

Clive Facility

Waste Acceptance Criteria (WAC)

Technical Support Document

Revision 0



SCOPE

This document provides supplemental information to the EnergySolutions Clive Bulk Waste Disposal and Treatment Facilities Waste Acceptance Criteria (BWF WAC) and Containerized Waste Facility Waste Acceptance Criteria (CWF WAC). Additional details are provided herein to aid customers evaluating, characterizing, profiling, and shipping waste to the Clive disposal facility. This document is written particularly to those new to the process, providing examples and extended definitions beyond those within the BWF and CWF WAC.

In addition to information necessary to profile and ship waste to the Clive Facility, this document contains a list of acronyms used in the WAC documents and general information about the Clive Facility.

If there are any questions concerning the information in this document or the WAC documents, please contact EnergySolutions' Technical Services department:

Tim Orton Director of Technical Services
Phone: (801) 649-2144
Cell: (801) 209-7251
Email: torton@energysolutions.com

Jake Gardner VP of Technical Services
Phone: (801) 836-1555
Cell: (801) 836-1555
Email: jhgardner@energysolutions.com

Veronica Pitts TS Customer Specialist
Phone: (801) 649-2169
Cell: (801) 573-1707
Email: vpitts@energysolutions.com

Subject List

List of Acronyms	iv
Definitions	vii
History of the Clive Disposal Site Location	1
Disposal at the Clive Facility	1
Customer Portal Usage	2
Customer Portal Access	2
Profiles	3
Profile Revisions	7
Shipment Orders	8
Radiological Criteria	10
Waste Classification	10
ALARA Criteria	15
Special Nuclear Material (SNM)	15
Concentration Averaging using the BTP	24
Radioactive Release Criteria	24
11e.(2) Byproduct Material	25
Mixed Waste Treatments	26
Chemical Stabilization	26
Macroencapsulation	27
Thermal Desorption	29
Mercury Treatment	30
Specific Wastes	31
Polychlorinated Biphenyl (PCBs) Radioactive Waste	31
Asbestos and Beryllium	36
Lab Packs	36

<u>Reactive Waste</u>	37
<u>Batteries</u>	37
<u>Required Chemical Analytical Data</u>	39
<u>Waste Packaging Guidelines</u>	41
 <u>Attachment A</u> - BTP Technical Basis Document and Request Form.....	 46

List of Acronyms

The following list of acronyms is used in this document, the BWF WAC and the CWF WAC.

ACM	Asbestos-Containing Material (friable and non-friable)
ALARA	As Low As Reasonably Achievable
AMLGM	Amalgamation of Mercury (Treatment Technology Code)
BTP	The NRC's Branch Technical Position on Concentration Averaging and Encapsulation
BWF	Bulk Waste Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHOXD	Chemical Oxidation (Treatment Technology Code)
CHRED	Chemical Reduction (Treatment Technology Code)
CLSM	Controlled Low-Strength Material
CMBST	Combustion (Treatment Technology Code)
COD	Certificate of Disposal
COT	Certificate of Treatment
CRF	Clive Rail Facility
CWF	Containerized Waste Facility
C-WPR	Containerized Waste Profile Record
DAW	Dry Active Waste
DEACT	Deactivation to Remove a Hazardous Characteristic (Treatment Technology Code)
DOD	US Department of Defense
DOE	US Department of Energy
DOT	Department of Transportation
DU	Depleted Uranium
DWMRC	Division of Waste Management and Radiation Control
ECI	Export Controlled Information
EPA	US Environmental Protection Agency
ES	Energy <i>Solutions</i>
GSAP	Generator Site Access Permit (issued by the Utah DWMRC)
GWQDP	Groundwater Quality Discharge Permit
HIC	High Integrity Container
HMR	Hazardous Materials Regulations (DOT)
IMERC	Incineration of Mercury
LDR	Land Disposal Restrictions
LLD	Lower Limit of Detection

LLRW	Low-Level Radioactive Waste
LSA	Low Specific Activity
MACRO	Macroencapsulation (Treatment Technology Code)
MDL	Method Detection Limit
MW	Mixed Waste
NARM	Naturally Occurring and Accelerator-Produced Radioactive Material
NELAC	National Environmental Laboratory Accreditation Conference
NEUTR	Neutralization (Treatment Technology Code)
NORM	Naturally Occurring Radioactive Material
NRC	Nuclear Regulatory Commission
NTT	Notice to Transport
ORNL	Oak Ridge National Laboratories
PCB	Polychlorinated Biphenyl
PFLT	Paint Filter Liquids Test
PPE	Personal Protective Equipment
RAMQC	Radioactive Materials in Quantities of Concern
RCRA	Resource Conservation and Recovery Act
RMERC	Retorting Mercury
RML	Radioactive Material License
RSO	Radiation Safety Officer
RST	Radiation Safety Technician
SCO	Surface Contaminated Object
SER	Safety Evaluation Report (SNM Exemption)
SI	International System (or Standard) of Units
SNM	Special Nuclear Material
SOF	Sum of Fractions
STABL	Stabilization (Treatment Technology Code)
SWSA	Special Waste Shipment Authorization
TCLP	Toxicity Characteristic Leaching Procedure
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
TF	Treatment Facility
TSCA	Toxic Substance Control Act
UAC	Utah Administrative Code
UCNI	Unclassified Controlled Nuclear Information
UHC	Underlying Hazardous Constituent, defined in 40 CFR 268.48

UHWM	Uniform Hazardous Waste Manifest
UMTRA	Uranium Mill Tailings Remediation Act
USDA	US Department of Agriculture
VTD	Vacuum Thermal Desorption
WAC	Waste Acceptance Criteria

Definitions

Below are a few definitions applicable to this document, the BWF WAC and the CWF WAC.

11e.(2)	A section of the Atomic Energy Act of 1954 describing a specific type of waste: the tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content.
Aqueous Liquid	Any liquid that is miscible or completely soluble in water, not creating a distinguishable layer in the mixture.
Bulk Packaging	Defined in 40 CFR 171.8, bulk packaging is a packaging, other than a vessel or a barge, in which hazardous materials are loaded with no intermediate form of containment. Bulk packaging has a maximum capacity greater than 119 gallons for a liquid, a maximum net mass greater than 882 lbs and a maximum capacity greater than 119 gallons for a solid, and a water capacity greater than 1000 pounds for a gas.
Depleted Uranium	The byproduct left over after the uranium enrichment process removes the U-235 isotope for use in nuclear fuel and weapons. Depleted uranium contains less U-235 and more U-238 than natural uranium.
Friable Asbestos	Asbestos containing material that, when dry, can be easily crumbled, pulverized, or reduced to powder by hand pressure.
LLRW	Low-Level Radioactive Waste. Radioactive waste that is not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or 11e.(2) byproduct material.
LLRW Compacts	Interstate agreements among states to manage and dispose of low-level radioactive waste. There are currently 10 approved compacts (with four active disposal sites) and 10 unaffiliated states.
Non-Aqueous Liquid	Any liquid that has poor solubility with water and creates a separate phase when mixed with water.

Non-Bulk Packaging	Defined in 40 CFR 171.8, non-bulk packaging is packaging with a maximum capacity of 119 gallons or less for a liquid, a maximum net mass of 882 lbs or less and a maximum capacity of 119 gallons or less for a solid, and a water capacity of 1000 pounds or less for a gas.
Mixed Waste	Waste that is both radioactive and RCRA hazardous.
PCB/Mixed	PCB Waste that also is RCRA hazardous.
PCB/Radioactive	PCB Waste that is not RCRA hazardous.
RAMQC	Radioactive Materials in Quantities of Concern. This is a list of specific radioactive materials that pose a security risk in the hands of terrorists. Provisions for this category, and a list of the category 1 and category 2 quantities, is described in 10 CFR 37.
Source Material	Defined in 10 CFR 40.4 as uranium or thorium, or any combination thereof, in any physical form or ores which contain 0.05% or more of uranium, thorium, or any combination thereof. Source material does not include Special Nuclear Material.
Special Nuclear Material	Defined in 10 CFR 40.4 as plutonium, uranium-233, uranium enriched in the isotopes of 233 or 235, or any material artificially enriched by any of the foregoing.
Transuranic	All chemical elements with an atomic number greater than 92 (uranium).

History of the Clive Disposal Site Location

The initial selection of the EnergySolutions disposal site location dates back to the late 1970s when the Department of Energy (DOE) and the State of Utah began the cleanup of an abandoned uranium mill site within the Salt Lake valley. 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, 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 EnergySolutions' 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 is uniquely situated near both rail (Clive is a rail spur off the Union Pacific railroad line) and road (just five miles south of Interstate 80). The Clive site has received waste from cleanups carried out across the country including projects by the Environmental Protection Agency (EPA), Department of Energy (DOE), Department of Defense (DOD), utilities and other commercial entities.

