table 2 applies then choose one of the following:

a) Is the material Radium 226 or 228?

Note: Ra-226 and Ra-228 will routinely be considered completely in equilibrium with their progeny.

If yes, use Table 2 directly

b) Is the material Lead 210?
Note: Lead-210 will routinely be considered completely in equilibrium with its progeny.

If yes, use Table 2 directly

c) Is the material anything other than NORM?

If yes, use Table 2 directly

3. If Table 3 applies , then

Use Table 3 directly

Note: You must provide an inventory estimate of the radioactive content of each container. (Please list by isotope.)

Radioactive Estimate by Container and Isotope:_____

_____

_____

Note: You can add additional sheets, if necessary

4. If Table 4 applies, then

Use Table 4 directly

Note: You must provide an inventory estimate of the radioactive content of each container. (Please list by isotope.)

Radioactive Estimate by Container and Isotope:_____

_____

_____

When using Table 4 please note the following:

1. Material must be transported in accordance with DOT rules and regulations
2. Individual packages can bear White I or Yellow II Labels but no Yellow III Labels(surface dose rate > 50 mrem/hr). Contact a Customer Service Representative or Sales Representative if you need help with packaging requirements. Depending on the scope, USEI may charge for this service.
3. Provide specific reference for NRC exemption

NRC Exemption: Material is less than 0.05% Source Material by weight.

Placarding Required?_____ If yes, what type_____

Certification Statement: I certify that the contents of the packages being shipped to US Ecology Idaho (USEI) are exempt from regulation by the US Nuclear Regulatory Commission in accordance with 10CFR (list each section of the NRC regulations that contains an exemption for each type of device or item in the shipment)

COSTAS. T. LYMBERIS PROJECT ENGINEER
Name/Title (Please Print)

Signature

03/12/2008
Date

FUSRAP MAYWOOD SUPERFUND SITE HISTORY & REMEDIAL INVESTIGATION SUMMARY

The FUSRAP portion of the Maywood Chemical Company Site consists of 88 designated properties: the Stepan property, which includes all of the contaminated buildings, and the three NRC-licensed burial pits; Maywood Interim Storage Site (MISS); 59 residential properties; 3 properties owned by the state or federal government; 4 municipal properties; and 20 commercial properties. Of the 88 properties, 64 Phase I properties (including all residential and municipal properties) have already been cleaned up by DOE or the USACE. During cleanup actions on these properties, additional properties were remediated. This occurred if the contamination extended on to an adjacent undesignated property.

Radioactive contamination at the FUSRAP Maywood Superfund Site resulted from rare earth and thorium processing operations conducted by the Maywood Chemical Works (MCW) and associated material storage and waste disposal practices. Historical records indicate that processing of thorium from monazite sands may have begun as early as 1895; other records indicate that thorium processing was initiated in 1916, and continued until 1957. Processing operations created wastes containing thorium and lesser amounts of radium and uranium as well as rare earths. (Rare earths are defined as oxides of metals in the lanthanide series of elements, plus the elements of yttrium and scandium.) Some of these process wastes and residues were stored, treated, or disposed on the original processing site where MISS and Stepan are now located. In addition, radioactivity was spread to nearby properties by the use of the waste materials as mulch and fill or through soil and sediment transport along Lodi Brook. Although currently an underground culvert, Lodi Brook was formerly an open channel. The only contaminated buildings at the FUSRAP Maywood Superfund Site are located on the MISS or Stepan property and are associated with the original processing facility.

In 1959, MCW sold the plant to the Stepan Company. In the late 1960s, Stepan Company took corrective measures at some of the former disposal areas located on the original MCW plant site property both east and west of NJ State Route 17. (NJ Route 17 was built in the early 1930's over and through the MCW's thorium waste lagoons.) Stepan's corrective measures included relocation and burial of approximately 19,100 yd^3 of excavated waste materials. These waste materials were relocated to three burial areas on property currently owned by Stepan Company. Stepan sold the portion of the original plant property located west of NJ Route 17 after relocation of the waste materials. Stepan currently holds an NRC license for the storage of thorium-bearing materials in Burial Pits 1, 2, and 3.