The initial disposal license was for Naturally Occurring Radioactive Material (NORM). Since 1988, EnergySolutions' Radioactive Material License (RML) has been amended several times, expanding the types of radioactive materials to include Class A low-level radioactive waste (LLRW), in addition to NORM. The Clive Facility also holds a state-issued Part B Permit to dispose of Mixed Waste (both radioactive and RCRA hazardous) and a Coordinated Approval from the Environmental Protection Agency (EPA) to manage and dispose of waste contaminated with Polychlorinated Biphenyls (PCBs).

Disposal at the Clive Facility

The Clive Facility builds engineered embankments from the ground up based on a Construction Quality Assurance/Quality Control Manual that is part of the License. The embankment begins by excavating approximately ten feet below grade. Then clean clay is placed and compacted to create a liner for the base of the embankment. Waste is then placed on the liner until the approved design height of the embankment is reached. After the design height is reached, clean soil layer is placed over the waste and then the cover is constructed over the waste. The cover consists of a clay radon barrier layer followed by several rock layers to promote drainage (and minimize infiltration), provide protection of the radon barrier from freezing, and protect the entire embankment from erosion.

Typically (and preferably), waste is disposed in compacted lifts. Waste is spread over a lift area and compacted to 95% of a proctor. Typical lifts are one foot thick after compaction. This type

of waste management works well with soil and with smaller, compactable debris. Larger debris cannot be compacted into lifts to meet this requirement, instead larger debris is placed in a formed area of the embankment and then infilled with a Controlled Low-Strength Material (CLSM), a runny cement mixture that can reach voids within the waste matrix. The CLSM sets to a slightly hard soil form. High dose waste is also managed in this manner to minimize handling and spreading of contamination.

The Containerized Waste Facility manages waste differently since the waste is never removed from the container. Containers are driven to a clean portion of the Low-Level Embankment and off-loaded into specific areas which are then backfilled with sand immediately. The CWF is only allowed to have two lifts (rows of liners) on the bottom level of the embankment. Because of this waste placement methodology, CWF waste cannot have internal voids.

Large Components are also managed in a clean area of the Low-Level Embankment. The waste is generally off-loaded with cranes and placed into position in the area. Engineering saddles are created to distribute the weight and not crack the embankment liner beneath the large component. All large components will be infilled and covered with CLSM prior to additional waste lifts above them to the height of the embankment.

Customer Portal Usage

All profiling and shipment orders to the Clive Facility are completed through the online Customer Portal system. Customer Portal may be accessed through the *EnergySolutions* website at www.energysolutions.com. The Customer Portal button is near the top left of the website home page. Clicking on the words accesses the login portion of Customer Portal. This section describes operation of the Customer Portal.

Customer Portal Access

The first step in completing a Customer Portal profile is to obtain access. Access is acquired on an individual basis. If access is needed, contact a Technical Services representative, or the company user representative for the customer number, and provide a contact email and telephone number. Once access is provided, the individual will receive an email from Customer Portal with a link to update their password. The individual will be presented with a CAPTCHA that contains a simple math equation. The mathematical answer should be submitted, not a repeat of the equation. If a password is ever lost or doesn't seem to be working, clicking on the "Forgot password" in the sign in page will send a new reset email to the individual's email address that is in the system.

Different roles may have different access within Customer Portal. Roles are assigned when a generator profile is established and whenever new individuals are given access. There are roles for Profiles, Shipment Orders, and User access. Individual roles are as follows:

- Profile
 - Create/Edit – can make changes to profiles
 - View – can only view profiles
- Order
 - Create/Edit – can make changes to shipment orders
 - View – can only view shipment orders
 - Upload Manifests – can upload manifests and perform manifest validations
 - Return Signed Manifests – Will receive a copy of the signed manifest after it is received at the Clive Facility
- User
 - Create/Edit – This role should only be given to one or two trusted personnel. Individuals with this role can add new personnel to the customer number and can assign different roles to existing personnel. They can also remove personnel from the lists when needed.
 - View – can view all personnel with roles associated with the customer number

Profiles

A waste profile consists of the four-digit customer number, a dash, and the specific waste stream number. For example, if the number associated with a specific customer is 9999, then the first waste stream for that customer would be 9999-01. A customer may have up to 99 waste streams under their customer number. This is also known as the Waste Profile ID. Customers are encouraged to be specific regarding the waste in each waste stream.

The Customer Portal profile section is accessed by clicking on the words “waste profiles” in the black ribbon at the top of the Customer Portal page. When opening the Customer Portal profiles section, the user will see a list of active profiles and three tab headings near the top of the page: Active, New/Revising, and Archive. Profiles that are being worked on (initial or revisions) and have not been submitted yet will be located in the New/Revising tab.

Creating a new profile can be done by clicking on the green “Add Profile +” button at the bottom of any of the tabs in this section. An alternate way of creating a new profile is to locate a similar completed profile and clicking on the green “Copy +” button to the right. This allows all of the information from one profile to be copied to a new profile. This is convenient if, for example, there are many isotopes associated with both profiles. Instead of recreating the entire radionuclide list, the user can copy another profile with the same nuclides, and then only change the specific details for the new profile.

Once a profile has been filled in and is ready for review by the Clive team, click on the orange “Submit for Approval” button in the Profile Information section at the top of the profile.

The profile is presented as electronic forms with questions about the waste that should be filled in. The Customer Portal profile form contains several tabs to describe different aspects of the waste. The answers provided in some of the forms will open up additional forms that need completed;

those forms will remain greyed out and not accessible unless needed to describe the waste. Sections of the forms (with explanatory notes) are as follows:

Profile Information

This section is above the tabs and always remains at the top of the page. This section contains general information including:

- The Waste Profile ID (e.g., 9999-01)
- The location of the waste – city and state
 - Needed for potential Compact issues
- The Waste Stream Name
 - Descriptive name for the waste (e.g., “standard size debris” instead of “waste”)
- The EPA ID Number for the generation site (if applicable)
 - This is a dropdown box from the *EnergySolutions* contracts database. If your EPA ID Number is not showing in the dropdown box, contact Technical Services and we can adjust the database as needed.

Waste Summary Tab

This tab contains overall information about the waste stream and, depending on what is checked here, opens other tabs on the form. Information includes:

- Noting if the waste is RCRA hazardous and whether it needs treatment at Clive
- Noting if the waste is Low Level Radioactive Waste, NORM/NARM (including TENORM), or 11e.(2) Byproduct Material.
- Does the waste contain Special Nuclear Material?
 - If the “Yes” box is clicked, the Special Nuclear Material tab will open and need filled in.
- Does the waste contain regulated PCBs?
 - If “Yes”, the PCB tab will open and need filled in
- Does the waste contain asbestos containing materials (friable or non-friable)
 - If “Yes”, the Asbestos tab will open and need filled in

Physical Properties Tab

This tab is where the physical description of the waste is provided, including:

- Does the waste contain free liquids (in excess of 1%) and are those free liquids are aqueous
 - The aqueous question is necessary because an additional DWMRC approval is required for non-aqueous liquid waste
 - *EnergySolutions* considers any liquid that is miscible or completely soluble in water to be aqueous

- If free liquids are noted, an additional question becomes available asking if the waste contains elemental mercury. This question is necessary because liquid mercury is allowed without additional DWMRC approval.
- Does the waste contain absorbent?
- Density range of the waste.
 - Particularly important for direct disposal waste
- Percentages of Waste by Type and Volume
 - Provide all types and make sure the total adds to 100%
 - Avoid using decimals
 - If a percentage is placed in the other box, please provide a description
- Gradation of material
 - Include the amount of waste that would pass through each size of screen (e.g., is smaller than that particular size)
 - Do not include the containers if the waste is in smaller containers (e.g., a one liter bottle of liquid would be noted 100% through the 1/200 in screen because the gradation is representative of the liquid waste inside the bottle)
- Does the waste contain oversized debris
 - Oversized debris is greater than 10-inches in any dimension or 12-feet in any one dimension
 - This section also has a box for details on large components.
- Material Volume
 - Estimate the total amount of waste expected under this waste stream (does not have to be exact)
 - This field cannot be left blank
- Moisture Content
 - Particularly important for direct disposal soil or soil-like waste
- Transportation Mode (Highway or Rail or Both)
- Containers used to hold the waste when shipped to the Clive Facility
 - If drums or small soft-sided bags are used, the Clive Facility requires they be palletized (please contact Technical Services if there is an issue using pallets)
- Narrative Description of the Waste
 - Please provide as much detail as possible
 - The bulleted list in this section of the Customer Portal profile can be used as a guide for information needed

Radionuclides Tab

All radionuclides, their maximum and weighted average concentrations (in pCi/g) associated with the waste are to be provided in this tab. It is important to be accurate with the information in this tab since shipment orders will compare manifest nuclides and concentrations with those provided in this tab.

A question is asked at the top of the tab whether there are any contact dose rates greater than 500 mR/hr on any accessible surfaces. Accessible surfaces refers to the waste itself

when it is being disposed at the Clive Facility. It may be inaccessible after packaging, but the Clive Facility will generally dump the waste out of the package during disposal operations. Inaccessible refers to things like the internal surfaces of a pipe, etc.