EPA listed the Maywood Chemical Company on the Superfund NPL in 1983. In late 1983, Congress assigned DOE a research and development project to clean up the radioactive wastes at the Maywood Chemical Company Site (via the FY84 Energy and Water Appropriations Act). DOE then assigned the site to FUSRAP. In 1997, the FY98 Energy and Water Development Appropriations Act transferred responsibility for the execution and administration of FUSRAP from DOE to the USACE. The inclusion of chemical contaminants under the FUSRAP Maywood Superfund Site's definition of

FUSRAP waste is limited to chemicals on the MISS or chemicals on vicinity properties that are commingled with or related to the radioactive waste, chemicals associated with thorium processing at MCW, and chemicals on or migrating from the MISS. The Stepan Company, which operates an active chemical manufacturing facility at the Maywood Chemical Company Site, is conducting an RI/FS on chemical, non-radiological contamination on its facility and on the adjacent property at 149-151 Maywood Avenue. The EPA is overseeing the Stepan RI/FS and is coordinating that RI/FS and cleanup, with USACE's FS and Proposed Plan and other USACE actions related to environmental cleanup at the Site.

DOE began investigating the FUSRAP Maywood Superfund Site and surrounding area in 1983 and, during 1984-1985, cleaned up 25 residential properties and a portion of one commercially zoned property. Due to the limited commercial disposal capacity for radiological wastes, the excavated materials from these cleanups were stored on property that was a part of the original MCW processing site. DOE acquired this property from Stepan Company and named it the MISS. During a cleanup action conducted by DOE in 1995 and 1996, these stored materials were removed from MISS and sent to a permanent, off-site commercial disposal facility. Also during 1995, the cleanup of the remaining residential properties, four municipal properties (three parks and a fire station), and one commercially zoned property was initiated. These interim property cleanups were implemented as removal actions as proposed in DOE's September 1995 EE/CA under CERCLA. These interim cleanup actions were completed in 2000 by the USACE.

The Remedial Investigation (RI) report (December 1992) was prepared to evaluate the nature and extent of radioactive constituents and related chemical contaminants at the FUSRAP Maywood Superfund Site. Eighty-eight properties have been designated for cleanup based on radiological surveys and soil sampling. The primary radioactive contaminants of concern (COCs) have been identified as thorium-232, radium-226, uranium-238, and their radioactive decay products present in soils and other wastes at the FUSRAP Maywood Superfund Site.

Metals and organic chemicals are also present in soils at MISS, Stepan, and nearby vicinity properties above site-specific background levels. Some of these metals and organic chemicals are not associated with specific thorium processing activities at MCW, nor have they been shown to originate from the MISS. No chemical COCs were identified for soil based on the risk analysis in the Baseline Risk Assessment of the RI.

ENERGYSOLUTIONS

CL-WM-PR-001 F2 (EC-0230)
Revision 9

RADIOACTIVE WASTE PROFILE RECORD

A. GENERATOR AND WASTE STREAM INFORMATION

GENERAL: Complete this form for one waste stream. Contact EnergySolutions at (801) 532-1330 if you have any questions while completing this form. Please indicate "N/A" if a category does not apply.

1. GENERATOR INFORMATION

Generator Name: US Army Corps of Engineers (Maywood) EPA ID #: N/A

Generator Contact: Mike Johnson Title: Resident Engineer / Team Leader

Mailing Address: 100 West Hunter Ave., Maywood, NJ 07607

Utah Site Access Permit #: Exempt

Phone: 201-226-6602 Fax: 201-843-5749 Email: michael.c.johnson@usace.army.mil

Contractor Name: Cabrera Services Location of Waste (City, State): Maywood, NJ

Name & Title of Person Completing Form: Jim Imbornoni, T&DCoordinator Phone: (201)226-6625 Email:

2. WASTE STREAM INFORMATION

Waste Stream ID: 4106-04 Waste Stream Name: Maywood Soil State of Origin: NJ

Revision: 0 Date: 12/18/13 Volume (ft^3): 500,000 Delivery Date: 2014

CHECK APPROPRIATE BOXES BELOW. Please verify the required forms requested below are completed and submitted with the Radioactive Waste Profile Record.

HAZARDOUS WASTE: Is the waste classified as hazardous waste as defined by 40 CFR 261?

N ☒ If **NO**, complete and attach the **"Low-Level Radioactive Waste Certification Attachment"**.

Y ☐ If **YES**, complete and attach the **"Hazardous Waste Certification Attachment"** and check applicable box below.
Has the waste been treated to meet applicable treatment standards per 40 CFR 268? Y ☐ N ☐
Is the waste to be treated by EnergySolutions? Y ☐ N ☐

LOW-LEVEL RADIOACTIVE WASTE: Is the radioactive waste defined as Low-Level Radioactive Waste in accordance with the Low-Level Radioactive Waste Policy Amendments Act of 1985 or in DOE Order 435.1?

Y ☐ If **YES**, , a current copy of a LLRW Compact Export letter authorizing export must be submitted if applicable. Compact export approval is not required for DOE-generated or 11e.(2) waste streams. Case by case export approval for mixed waste and NORM may be required based on generator's governing Compact requirements; contact Energy***Solutions*** Technical Services staff for additional guidance.

N ☒ If **NO**, check appropriate box: NORM/NARM ☐ 11e.(2) Byproduct Material ☒ Other: See attached Congressional Language in Att B.5

SPECIAL NUCLEAR MATERIAL: Does the waste stream contain material with uranium enriched in U-235 or any of the following radionuclides: U-233, Pu-236, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Pu-243, or Pu-244?

Y ☐ N ☒ If Yes, complete and attach the "SNM Exemption Certification" form (EC-0230-SNM). Supporting statements, analytical results, and documentation must be included with the submittal.

PCB WASTE: Does the waste contain Polychlorinated Biphenyls (PCB) that are regulated for disposal per 40 CFR 761?

Y ☐ N ☒ If Yes, complete and attach the "PCB Waste Certification" form (EC-98279).

ASBESTOS: Does the waste contain Asbestos Containing Material?

Y ☐ N ☒ If Yes, Asbestos Containing Material must be managed in accordance with applicable federal regulations. Provide a detailed description of the waste containing asbestos in Section B.5 of the waste profile.

RADIOACTIVE WASTE PROFILE RECORD

B. WASTE PHYSICAL PROPERTIES & PACKAGE INFORMATION

1. GENERAL CHARACTERISTICS

Does the waste contain free liquids? (>1%) Y ☐ N ☒ If **Yes**, what is the percent of free liquid by waste _____ %

If **Yes**, is the liquid aqueous (water-based)? Y ☐ N ☐

Does the waste contain absorbent? Y ☒ N ☐ Density range of the waste: 95 - 105 g/cc ☐ lb/ft³ ☒

List percentage of waste type by volume: Soil 90% Concrete & Metal 5% DAW 5% Resins _____% Sludge _____%

Other constituents and percentage by volume? < 10% debris consisting of wood, metal, PPE, absorbent, etc.

2. MATERIAL SIZE

Gradation of Material: Indicate the percentage of waste material that would **pass through** the following grid sizes. For example, 95% of the material would pass through a 12" square, 90% passes through a 4" square, 80% passes through a 1" square, etc.

12" 100 % 4" 85.4 % 1" 78.2 % 1/4" 69.1 % 1/40" 65.9 % 1/200" 27.8 %

Does the waste stream contain oversize debris (i.e., no dimension < 10 inches and any dimension > 12 feet)? Y ☐ N ☒

If Yes, include a detailed description (i.e., weight, size, drawings, etc.) of the oversize debris in the narrative of Section B.5.

3. MOISTURE CONTENT

For soil or soil-like materials, please use **Std. Proctor Method ASTM D-698** to determine the optimum moisture content. The waste material must not exceed 3 percentage points above optimum moisture upon arrival at EnergySolutions' disposal facility unless approved by EnergySolutions.

Optimum Moisture Content: 14.8 % at Maximum Dry Density (lb/ft³): 112.2

Average Moisture Content: 15.1 % Moisture Content Range: 11.4% - 19.7%

4. WASTE SHIPPING & PACKAGING

Transportation Mode: ☐ Highway ☒ Rail

Shipping & Container Packages: (Check all that apply) ☐ Drums* (≤ 85 gallons) ☐ Boxes (≤ 100 ft³) ☐ Soft-Sided Bags (≤ 10 yd³)

☐ Intermodal ☐ Sealand ☒ Gondola** ☐ Box Car

Other:

*Palletized drums are preferred by the disposal site. Please specify in the "Other" field if drums will not be palletized.