Waste Tabs (Low Level Radioactive Waste or Hazardous Waste)

The tab highlighted to fill in is dependent on the response to “Is the waste classified as hazardous waste” in the Waste Summary tab. Both tabs describe analytical data provided (or waived), potential hazardous waste codes (current or former), and other chemical constituents. Please fill in the “Justification for Waiving Chemical Analysis” box if analytical data is not provided. Also, fill in any “other Chemical Constituents” that may be present, particularly if they may affect treatment or disposal at the Clive Facility.

Both tabs also ask for laboratory certification information since the Clive Facility License and Permit requires data be provided by Utah or NELAC certified (or other certifications as allowable, contact Technical Services if another certification is being used).

Low Level Radioactive Waste Tab

The Clive Facility RML requires analysis of characteristic hazardous contaminants to ensure the waste is not characteristically hazardous. The tab requires filling in worst-case concentrations for all of the toxicity D-coded hazardous contaminants (EPA Codes D004-D043).

The tab also requires noting any former hazardous waste codes present in the waste, and applicable UHCs (mostly needed for previously treated waste that is no longer hazardous).

Hazardous Waste Tab

This tab includes results of the Paint Filter Liquids Test (PFLT) for non-liquid waste (primarily direct disposal waste) and pH for liquid waste. Distinguishing colors and odors are also requested. These are simple inspection points at Clive to confirm the correct waste was shipped.

This tab requires listing all hazardous waste codes and UHCs associated with the waste. It is important to include all codes that are going to be shipped since a profile revision is required to add new waste codes and that could prove problematic if a transport vehicle is in the Clive Facility parking lot waiting to be off-loaded.

Special Nuclear Material Tab

This tab will be highlighted and need filling in if the box is checked in the Waste Summary Tab stating the waste contains Special Nuclear Material. Instructions for filling out this tab are provided in the Special Nuclear Material section of this WAC Technical Support Document.

PCB Tab

This tab will be highlighted and need filling in if the box is checked in the Waste Summary Tab stating the waste contains regulated PCBs. This tab includes check boxes for all of the different categories of PCBs as previously described in the Polychlorinated Biphenyl section of this WAC Technical Support Document. Please include all potential PCB categories associated with waste in the specific waste profile. Each category does not need to be present in each shipment of waste from this waste profile. Those categories that require Mixed Waste disposal are noted with an asterisk (*) in this tab.

The tab also provides a section for a description of the PCBs in the waste.

Asbestos Tab

This tab will be highlighted and need filling in if the box is checked in the Waste Summary Tab stating the waste contains Asbestos. The tab is very simple, asking if the waste is friable (and noting that it is to be managed in accordance with regulations) and a description of the asbestos in the waste.

Attachments Tab

Upload any additional information regarding the waste into the Attachments Tab. This includes analytical reports, Safety Data Sheets, pictures, waste characterization reports, etc. As much information as possible should be provided so that the Clive Facility understands the waste and can manage it safely and compliantly.

Comments Tab

Any additional comments regarding the waste may be placed in this tab.

Transaction History and Contacts Tabs

These last two tabs are informational regarding profile management. The Transaction History Tab provides a list of all changes made to the profile, by date and time, and the user who made those changes. The Contacts tab is a list of contacts who have access to the profile (view or edit/create).

Profile Revisions

Profile revisions are done by simply clicking the orange “Revise” button at the bottom of the Profile Information section. Simply hit the button, make the necessary revisions, and then click on the orange “Submit for Approval” button.

When making a revision to a profile, *EnergySolutions* requests that customers add a description of the Revision and the specific changes to the top of the narrative at the bottom of the Physical Properties tab.

Shipment Orders

In addition to creating profiles, the Customer Portal system is also where shipment orders to the Clive Facility are created and managed. This provides a good foundation to find potential discrepancies early in the process as the system compares information supplied in a shipment order with information in a profile and will inform the user if there is a discrepancy – before the shipment ever leaves the customer’s site.

Shipment orders are accessed by clicking on the words “orders/shipments” black, ribbon at the top of the Customer Portal page. Similar to the profile, the order section of Customer Portal has several different tabs. To begin a new order, click the green “New Order +” button at the bottom of the screen. When the form is completed, the orange “Request Schedule” button should be clicked.

This process is to be completed at least five working days before the waste is shipped to the Clive Facility. Manifests do not need to be uploaded until the time of shipment, but the rest of the information should be provided so that the Clive Facility Shipping & Receiving Department can build daily incoming shipment schedules.

Order Summary Tab

This tab provides the basics for the shipment and opens the other tabs as necessary. Information needed includes:

- What type of Order?
 - For purposes of the Clive Facility WACs, the Send Waste to *EnergySolutions* button is the only one concerned about and is needed clicked to send waste to the Clive Facility
 - The other selections under this question are for other services *EnergySolutions* offers outside of disposal at the Clive Facility. Contact your Business Development representative or Account Manager to learn more about these services.
- Is this a cask shipment?
- Is this a rail shipment?
- What carrier is being utilized
 - If *EnergySolutions* / Hittman Transport Services is clicked, the Hittman tab will be made available to order those services. This service is available, but outside the scope of the Clive Facility WACs.
- Trailer Type
 - Pick from the dropdown menu
- RAMQC?
 - Cat 1, Cat 2, or N/A

Hittman and Order Empty Containers Tabs

These tabs are used to order other services offered by EnergySolutions; however, they are outside the scope of the Clive Facility WACs. Contact your Business Development representative or Account Manager to learn more about these services.

Ship Waste to ES Tab

This tab provides the specific information needed by the Clive Facility Shipping & Receiving department to schedule a shipment to the facility.

Orders are started by filling in the departure date and the estimated date the shipment is expected to reach the Clive Facility. If Hittman Transport Services is used for shipping, these boxes will already be filled in by the transportation order. These dates are required to schedule the shipment.

The next step is to associate a profile to the shipment. This is done by clicking the green “Add Waste Profile +” button. When clicked, several boxes are opened to provide additional information. The Profile box has a dropdown menu of all approved profiles associated with customer number. Note that the manifest number to the right of the profile must match the profile number and be followed by four digits to represent the specific shipment. The container type and number of containers is required at this time as well as a brief description of the waste.

This section also asks if there is a Special Waste Shipment Authorization (SWSA) associated with this shipment. It is required to select either Yes or No to this question. If a SWSA is needed, but has not been completed previously, it can be started at this time and submitted through the system. Note that the person logged in must have the Profile Create/Edit role in order to perform this action.

The last portion in the waste profile section of the order is several checkboxes regarding anything special that may be associated with this shipment. Please fill in as many as are applicable as that helps the Clive Facility safely and compliantly manage the waste.

Note that multiple shipments may be associated with an order by clicking on the green “Add Waste Profile +” button again.

The form then requests a current GSAP number for the order. Available GSAPs for the customer number will be provided in a dropdown menu.

Any comments regarding the shipment, including special handling and other information, can be typed into the comments box at the bottom of the form.

Manifest Validation Tab

As noted previously, the order may be requested in the system before a manifest is added, but a manifest is needed, and this portion completed, before the shipment leaves the customer’s site. The Manifest Validation Tab takes the comma-delimited text file associated with the manifest and then performs internal checks for the shipment and the

associated profile to ensure everything is valid and the shipment will not be rejected at the Clive Facility. If you are having trouble validating a manifest, contact a Technical Services representative.

LDR Certification Tab

This tab remains grayed out unless the profile is a Mixed Waste profile and an LDR certification is required. A customer may use their own LDR certification, but it is strongly suggested that the internal Customer Portal LDR Certification is used as it makes additional checks to ensure the correct codes, associated with the profile, are in the shipment.

Comments Tab

Any additional comments regarding the shipment may be placed here.

Attachments Tab

Upload any additional information regarding the shipment into the Attachments Tab. This includes pictures, surveys, Safety Data Sheets, etc.

Contacts and Transaction History Tabs

Similar to the profile page, these last two tabs are informational regarding shipment order management. The Transaction History Tab provides a list of all changes made to the order, by date and time, and the user who made those changes. The Contacts tab is a list of contacts who have access to the order (view or edit/create).

Radiological Criteria

Waste Classification

The information provided below is a summary of the waste classification regulations and how generators must classify their LLRW prior to shipment to the Clive Facility. Further guidance is provided in NRC's "Branch Technical Position on Concentration Averaging and Encapsulation", as amended (BTP). All generators shipping LLRW to the Clive Facility must comply with the NRC's BTP. In the classification discussion below, the state of Utah regulation (Utah Administrative Code, UAC, R313-15-1009) is considered. This regulation is consistent with the NRC waste classification regulation in 10 CFR 61.55, with the addition of Radium-226 as a waste classifying isotope.

Determination of waste class involves two considerations. First, consideration must be given to specific long-lived radionuclides listed in Table I of UAC R313-15-1009. Second, consideration must be given to specific short-lived radionuclides listed in Table II of UAC R313-15-1009. 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 R313-15-1009.