**Dimensions of gondola railcars must be between 48 to 65 feet in length and 8.5 to 12.5 feet in height as measured from the top of the rail to the top of the railcar unless approved by EnergySolutions.

5. NARRATIVE DESCRIPTION AND HISTORY OF WASTE

Please submit a narrative description and history of the waste as an attachment to the Radioactive Waste Profile Record. This attachment should include the following:

- Process that generated the waste
- Waste material physical composition and characteristics
- Radiological and chemical characterization method
- 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 this form

RADIOACTIVE WASTE PROFILE RECORD

Waste Stream ID: 4106-04 Revision: 0 Date of Revision: *12/18/13*

C. RADIOLOGICAL INFORMATION

Obtain sufficient samples to adequately determine a range and weighted average of activity in the waste. Attach the gamma spectroscopy or radiochemistry data supporting the radionuclide information listed below.

1. Does the waste material contain accessible surfaces with contact dose rates greater than 500 mR/hr? Y ☐ N ☒

2. Does the waste material contain any of the following isotopes: Aluminum-26, Berkelium-247, Calcium-41, Californium-250, Chlorine-36, Rhenium-187, Terbium-157, or Terbium-158? Y ☐ N ☒

3. Please list the following information for each isotope associated with the waste. Provide an explanation in the narrative description of Section B.5 if the waste contains localized "hot spots" or elevated concentrations that significantly exceed the upper concentration range. If additional space is needed, provide an Attachment C.3 to this profile record formatted as below.

Isotope	Manifested Upper Concentration (pCi/g)	Weighted Avg. per Container (pCi/g)	Isotope	Manifested Upper Concentration (pCi/g)	Weighted Avg. per Container (pCi/g)
Ra-226	300	17.5	Th-230	800	31
Th-232	3,000	176	U-Nat	800	31
K-40	100	15			

RADIOACTIVE WASTE PROFILE RECORD

LOW-LEVEL RADIOACTIVE WASTE CERTIFICATION ATTACHMENT

This form is required only if the checkbox for Hazardous Waste on page one has been checked No. Otherwise, complete the Hazardous Waste Certification Attachment instead of this attachment. 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 Section B.5.

D. MINIMUM REQUIRED CHEMICAL ANALYSIS

The following parameters must be analyzed by a Utah or NELAC certified laboratory. Typical SW-846 analytical methods have been listed. Other approved methods are acceptable. Attach the most recent or applicable chemical analytical results representing the waste.

1. GENERAL CHEMICAL PARAMETERS

SW-846 Analytical Methods

PFLT: Pass Pass / Fail **Method 9095** Not applicable for liquid radioactive waste streams.

2. 40 CFR 261.24 Table 1 – Contaminants of Toxicity Characteristic

Metals: Methods 6010 & *7470 ☐ TCLP (mg/L) or ☒ Total (mg/kg)

Arsenic	13.8	Chromium	86	Selenium	0.83
Barium	2.1	Lead	98	Silver	.131
Cadmium	0.33	*Mercury	.017		

Organics, Pesticides/Herbicides: Methods 8081/*8151 ☐ TCLP (mg/L) or ☒ Total (mg/kg)

Endrin	0.005	Toxaphene	0.098	Chlordane	0.002
Lindane	0.002	*2,4-D	0.002	Heptachlor	0.002
Methoxychlor	0.024	*2,4,5-TP Silvex	0.002		

Organics, Semi-Volatile: Method 8270 ☐ TCLP (mg/L) or ☒ Total (mg/kg)

o-Cresol	0.65	Hexachlorobenzene	0.2	Pentachlorophenol	3.3
m-Cresol	0.65	Hexachlorobutadiene	0.2	Pyridine	0.2
p-Cresol	0.65	Hexachloroethane	0.2	2,4,5-Trichlorophenol	3.2
Total Cresol	3.3	Nitrobenzene	0.2	2,4,6-Trichlorophenol	0.65
2,4-Dinitrotoluene	0.2				

Organics, Volatile: Method 8260 ☐ TCLP (mg/L) or ☒ Total (mg/kg)

Benzene	1.0	1,4-Dichlorobenzene	0.2	Methyl ethyl keytone	2.0
Carbon Tetrachloride	1.0	1,2-Dichloroethane	1.0	Tetrachloroethylene	1.0
Chlorobenzene	1.0	1,1-Dichloroethylene	1.0	Trichloroethylene	1.0
Chloroform	1.0	Vinyl Chloride	2.0		

3. Was the waste at the point of generation a RCRA hazardous waste per 40 CFR 261? Y ☐ N ☒

If Yes, list former hazardous waste codes and former underlying hazardous constituents. List worst-case concentrations for each hazardous constituent. If additional space is needed, provide an Attachment D.3 to this profile record formatted as below. Attach the most recent chemical analytical results demonstrating compliance with applicable treatment standards.

If No, indicate "N/A" in Section D.3 below.

RADIOACTIVE WASTE PROFILE RECORD

D. 3.

Former EPA HW Codes or Underlying Hazardous Constituents	Treatment Standard (mg/kg unless noted as mg/L TCLP or Technology Code)	Worst Case Concentration (mg/kg unless noted as mg/L TCLP)
None		

4. OTHER CHEMICAL CONSTITUENTS

List any other chemical constituents of concern (e.g., PCBs, chelating agents, etc.) and worst-case concentrations. If additional space is needed, provide an Attachment D.4 to this profile record formatted as below.

Other Chemical Constituents	Worst-Case Concentration (mg/kg unless noted as mg/L TCLP)	Other Hazardous Constituents	Worst-Case Concentration (mg/kg unless noted as mg/L TCLP)
None			

5. LABORATORY CERTIFICATION

☐ **UTAH or NELAC CERTIFIED**
The Utah or NELAC certified laboratory holds a current certification for the applicable chemical test methods insofar as such official certifications are given. Please provide a copy of the laboratory's current certification letter for each parameter analyzed and each method used for chemical analyses required by this form.

☒ **OTHER LABORATORY CERTIFICATION** (Describe below)

Historical Data Used: Generators State Certification for FUSRAP Maywood Laboratory and STL

6. CERTIFICATION

I certify that sample results representative of the waste described in this profile were or shall be obtained using state- and EPA-approved analytical methods. I also certify that where necessary representative samples were or shall be provided to EnergySolutions and to qualified laboratories for the analytical results reported herein. I further certify that the waste described in this record is not prohibited from land disposal in 40 CFR 268 (unless prior arrangements are made for treatment at EnergySolutions) and that all applicable treatment standards are clearly indicated on this form. I also certify that the information provided on this form is complete, true, and correct and is accurately supported and documented by any laboratory testing as required by EnergySolutions. I certify that the results of any said testing have been submitted to EnergySolutions. I certify that the waste does not contain any prohibited items listed in EnergySolutions' Radioactive Material License.

Generator's Signature: HAYS.DAVID.CHARLES.JR.1052582110 Digitally signed by HAYS.DAVID.CHARLES.JR.1052582110 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=HAYS.DAVID.CHARLES.JR.1052582110 Date: 2013.12.18 08:14:41 -06'00' Title: Health Physicist Date: 18 Dec 2013

ATTACHMENT B.5
PHYSICAL PROPERTIES

Generator Name: US Army Corps of Engineers Waste Stream ID: 4106-04
Revision #: 0 Revision Date: 12/18/13

The Maywood Chemical Works (MCW) site was established in 1895. In 1916, the plant began extracting thorium and rare earth metals from monazite sands, by an acidic process, for use in manufacturing industrial products such as mantles for gas lanterns. The plant stopped accepting monazite sands for extraction of thorium in 1956, but it processed stockpiled materials until 1959. The soils to be disposed are contaminated with the tailings generated by the thorium extraction process. The soils will be generated by activities on the Maywood Interim Storage Site and the Vicinity Properties which are part of the FUSRAP Maywood Superfund Site.

The U.S. Army Corps of Engineers (USACE) classified the Maywood waste as 11e(2) byproduct material and Energy Solutions disposed of the waste at the 11e(2) disposal facility prior to the year 2001. In December 2000, the NRC took a position that it would not regulate mill tailings generated prior to 1978 as 11e(2) byproduct material. Subsequently, the waste from Maywood was disposed at the Clive LARW disposal facility. Approximately 250,000 cubic feet of waste was disposed at the LARW disposal facility in 2001.

In September 2001, the NRC reversed its earlier decision and took the position that the Maywood waste is 11e(2) byproduct material. As a result of the NRC position, the Maywood waste reverted back to being disposed at the Clive 11e(2) disposal facility.