The following rules apply when calculating waste class:

- If the waste does not contain any radionuclides (or radionuclide categories) listed in either Table I or Table II, it is Class A.
- For waste that only contains radionuclides from Table I:
 - If the concentration does not exceed 0.1 times the value in Table I, the waste is Class A.
 - 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.
- For waste that only contains radionuclides from Table II:
 - If the concentration does not exceed the value in Column 1 of Table II, the waste is Class A.
 - For wastes containing mixtures of the radionuclides listed in Table II, the total concentration shall be determined by the sum of fractions rule as illustrated in the example below.
- For waste that contains radionuclides from both Table I and Table II, classification will be determined by the highest classification between the two tables.
 - Example 1: A waste contains 2 Ci/m³ Tc-99 and 500 Ci/m³ Co-60 → the waste is Class A
 - Example 2: A waste contains 4 Ci/m³ Tc-99 and 500 Ci/m³ Co-60 → the waste is Greater than Class A
 - Example 3: A waste contains 2 Ci/m³ Tc-99 and 800 Ci/m³ Co-60 → the waste is Greater than Class A

Classification Tables from UAC R313-15-1009

Table I

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

* The AM designation means that the radionuclide is in Activated Metal

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.

Columns 2 and 3 in Table II provide concentration limits for Class B or C waste; however, since the Clive Facility can only receive Class A waste, those columns are not applicable for waste shipped to the Clive Facility.

Sum of Fractions (SOF) Rule

For waste material that contains more than one radionuclide within Table 1 or Table 2, the waste must be classified by applying the sum of fractions rule described in UAC R313-15-1009(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.

SOF EXAMPLE #1

A generator has one 55-gallon container of soil contaminated with plutonium-241, radium-226, uranium-234, uranium-235, uranium-238, cesium-137, and strontium-90. The density of the soil is 1.6 g/cm³ and is used to convert concentration units from pCi/g to Ci/m³. 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-241	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/cm³) is used to convert from pCi/g to Ci/m³.

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

$$\text{Table I: } \frac{3.0E+03}{1.0E+04} + \frac{6.0E+03}{1.0E+04} = 9.0E-01 = 0.9 (< 1.0)$$

$$\text{Table II: } \frac{8.0E-03}{4.0E-02} + \frac{1.3E-02}{1.0E+00} = 2.1E-01 = 0.21 (< 1.0)$$

Based on the sum of fractions rule, the waste in this container is determined to be Class A waste (90 percent of the Class A limit for Table I radionuclides). This container is acceptable for disposal at the Clive Facility 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 R313-15-1009.

SOF EXAMPLE #2

A generator has one 55-gallon container of Dry Active Waste (DAW) contaminated with americium-241, technetium-99, europium-155, cobalt-58, and cesium-135. The density of the DAW is 0.25 g/cm³ and is used to convert Table II units from pCi/g to Ci/m³. 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/cm³) is used to convert from pCi/g to Ci/m³.

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

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

$$\text{Table II: } \frac{3.8E-02}{7.0E+02} + \frac{2.5E-02}{7.0E+02} = 9.0E-05 (<< 1.0)$$

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 the Clive Facility. Note that Cs-135 is not included in the sum of fractions calculation since this radionuclide is excluded in Table I or II of R313-15-1009. Note also that the Table II calculation is immaterial because the Table I calculations demonstrate the waste is greater than Class A.

ALARA Criteria

ALARA principles are designed to protect Clive Facility personnel managing the waste. Licenses and permits at the Clive Facility require sampling of the waste upon receipt; furthermore, the typical and most efficient disposal process is to empty the contents of containers and spread into lifts which are compressed to strict compaction requirements. The ALARA criteria is more stringent for the BWF Facility than the CWF Facility because the CWF Facility does not require sampling or opening of containers as part of waste management.

Exceedances of the values in Table 2-1 of the BWF WAC require the waste to be managed differently, usually by keeping the waste in the shipping container and encasing with a cement-like material within a specific, highly shielded area of the disposal embankment. All instances of ALARA criteria exceedance are reviewed on a shipment-by-shipment basis. In many cases, the safest alternative, from a radiation safety perspective, is to receive the waste as containerized waste at the CWF. The Clive Facility has placed a hard limit of 500 mR/hr on resin waste; any dose beyond that limit requires CWF disposal.

It is important to note that the external contact dose rate is the dose rate that may be encountered by disposal facility personnel. For example, a pipe does not exceed the ALARA criteria even if the internal surface of the pipe exceeds 500 mR/hr as long as the opening of the pipe is less than 500 mR/hr. Note also that the Clive Facility is required by license to fill all voids within waste; therefore, in this example, shield plates used to cover the opening of the pipe cannot be the sole means of lowering dose rates below the ALARA criteria.

Another example is DAW placed into 55-gallon drums and compacted into pucks. Since the compacted DAW is not accessible, the ALARA dose rates apply to the external surface of the puck itself and not to the DAW inside the puck.

Special Nuclear Material (SNM)

The NRC developed the Clive Facility 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; ML060750320). Specific guidance from the SER is included in this section.

The current two-page SNM form (Revision 4) was shown in Figures 3-1 and 3-1a of the BWF WAC and is also depicted below in the two figures below. These forms are filled out in Customer Portal, in the Special Nuclear Material tab which opens when Special Nuclear Material is checked in the Waste Summary tab. Specific instructions for filling out the form are provided below.



SPECIAL NUCLEAR MATERIAL EXEMPTION CERTIFICATION

The Special Nuclear Material Exemption Certification form must be completed and signed by each generator certifying to the following conditions. Please attach this form and all required information to the Radioactive Waste Profile Record (EC-0230). **A completed and signed copy of this form must also accompany each waste manifest.**

Waste Stream ID: _____ Manifest No. _____

1. Check applicable category below for the waste stream:

✓	Uranium Enrichment Percent	Weight Percent of Chemicals in Condition 2c	Weight Percent of Materials in Condition 2d	U-235 Concentration (pCi/g)	Measurement Uncertainty* (pCi/g)
☐	< 10 %	≤ 20 %	≤ 1 %	≤ 1,900	≤ 285
☐	Unlimited	≤ 20 %	≤ 1 %	≤ 1,190	≤ 179
☐	Unlimited	Sum of both ≤ 45 % of waste by weight		≤ 680	≤ 102
☐	Unlimited	Unlimited	Unlimited	≤ 26	≤ 10
☐	Not Applicable - Enriched U-235 is not present in the waste.				

* A concentration value is used for the maximum measurement uncertainty limit rather than a percentage value to allow greater flexibility for generators with waste having very low SNM concentrations.

2. Certify to the following requirements by checking applicable boxes, A-E for solid waste or A-F if waste includes liquid:

- ☐ a. Concentrations of SNM in individual waste containers do not exceed the applicable values listed in the above table and SNM isotope concentrations listed in Table 1.
- ☒ b. The SNM is homogeneously distributed throughout the waste or the SNM concentrations in any contiguous mass of 600 kilograms (1,323 lbs) do not exceed on average the specified limits. (Based on process knowledge or testing).
- ☐ c. Except as allowed by Condition 1, the waste does not contain "pure forms" of chemicals containing carbon, fluorine, magnesium, or bismuth in bulk quantities (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. (Based on process knowledge or testing).
- ☐ d. Except as allowed by Condition 1, the waste does not contain total quantities of beryllium, hydrogenous material enriched in deuterium, or graphite above one percent of the total weight of the waste. (Based on process knowledge, physical observations, or testing).
- ☐ e. Waste packages do not contain highly soluble forms of uranium greater than 350 grams of uranium-235 or 200 grams of uranium-233. If the waste contains mixtures of U-233 and U-235, the waste meets the sum of the fractions rule. 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. (Based on process knowledge or testing).
- ☐ f. For containers of liquid waste with more than 600 kilograms of waste, the total activity (pCi) of SNM in the manifested container does not exceed the SNM concentration in the above table or Table 1 times 600 kilograms of waste (based on process knowledge or testing). For example, the maximum activity of Pu-239 in any manifested container of liquid waste is 6.0 mCi (6.0E+09 pCi) as shown below:

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



SPECIAL NUCLEAR MATERIAL EXEMPTION CERTIFICATION

Table 1. Maximum concentrations of SNM in individual waste containers (refer to above table for U-235 limits).

Radionuclide	Maximum Concentration (pCi/g)	Measurement Uncertainty (pCi/g)	Radionuclide	Maximum Concentration (pCi/g)	Measurement Uncertainty (pCi/g)
U-233	75,000	11,250	Pu-241	350,000	50,000
Pu-236	500	75	Pu-242	10,000	1,500
Pu-238	10,000	1,500	Pu-243	500	75
Pu-239	10,000	1,500	Pu-244	500	75
Pu-240	10,000	1,500			

3. Indicate that the following information is attached to the Radioactive Waste Profile Record by checking each box. (Note: Only the two-page Special Nuclear Material Exemption Certification form needs to be included with each manifest).

- ☐ a. Provide a description of how the waste was generated, list the physical forms in the waste, and identify the uranium chemical composition.
- ☐ b. Provide a general description of how the waste was characterized (including the volumetric extent of the waste, and the number, location, type, and results of any analytical testing), the range of SNM concentrations, and the analytical results with error values used to develop the concentration ranges.
- ☐ c. Describe the process by which the waste was generated showing that the spatial distribution of SNM must be uniform, or other information supporting spatial distribution.
- ☐ d. Describe the methods to be used to determine the concentrations on the manifests. These methods could include direct measurement and the use of scaling factors. Describe the uncertainty associated with sampling and testing used to obtain the manifest concentrations.

4. **Generator's certification of compliance with the SNM exemption:** I certify that the information provided on this form is complete, true, and correct and is based on process knowledge, physical observations, or approved laboratory testing. I also certify that sampling and radiological testing of waste containing SNM was performed in accordance with EnergySolutions' Radioactive Material License and that any supporting documentation and analytical results have been submitted to EnergySolutions.

Authorized Signature

Printed Name

Title

Date

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 five 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. 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.

Condition 2 – Specified Limits for Waste Containing SNM

Each generator must certify all five conditions listed in this section, and the sixth if the waste is a liquid. This certification is done by checking Yes for the question at the top of this section (“Does this waste stream meet the requirements of (a) through (e) below and requirement (f) if applicable?”). These conditions are categorized as follows:

- a. SNM Isotope Concentration Limits
- b. Spatial Distribution Requirements
- c. Bulk Chemical Limits
- d. Unusual Moderator Limits
- e. Soluble Uranium Limits
- f. SNM concentration limits within liquid waste containers

Information for the generator to assess in each of these categories is described below:

2.a. SNM Isotope Concentrations

This condition 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.

2.b. Spatial Distribution Requirements

This condition 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.

SPATIAL DISTRIBUTION 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 (2.16X10⁶ pCi/g) as follows:

$$\frac{1,900 \frac{\text{pCi}}{\text{g}} \times 600,000 \text{ g}}{2.16 \times 10^6 \frac{\text{pCi}}{\text{g}}} = 527.8 \text{ g U235}$$

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.

2.c. Bulk Chemical Requirements

This condition 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 criticality studies conducted by Oak Ridge National Laboratories (ORNL) for the NRC. The ORNL studies used silicon dioxide (SiO₂) to represent the waste matrix in performing criticality calculations. Additional studies were performed replacing the silicon in the SiO₂ 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.

2.d. Unusual Moderator Limits

This condition 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.

2.e. Soluble Uranium Limits

This condition 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.

2.f. Liquid SNM Concentration Limits

This Condition limits the concentration of SNM in individual containers of liquid waste. Radioactive liquid waste containing SNM is acceptable at the Clive Facility 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:

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

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.

Condition 2 concludes with a table of maximum allowed concentrations in any individual waste container for SNM radionuclides other than U-235.

Condition 3 – Characterization of Waste Containing SNM

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

- a. Waste Description
- b. Waste Characterization Summary
- c. Uniformity Description
- d. Manifest Concentration

Generators are required to provide information and justifications in all four sections of this condition.

Condition 3.a

This condition 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.

This condition 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.

Condition 3.c.

A description of the spatial distribution of SNM in the waste is required by this condition. 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 of the SER contains the related NRC guidance.

Condition 3.d

This condition 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 of SNM 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.

Condition 4 – Generator’s Certification

The generator’s certification of compliance is required in the final section. This certification is automatically given by Customer Portal when the Submit for Approval button is clicked.

Concentration Averaging using the BTP

Both the BWF and the CWF WAC allow waste to be received utilizing the NRC's "Concentration Averaging and Encapsulation Branch Technical Position", as amended (BTP) to achieve Class A concentrations. EnergySolutions has created Technical Basis Document # 17-001 to describe BTP requirements for acceptance at the Clive Facility. The document was created in 2017 and is still applicable; however, the technical points of contact on the second page have been changed to Tim Orton and Jake Gardner (contact information provided in the Scope section of this document). A copy of the BTP Technical Basis Document is provided in Attachment A of this document.

The last two pages of the BTP Technical Basis Document is a form that EnergySolutions requests be filled in and submitted to Technical Services. This form is not required, but provides good guidance to ensure the BTP has been followed correctly. Contact Technical Services if you would like a fillable form to submit.

Radioactive Release Criteria

Section 6.2 of the BWF WAC provides general release criteria for the Clive Facility. More detailed release criteria are provided in the table below:

Release Type Reference	Application	Limits								
		Dose Rate (mrem/hr)		Loose Contamination (dpm/100cm ²)			Total Contamination (dpm/100cm ²)			
<u>Unrestricted Use</u> EnergySolutions’ RML Condition 27	Conveyances or containers that do not require radiological control.	Internal	0.2 Contact	Internal	α	20	Internal	α	100	
					β/γ	200		β/γ	1,000	
		External	0.2 Contact	External	α	20	External	α	100	
					β/γ	200		β/γ	1,000	
<u>DOT Empty</u> 49CFR173.428	Conveyances or containers that have previously contained “Class 7” (Radioactive) materials, that have been emptied of contents as far as practical.	Internal		Internal	α	24,000				
					β/γ	240,000				
		External	0.5 Contact	External	α	240				
					β/γ	2,400				
<u>Sole Use</u> 49CFR173.443(d)	Conveyances that are used only for the transport of radioactive material and are marked “For Radioactive Material Use Only.”.	Internal	10 Contact 2 @1 Meter	Internal						
		External	1@30cm	External	α	240				
					β/γ	2,400				
<u>49CFR173.403</u> 49CFR173.403	Conveyances used for the transport of Class 7 (Radioactive) material exclusive use shipments which are not considered the package (i.e. flatbed trailers, cask trailers, intermodal railcars) and are being shipped back with a DOT package.						Internal	α	240	
								β/γ	2,400	
							External	α	240	
								β/γ	2,400	

49CFR173.443(c) 49CFR173.443(c)	Conveyances used for the transport of Class 7 (Radioactive) material exclusive use shipments which are considered the package (i.e. railcars, intermodals, vans) and are remaining in exclusive use service.	Internal	0.5 Contact	Internal	α	240	
					β/γ	2,400	
		External	0.5 Contact	External	α	240	
					β/γ	2,400	

11e.(2) Byproduct Material

Below is additional information regarding radionuclide limits, acceptable forms, certifications, and shipping paperwork requirements for 11e.(2) waste shipped to the Clive Facility.

Radionuclide Concentration Limits

The Clive Facility 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. The Clive Facility's 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.

Acceptable Forms of 11e.(2) Byproduct Material

In addition to soil and soil-like 11e.(2) byproduct material, the Clive Facility 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 a Technical Services representative to make necessary arrangements for the debris to be sized upon receipt.

Shipments of 11e.(2) byproduct material containing free liquid will be considered nonconforming and not acceptable for disposal.

Certification of 11e.(2) Byproduct Material

The Clive Facility 11e.(2) Radioactive Material License requires that each generator or owner certify in writing that the waste is 11e.(2) byproduct material as defined by the Atomic Energy Act, as amended. Specifically, the generator or owner must certify that

the waste materials are tailings or waste produced by extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. The generator or owner must also certify that the waste material does not contain any other radioactive waste or hazardous waste. The generator or owner must provide the following information as it relates to the 11e.(2) byproduct material:

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

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

Shipping Paperwork for 11e.(2) Byproduct Material

Although 11e.(2) byproduct material is specifically excluded from the definition of Low-Level Radioactive Waste; the Clive Facility 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 R313-15-1009. Generators may enter “N/A” in column 16 of the NRC Form 541 for Waste Classification.

Mixed Waste Treatments

The following information lists additional details on permitted treatment processes at the Clive Facility. Treatment Processes listed in Section 3.1.3.3 of the BWF WAC include:

- Chemical Stabilization, Oxidation, Reduction, Neutralization, and Deactivation
- Macroencapsulation of hazardous debris or radioactive lead solids
- Thermal Treatment of Organics including PCBs (VTD)
- Mercury Treatment (Amalgamation, AMLGM)

Chemical Stabilization

Chemical stabilization involves the addition of approved chemical reagents in accordance with waste-specific treatment formulas and is performed in permitted mixers at *EnergySolutions*’ Treatment Facility. Formula additions of waste, reagents, and water involve the following chemical processes:

- Stabilization (STABL)
 - Binding metal contaminants to reduce their ability to leach from waste

- Deactivation (DEACT)
 - Removing the characteristics of ignitability, corrosivity, or reactivity
- Neutralization (NEUTR)
 - Creating a final pH between 2 and 12.5
- Chemical Oxidation (CHOXD)
 - Creating a different oxidation state to increase reactivity with other reagents and/or decrease leachability
- Chemical Reduction (CHRED)
 - Creating a different oxidation state to increase reactivity with other reagents and/or decrease leachability

Although each of these processes are different, they all include the combination of waste and reagents. The Clive Part B Permit lumps these processes under the broader label of stabilization. Mixed Waste requiring stabilization may be pretreated through size reduction and homogenization using various equipment including shredders and mixers.