In December 2007, the U.S. Congress approved of a provision in the 2008 Consolidated Appropriations Act which states,

> "Sec. 129. Notwithstanding provisions of 42 U.S.C. 2011 et seq. and 42 U.S.C. 7901 et seq. the U.S. Army Corps of Engineers shall have the authority to arrange disposal of waste materials from the Maywood, New Jersey, Formerly Utilized Sites Remedial Action Program (FUSRAP) site at off-site facilities permitted to accept such waste materials under subtitle C of the Resource Conservation and Recovery Act (42 U.S.C. 6921 et seq.). FUSRAP waste materials from the Maywood site may be, but shall not be required to be, disposed at sites licensed under the Atomic Energy Act (42 U.S.C. 2011 et seq.)."

The Consolidated Appropriations Act (CAA) explicitly authorizes the disposal of the Maywood waste at a RCRA Subtitle C facility or disposal at a site licensed under the Atomic Energy Act. Subsequent to the approved CAA of 2008, USACE began shipping the Maywood waste to the US Ecology RCRA Subtitle C facility in Idaho.

The CAA also explicitly authorizes disposal of the Maywood waste in a site licensed by the Atomic Energy Act. The Energy Solutions Class A disposal embankment is licensed by the Utah Division of Radiation Control since Utah is an NRC Agreement State under the Atomic Energy Act. The Energy Solutions Class A disposal embankment is therefore licensed under the Atomic Energy Act and falls under the purview of Section 129 of the Consolidated Appropriations Act of 2008.

The Maywood waste contains uranium and thorium radionuclides identical to the same type of radioactive soil already being disposed at the Class A disposal embankment. There would be no adverse impacts for disposing of the waste at the Class A disposal embankment. In fact, as noted above, Energy Solutions has already disposed of waste from the Maywood project at the LARW disposal embankments in 2001.

USACE is submitting this profile revision to include the language from the CAA which provides Congressional authorization for Energy Solutions to dispose of the Maywood waste at the Class A disposal embankment.

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APPENDIX D

ACTIVITY CALCULATION FACTORS

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Activity Calculation Factors for the Determination of Total Activity Assuming Secular Equilibrium

PURPOSE

In characterizing the soil contaminated with trans-uranium nuclides, frequently only the activity levels of the major radioisotopes are measured. The daughters of the measured nuclides must be included in the determination of the total activity in the samples. The purpose of this evaluation is to calculate the activity calculation factors for Th-232, Ra-226 and U-238, assuming their daughters are in secular equilibrium with the parents. Secular equilibrium means the activity level of the daughter is the same as that of the parent.

ACTIVITY CALCULATION FACTORS

1. Th-232

Th-232 decays into the following radioactive

daughters: Ra-228	AC-228
Th-228	Ra-224
Rn-220	Po-216
Pb-212	Bi-212
Po-212 (64%), Tl-208 (36 %)	

In secular equilibrium, each of the 9 daughter groups has the same amount of activity as that of Th-232. The activity calculation factor is **10**.

2. Ra-226

Ra-226 decays into the following radioactive

daughters: Rn-222	P0-218
Pb-214 (99.98%), At-218 (.02%)	Bi-214
Po-214 (99.98%), Tl-210 (.02%)	Pb-210
Bi-210	Po-210 (~100%), Tl-206 (.00013%)

In secular equilibrium, each of the 8 daughter groups has the same amount of activity as that of Ra-226. The activity calculation factor is **9**.

3. Ra-226

U-238 decays into the following radioactive daughters (up to Th-230 which decays to Ra-226):

Th-234	Pa-234m, plus 0.16% of IT decay to Pa-234
U-234	Th-230

In secular equilibrium, each of the 4 daughters has the same amount of activity as that of U-238. The activity of Pa-234 is 0.16% of the U-238 activity.

Activity of U-235 and the daughters should be added to the measured U-238 activity. The ration of U-235 activity to u-238 activity is

(0.72/99.27) x (238.05/235.04) x (4.468E9 year/7.038E8 year) = 0.0466,

where 0.72 and 99.27 are the weight percentages of U-235 and U-238 respectively, 235.04 and 238.05 are the atomic weights of U-235 and U-238 respectively, and 7.038E8 years and 4.468E9 years are the half-lives of U-235 and U-238 respectively.