Treatment of metal contaminants requires meeting a leachability standard as determined by the Toxicity Characteristic Leaching Procedure (TCLP) test, EPA Method 1311. Organic contaminants primarily require treatment to a total concentration standard, which requires destruction of the compound. Only very low concentrations of organic contamination may be destroyed using chemical oxidation or reduction. In general, it is difficult to treat organic contaminants that are more than three times their regulatory treatment standard (e.g., tetrachloroethylene has a treatment standard of 6.0 mg/kg and would be very difficult to meet that standard if the initial concentration were greater than 15 mg/kg). The Clive Facility may perform laboratory treatability studies to create a new formula or confirm an existing formula can treat contaminants below regulatory treatment standards. Organic contaminants that cannot be treated by chemical processes will require thermal treatment (see below).

In order to evaluate chemical compatibility within 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

Mixed Waste consisting of hazardous debris may be macroencapsulated in accordance with the “Alternative Treatment Standards for Hazardous Debris” as specified in R313-268-45 (40 CFR 268.45). The regulatory requirement for microencapsulation (MACRO) is as follows:

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.

In order for hazardous debris to qualify for this alternative treatment, the waste must comply with the debris definition in R315-268-2(g) (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)

Therefore, packaged waste subject to macroencapsulation 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 R315-268.2(h) (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 Section R315-268-3. (40 CFR 268.3)

The Clive Facility performs macroencapsulation in Macro Vaults within the footprint of the triple-lined Mixed Waste Landfill Cell. In this treatment process, waste is placed in a formed area and a proprietary, regulatory-approved Macro Mix is poured over the waste. The Macro Mix is a pozzolanic cement-like material with low permeability and high slump to fill voids within the waste. The Clive Part B Permit requirement is that the waste is surrounded by at least a four-inch cover of Macro Mix. The figures below illustrate the Macro Vault process.



Macro Vault

Radioactive Lead Solids 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 Radioactive Lead Solids unlike the 60 mm particle size requirement for hazardous debris. As such, smaller forms of Radioactive Lead Solids such as lead shot or fines require macroencapsulation prior to disposal.

EnergySolutions' MACRO treatment capability accommodates any size or weight of hazardous debris, thus enabling the generator to reduce the amount of time and cost associated with preparing waste packages for shipment. Generators with large debris over 20,000 pounds requiring macroencapsulation will provide the following information to EnergySolutions for review during the waste acceptance process: drawings, photographs, dimensions, weight, description of access ports to internal voids, radiological dose rate and contamination levels, and loading plans. Generators should contact Technical Services long before shipping larger wastes for macroencapsulation as they may require specific Macro Vault locations and equipment to accommodate the treatment.

Thermal Desorption

As described in the chemical stabilization description above, 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 standards. As such, treatment of organic contaminated waste streams requires either destruction or removal of the organic constituent from the waste. Furthermore, several organic contaminants carry the

CMBST (combustion) technology-based treatment standard and requires high temperature organic destruction technologies to meet that treatment standard.

EnergySolutions teams with TD*X Associates, LP to treat high organic-contaminated waste through a Vacuum Thermal Desorption (VTD) unit within the Treatment Facility at Clive. The VTD process is permitted by the state of Utah for hazardous wastes and the Environmental Protection Agency (EPA) for high concentration polychlorinated biphenyls (PCBs). Waste containing PCB liquids is also acceptable for VTD treatment. PCB capacitors (leaking small PCB capacitors and light ballasts as well as large PCB capacitors) may also be processed through VTD. These wastes require size reduction prior to treatment and EnergySolutions has regulatory authority (through the EPA-administered TSCA Coordinated Approval) to shred PCB capacitors prior to treatment. The EnergySolutions' Vacuum Thermal Desorption (VTD) unit has also been demonstrated and approved by the EPA to meet the CMBST standard.

The VTD process indirectly heats mixed waste at sufficient temperatures to volatilize the organic constituents which are then condensed and collected as a liquid. No thermal destruction occurs within the process, only separation. The thermally treated residue is then sampled to verify LDR compliance and disposed of in the on-site Mixed Waste Landfill Cell. In some cases, the treatment residue will require additional treatment to stabilize hazardous metals prior to disposal. After VTD treatment, the organic liquid condensate is considered a newly generated waste attributed to EnergySolutions. This condensate is free of radioactivity and can be free released from radioactive standards. This waste is shipped to a non-rad RCRA incinerator to meet final treatment standards.

Mercury Treatment

Elemental mercury contaminated with radioactive materials must be treated via amalgamation (AMLGM) per R315-268-40 (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 DWMRC also requires the amalgamation treatment to reduce the leachability of elemental mercury to below the characteristic concentration limit of 0.2 mg/L TCLP prior to disposal in the Mixed Waste Landfill Cell. This requirement applies to amalgamated mercury treated at either EnergySolutions' Treatment Facility or treated at another facility and shipped to EnergySolutions for disposal. Generators may ship elemental mercury contaminated with radioactive materials to EnergySolutions for treatment and disposal.

EnergySolutions is also capable of treating Low Mercury Subcategory (< 260 mg/kg total mercury) and High Mercury-Organic/Inorganic Subcategories (> 260 mg/kg total mercury). Waste streams containing Low Subcategory Mercury must be treated to less than 0.025 mg/L TCLP mercury prior to disposal in the Mixed Waste Landfill Cell. The EPA requires High Mercury Subcategory waste streams be treated thermally by incinerating (IMERC) or retorting (RMERC). EnergySolutions has received a site-

specific treatment variance from the Utah Waste Management and Radioactive 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 R315-268-45 (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. The Clive Facility can inspect containers and remove elemental mercury accumulated in low spots prior to further treatment.

Specific Wastes

Polychlorinated Biphenyl (PCB) Radioactive Waste

PCB waste is delineated into different waste categories. Some of these waste categories require Mixed Waste disposal and shipment on a Uniform Hazardous Waste Manifest (UHWM). Other categories may be disposed at the LLRW facility and do not require a UHWM. Through regulations and EPA approvals, the Clive Facility is authorized to receive and dispose of all categories of PCB waste. PCB waste is typically designated PCB/Radioactive if it does not contain RCRA codes or PCB/Mixed if it does.

The following sections describe the types of PCB waste categories acceptable for disposal at the LLRW or Mixed Waste disposal embankments. Asterisks indicate PCB waste categories that require disposal in the Mixed Waste disposal embankment. Please note that 40 CFR 761.1(b)(2) requires that PCB concentrations be determined on a weight-per-weight basis (e.g., mg/kg), or for liquids, on a weight-per-volume basis (mg/L).

The Clive Facility 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 waste containing unauthorized free liquids will not be accepted by the Clive Facility unless re-profiled to a VTD waste stream. Generators shipping PCB waste in re-usable containers should include liners to prevent PCB contamination on the internal surfaces of the container. Any container contaminated with PCBs will be returned to the shipper as a PCB Container.

This section contains regulatory references to the governing regulations in 40 CFR 761. For more detail on anything described herein, refer to the specific citation referenced (or contact EnergySolutions Technical Services).

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 40 CFR 761.

PCB remediation waste includes soil, rags, and other debris generated as a result of any PCB spill cleanup, including, but not 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)).

The three PCB Remediation Waste categories and their disposition at Clive are described in the following table:

PCB Remediation Waste Category	Definition	Accepted
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	LLRW or MW
< 50 ppm or $< 100 \mu\text{g}/100 \text{ cm}^2$	PCB Remediation waste containing < 50 ppm or $< 100 \mu\text{g}/100 \text{ cm}^2$	
≥ 50 ppm or $\geq 100 \mu\text{g}/100 \text{ cm}^2$	PCB Remediation waste containing ≥ 50 ppm or $\geq 100 \mu\text{g}/100 \text{ cm}^2$	MW

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. Disposition of PCB Bulk Product Waste at the Clive facility is as follows:

PCB Bulk Product Waste Category	Definition	Accepted
Presumed or known to leach < 10 $\mu\text{g/L}$ 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 $\mu\text{g/L}$ of water measured using a procedure used to simulate leachate generation.	LLRW or MW
Presumed or known to leach ≥ 10 $\mu\text{g/L}$ PCBs	Paper or felt gaskets, fluorescent light ballasts with PCBs in the potting material ≥ 50 ppm	MW

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.

PCB Container Category	Definition	Accepted
≥ 500 ppm PCBs	The PCB concentration of material which was contained in the PCB Containers was ≥ 500 ppm	MW
< 500 ppm PCBs	The PCB concentration of material which was contained in the PCB containers was < 500 ppm	LLRW or MW

PCB Oils

The Clive Facility is authorized to process PCB oils through the VTD unit. Oils may originate from drained (either by the generator or *EnergySolutions*) large capacitors, transformers, or other PCB articles. PCB oils may also be generated from Research and Development projects as well as laboratories (e.g., standards).

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.

PCB management for PCB Articles at the Clive Facility is regulated under a TSCA Coordinated Approval from the EPA. Under the Coordinated Approval, the Clive Facility can receive both drained PCB articles (certified flushed), as well as articles that require draining and flushing (PCB transformers or hydraulic machines). PCB Articles that have been drained must be filled with sufficient absorbent material to absorb all remaining liquid. The Clive Facility can also receive and process small leaking PCB capacitors through VTD. Large PCB capacitors require size reduction and VTD processing prior to disposal; the Clive Facility has permits in place that allow both of these activities.

The table on the next page 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	Accepted
PCB Transformers	Any transformer that contains ≥ 500 ppm PCBs.	MW 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).	MW
	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.	MW ³
PCB Hydraulic Machines	Includes die casting machines	MW 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).	LLRW or MW
Other PCB Articles		--
	PCB Article (≥ 500 ppm PCBs)	MW
	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.	LLRW or MW

¹ Requires solvent flushing (by generator or EnergySolutions).

² Requires solvent flushing if PCB concentrations $\geq 1,000$ ppm.

³ Requires VTD treatment.

Asbestos and Beryllium

The EPA has codified asbestos abatement regulations in 40 CFR 61 Subpart M. When a generator notes their waste contains asbestos in the Waste Summary tab of the Customer Portal profile, the Asbestos tab opens to describe the asbestos in the waste. That tab also has a hyperlink to the Code of Federal regulations website where Subpart M may be accessed and reviewed. Subpart M contains all required regulations for removing, packaging, transporting and disposing of asbestos waste. Additional transportation requirements are codified by the Department of Transportation (DOT) at 49 CFR 173.216.

Some asbestos waste may require wetting to meet the regulatory requirements. 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 the Clive Facility Treatment Facility for solidification prior to disposal. Contact Technical Services 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 noted in the shipment order within Customer Portal. 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 EnergySolutions.

Lab Packs

A lab pack is a container that holds smaller containers of waste (e.g., unused pure product chemicals, lab standards, small clean-ups, etc.). The Clive Facility is authorized to receive lab packs as long as all of the contents are known and acceptable for treatment and/or disposal. Lab packs should have unique profiles and as much information as possible should be provided in the shipment order in Customer Portal.

It is important that the generator ensures all the waste in a lab pack is compatible and will not react considering the different temperatures and pressures encountered during storage and transport. DOT shipping requirements for lab packs are codified at 49 CFR 173.12. A generator should be familiar with these regulations prior to shipping a lab pack container.

Reactive Waste

The Clive Facility RML has three prohibitions related to reactive waste. These are:

- Waste shall not be capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water;
- Waste shall not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste; and
- Waste shall not be pyrophoric

Furthermore, Module III, *Storage and Treatment in Containers*, of the state-issued Part B Permit for the Mixed Waste Facility has the following prohibitions:

- Waste may not be pyrophoric
- Waste may not be DOT Forbidden Class 1, 2, and 3 explosives
- Waste cannot be shock sensitive

The permit also has a pathway to acceptance for these types of waste on a case-by-case basis. The pathway would require a management plan for the waste to document how the waste will be safely and compliantly managed from receipt through disposal. This pathway requires approval from the Director of the Utah DWMRC.

Smaller quantities (that may not pose a threat) or specific packaging (e.g., water reactive waste under oil) may be used to justify management of waste at the Clive treatment facility. Technical Services representatives can help determine if a specific waste may be eligible for management at the Clive Facility. Reactive batteries are approved for management at Clive, see the section below for more detail on batteries.

All reactive waste must be packaged, marked, and shipped in accordance with DOT regulations in 49 CFR. DOT categories of reactive waste vary and transportation requirements may be different depending on the waste. Contact Technical Services if you have any questions about shipping reactive waste.

Batteries

As noted in the BWF WAC, the Clive Facility can receive several different types of batteries for treatment and disposal. The disposition path is dependent upon the chemical composition of the battery. Common battery types are listed below along with a short description of EnergySolutions' management approach.

1. **Alkaline Batteries:** Alkaline batteries are not considered a RCRA- regulated hazardous waste. The electrolyte of an alkaline battery does not meet the definition of an aqueous solution or free liquid; therefore, they are not, by definition, a corrosive waste. Disposition is direct disposal.

2. **Carbon-Zinc Batteries:** Carbon-zinc batteries are not considered a RCRA-regulated hazardous waste. Disposition is direct disposal.
3. **Lead-Acid Batteries:** Lead-acid batteries destined for disposal are considered a RCRA-regulated hazardous waste due to their lead content (EPA Hazardous Waste Code D008). If the battery is not drained, it will typically also carry a D002 corrosive waste code. *EnergySolutions* will drain and neutralize the electrolyte, and macroencapsulate the battery carcass.
4. **Lithium Batteries:** Lithium batteries are subdivided into the following categories:
 - Lithium-manganese dioxide batteries are non-hazardous solid waste. Disposition is direct disposal.
 - Lithium-sulfur dioxide batteries (single-cell) are non-hazardous solid waste. Disposition is direct disposal.
 - Lithium-sulfur dioxide batteries (multi-cell) may be non-hazardous solid waste or characteristic hazardous wastes. If equipped with a Complete Discharge Device (CDD), the batteries are considered a non-hazardous solid waste after discharging. If the batteries are not equipped with a CDD, multi-cell lithium-sulfur dioxide batteries are characteristic hazardous waste due to ignitability (D001) and reactivity (D003). Disposition is direct disposal for non-RCRA regulated, and macroencapsulation for RCRA regulated.
 - Lithium-thionyl chloride batteries are characteristic hazardous wastes. These batteries are a characteristic hazardous waste due to the toxicity (chromium D007), ignitability (D001) and reactivity (D003). Disposition is macroencapsulation.
 - Note that Clive Facility maintains a variance from the Utah Radioactive and Hazardous Waste Board to allow the macroencapsulation of reactive lithium batteries.
5. **Magnesium Batteries:** Magnesium batteries with 50 percent or greater remaining charge are considered RCRA-regulated hazardous waste due to the characteristic of toxicity (chromium D007). Batteries with less remaining charge are not considered RCRA-regulated waste. Batteries with greater than 50 percent charge will be macroencapsulated; batteries with less than 50 percent charge will be direct disposed.
6. **Mercury Batteries:** Mercury batteries are considered RCRA-regulated hazardous waste due to the characteristic of toxicity (mercury D009). Disposition is macroencapsulation.

7. **Ni-Cad Batteries:** Ni-cad batteries are considered RCRA-regulated hazardous waste due to the characteristic of toxicity (cadmium D006). Disposition is macroencapsulation.
8. **Silver Batteries:** Silver batteries are considered RCRA-regulated hazardous waste due to the characteristic of toxicity (silver D011 and mercury D009). Disposition is macroencapsulation.
9. **Thermal Batteries:** Thermal batteries are considered RCRA-regulated hazardous waste due to the characteristic of toxicity (chromium D007). Disposition is macroencapsulation.

Shipping Waste Batteries

Regulations for the shipment of batteries to the Clive Facility are compiled in the DOT 49 CFR regulations. Specific sections to review prior to shipping batteries include:

- 49 CFR 173.159 for Wet Batteries
- 49 CFR 173.185 for Lithium Batteries

There are no specific transportation requirements for the shipment of non-hazardous batteries. Hazardous batteries must be packaged to prevent short-circuiting (non-conductive packaging, separation, and/or terminal capping) and damage to the batteries through shifting during transport. If packaged with other waste, batteries must be isolated and protected from the other waste in the package.

Required Chemical Analytical Data

The Clive Facility License and Permit have requirements for analytical data submissions with a profile. All data submitted must be performed by a laboratory with approval from the state of Utah or NELAC. Data may also be acceptable from other laboratories if appropriate quality control data is provided for review.

Chemical Analytical is required to ensure waste going to the Low-Level facility is not RCRA hazardous or to provide information on what management is necessary at the Mixed Waste facility. Regulations regarding hazardous waste is found in 40 CFR 261 (or UAC R315-261). The EPA designates waste hazardous as either listed or characteristic. Listed waste (F, K, P, and U-codes) are specific to the waste generation process or for spent commercial chemical products. Characteristic waste (D-codes) are overall characteristics of the waste. There are four types of characteristic waste:

Ignitable (40 CFR 261.21)

- A liquid that flashes at a temperature less than 60°C (140°F)

Corrosive (40 CFR 261.22)

- An aqueous liquid with a $\text{pH} \leq 2$ (acidic) or ≥ 12.5 (basic)
- A liquid that corrodes steel

Reactive (40 CFR 261.23)

- Unstable waste
- Reacts violently or forms potentially explosive mixtures with water
- Can generate toxic gases, vapors, or fumes that can be dangerous to human health or the environment (particularly cyanide bearing waste)

Toxic (40 CFR 261.24)

- List of 40 elements and compounds at specific concentrations. See the table from the regulations on the next page.
- Waste going to the Low-Level facility is required to be analyzed for these 40 constituents to confirm they do not exceed the concentration in the regulatory table.