U-235 decays into the following radioactive daughters:

Th-231	Pa-231
Ac-227	Th-227 (98.62%), Fr-223 (1.38%)
Ra-223	Rn-219
Po-215	Pb-211
Bi-211	Tl-207 (99.73%), Po-211 (0.27☺

In secular equilibrium, each of the 10 daughter groups has the same amount of activity as that of U-235. The activity calculation factor to account for daughter U-235 and its grand-daughters is 0.0466 x 11 = 0.513

The total activity calculation factor for U-238 samples with Ra-226 measured activity is 5 + 0.0016 + 0.513 = **5.51.**

4. U-238 samples without Ra-226 measured values

For samples without Ra-226 measured activity, the activity of Ra-226 and daughters should be included. The activity calculation factor is 5.51 + 9 = **14.51**.

SUMMARY

The activity calculation factors for Th-232, Ra-226, and U-238 assuming secular equilibrium with daughters are:

Th-232	-	**10**
Ra-226	-	**9**
U-238 samples with Ra-226 measured values	-	**5.51**
U-238 samples without Ra-226 measured values	-	**5.51**

APPENDIX E

TRANSPORT AND DISPOSAL FORM

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CABRERA SERVICES
RADIOLOGICAL•ENGINEERING•REMEDIATION

SOIL LOAD-OUT SURVEILLANCE CHECKLIST

Project Name: MISS Loadout **Inspectors Name:**_____

Date:_____ **Manifest #**_____ **Railcar No.:**_____

The Load-Out Checklist must be completed and signed for each rail car certifying to the following conditions.

Answer each question by checking the appropriate column (yes, no, or NA). This checklist is to be completed by the Inspector and randomly verified by the CQR.

RAILCARS ARE RECEIVED ON RAIL SPUR AND INVENTORIED:	**Yes**	**No**	**NA**	**Initial**
Was the car identification number logged on the ***Soil Load-Out Surveillance Checklist***?….	o	o	o	
Was the rail car *Tare Weight* noted? *Tare Weight*:_____	o	o	o	
PRE-LOADING: Inspections noted on ***Incoming Gondola Rail Car Survey Form***				
Has the car been inspected for **physical damage, debris, and cleanliness**? …….	o	o	o	
Has the RAD Tech performed an ***Incoming Gondola Rail Car Survey***? ……..	o	o	o	
Has ***Confined Space Air Monitoring*** been performed? **PID** ❑ **LEL** ❑	o	o	o	
Has car measurement been performed to determine the car volume? Volume: _____	o	o	o	
LOAD-OUT:				
Are **dust control measures** being implemented, if needed? ……..……	o	o	o	
Was a **calibration of the bucket scale** performed on this date? ……...	o	o	o	
Has the **liner** been installed and inspected prior to loading? ……..……	o	o	o	
Is material being weighed? What is the total **weight** of the load? _____tons	o	o	o	
SAMPLING:				
Have samples been taken? ….. **Yes** ❑ **No** ❑ ***Sample ID #***				
Explanation or results:_____				
Has a sample for **moisture content** test been taken? And what is **result**? _____**%**	o	o	o	
Has **absorbent** material been added if required? How much? _____**lbs.**	o	o	o	
FINAL INSPECTION & DOCUMENTATION VERIFICATION:				
Has a ***Gondola Rail Car Release Form*** been completed? ……	o	o	o	
Has an ***RQ Calculation Sheet*** been completed?……	o	o	o	
Has the material been **classified**? Class: _____	o	o	o	
Has the correct **placarding** been placed on the vehicle?……..	o	o	o	
Has the **liner** been **closed** and **inspected**?…….	o	o	o	
Has the **Non-DOT Specification Label (Hazardous Shipments)** been affixed to container or railcar?	o	o	o	
Has the USACE **"Open Only At Location" Label** been affixed to railcar?	o	o	o	

Corrective Actions/Action Items

List all corrective actions and/or corrective action documents generated. Initial and date in the last column when they were implemented.

_____ _____

_____ _____

DOCUMENTS REVIEWS: The Manifest Package

Incoming Survey, Outgoing Survey, Rad analysis results

CQR_____Date:_____ TDC_____Date:_____

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