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	Pentachlorophenol	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.

Waste Packaging Guidelines

The Clive Facility 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 SCO 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 the Clive Facility:

Bulk Packaging

Generators are able to minimize packaging and transportation costs by utilizing bulk packages that are intended for re-use. The Clive Facility receives various bulk packages 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 the Clive Facility and then decontaminated, surveyed, and returned in accordance with the requested radiological release criteria. 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 Packaging 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 into 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. The Clive Facility 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 at the Clive Facility unless approved in writing by *EnergySolutions*.
- Bulk packaging in intermodals, sealands, cargo containers, roll-offs, etc. must have ISO connectors on the top corners as illustrated in the figure below to allow the containers to be lifted from the top unless approved in writing by *EnergySolutions*.
- Friable asbestos is prohibited in bulk packages unless approved in writing by *EnergySolutions*.
- Each bulk container, which requires marking, will be properly marked in accordance with 49 CFR 172 Subpart D.
- Bulk packaging may not contain a mixture of bulk, unpackaged waste and manifested packaged waste (e.g., an intermodal containing loose unpackaged soil with manifested disposal containers within the same intermodal).
- 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 in writing by *EnergySolutions*.
- Large 40 foot sealands must not contain bulk unpackaged waste unless approved in writing by *EnergySolutions*.

Non-Bulk Packaging (Disposal Containers)

The Clive Facility receives non-bulk packages (disposal containers) including boxes, drums, super sacks, etc. Unless specifically requested, the disposal container is disposed of with the waste contents and will not be returned to the generator. Unless approved in writing, the Clive Facility requires drums are 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 *EnergySolutions*. Contact *EnergySolutions* to request approval to ship non-palletized drums prior to shipment. Non-Bulk packaging must conform to the following requirements:

- Non-Bulk packaging must, at a minimum, meet the applicable requirements contained in 49 CFR 173.24, General Requirements for Packaging 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. The Clive Facility 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 unless specifically requested in a SWSA.
- Non-bulk packages shall not exceed 7,500 lbs inside of an enclosed van trailer without prior written approval from *EnergySolutions*.
- Overpack containers only when necessary (e.g., to meet DOT requirements) for shipment.
- The Clive Facility 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 R313-15-1009.
- 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.



Bulk Shipping Containers

Highway Transportation

For highway shipments, the Clive Facility 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.



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.

Rail Transportation

Rail shipments will be delivered to the Clive Facility's rail siding by the Union Pacific railroad on a predetermined schedule. Once at the Clive Facility's siding, they will be moved into the disposal site by EnergySolutions' equipment.



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 emailed to the Clive Disposal Facility or uploaded into the "Attachments" section of the Customer Portal for the specific shipment. The documents must be uploaded into the Customer Portal or be emailed to the Clive Disposal Facility a minimum of 3 working days prior to the receipt of the rail shipment.

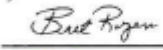
Attachment A
BTP Technical Basis Document and Request Form

Technical Basis Document # 17-001

Title: Standard Methods and Protocols for Applying the U.S. Nuclear Regulatory Commission Concentration Averaging and Encapsulation Branch Technical Position for Radioactive Waste Shipments to the Clive Disposal Facility

Revision: 0

Date: April 13, 2017

Prepared By:  Bret Rogers
Apr 13 2017 11:34 AM Bret Rogers, SVP Technical Services

Reviewed By:  Tom Brown, Clive Radiation Safety Officer *4/13/17*

Approved By:  Mark Ledoux
Apr 17 2017 9:21 AM Mark Ledoux, Corporate Radiation Safety Officer

Objective

Nuclear power plant decommissioning (D&D) involves dispositioning a relatively small portion of Low-Level Radioactive Waste (LLRW) with elevated concentrations. The disposition costs associated with managing LLRW at higher concentrations are significant. One of the objectives of D&D projects is to implement the U.S. Nuclear Regulatory Commission (NRC) Concentration Averaging and Encapsulation Branch Technical Position (BTP) in order to minimize disposition costs associated with managing the higher activity waste to the extent that the overall life-cycle costs and risks (including project schedule) are not negatively impacted.

Scope

The scope of this document is to outline the requirements for implementing the BTP, documentation requirements for waste shipments to EnergySolutions processing and/or disposal facilities, and EnergySolutions facility process for reviewing and approving waste subject to the BTP. This document does not intend to replace any regulation, federal guidance documents, or radioactive material license conditions. In the case of any conflict between said documents and this Technical Basis Document, said documents take precedence.

References

1. U.S. NRC Concentration Averaging and Encapsulation Branch Technical Position, Revision 1, February
2. EnergySolutions Radioactive Material License UT 2300249, as amended
3. EnergySolutions Containerized Waste Facility Waste Acceptance Criteria, as amended
4. EnergySolutions Bulk Waste Disposal and Treatment Facilities Waste Acceptance Criteria, as amended
5. 10 CFR 61, Licensing Requirements for Land Disposal of Radioactive Waste
6. 10 CFR 20, Standards for Protection Against Radiation

Contact Information

Technical points of contact to discuss these types of waste stream questions and applicability to BTP for shipments to the EnergySolutions Clive disposal facility:

1. Bret Rogers, 801-649-2142, brogers@energysolutions.com
2. Jeff Ginsburg, 801-649-2039, jfginsburg@energysolutions.com

Definitions

Refer to the BTP for additional definitions and information on concentration averaging.

Blendable Waste - For the purposes of the BTP, a waste type is “blendable” if: (1) the waste can be physically mixed to create relatively uniform radionuclide concentrations or (2) the waste is not expected to contain durable items with significant activity. Radionuclide concentrations are “relatively uniform” if an intruder who encounters the waste is unlikely to encounter waste more concentrated than the class limit by a factor of 10.

Concentration Averaging - The mathematical averaging of radionuclide concentrations in waste over its volume or mass, for the purpose of determining its classification in accordance with Tables 1 and 2 in 10 CFR 61.55, “Waste Classification.”

Discrete Item - For the purposes of the BTP, discrete items are items belonging to one of the following waste types: activated metals, sealed sources, cartridge filters (cartridge filters may be treated as blendable waste in some cases as prescribed in the BTP), contaminated materials, and components incorporating radioactivity into their design. Items belonging to these waste types are designated as discrete items in this guidance because (1) they are expected to be durable (i.e., remain intact at the time of intrusion) and (2) items belonging to these waste types often have relatively high amounts or concentrations of radioactivity.

Encapsulation - The process of surrounding a discrete item(s) or other materials in a binding matrix within a container, where the activity remains within the dimensions of the original discrete item(s) or other materials.

Primary Gamma-Emitting Radionuclides - Cobalt-60, Niobium-94, and Cesium-137.

Radionuclides of Concern - Any nuclides in the waste in concentrations greater than either one percent of the concentration of that nuclide listed in Table 1 in 10 CFR Part 61 or one percent of the applicable class-dependent concentration of that nuclide in Column 2 or 3 of Table 2 in 10 CFR Part 61. Note that any of the concentration limits for nuclides listed in 10 CFR Part 61 with the term “in activated metal” apply to “discrete items”. Conversely, if waste is considered “blendable” per the BTP, then the concentration limits for radionuclides listed in 10 CFR Part 61 with the term “in activated metal” do not apply.

Solidification - The process of incorporating radioactive material in a binding matrix to create a solid, physically and radiologically uniform material.

Overview

Generators are required to comply with and document their approach with supporting information when applying the NRC BTP to waste within packages shipped to disposal. *EnergySolutions* will review the information provided by the generator during the waste profiling and/or shipment process to concur with the application of the BTP. Generators must complete the request form shown in Figure 1 and attach any applicable information to request approval to ship *EnergySolutions* waste that has utilized the BTP. *EnergySolutions* will review the request and provide the generator comments or signed approval on the request form.

In accordance with Appendix G to 10 CFR Part 20, the licensee classifying the waste must have a quality assurance program in place to ensure compliance with the waste classification provisions of 10 CFR 61.55. As part of this quality assurance program, if the classification of a waste is based on the volumetrically averaged or weight-averaged nuclide concentration, the licensee responsible for classification of the waste should prepare, retain with manifest documentation, and have available for inspection a record documenting the licensee's waste classification analysis.

Waste Acceptance Process

EnergySolutions has two disposal embankments for Class A LLRW. Unless otherwise approved, most waste packages with contact dose rates greater than 200 mR/hr or that are shipped in a cask are disposed at the Clive Containerized Waste Facility (CWF). Waste packages with dose rates less than 200 mR/hr may also be disposed at the CWF but are mostly disposed at the Clive Bulk Waste Facility (BWF). *EnergySolutions* requires generators to 1) become certified to ship to the CWF, or 2) complete and submit a Waste Profile for waste shipments to the BWF documenting the physical, chemical, and radiological properties of the waste. For certified generators, *EnergySolutions* reviews the waste management procedures followed by the generator, quality assurance program, and independent audits to assess the ability for the generator to ship waste direct to the CWF. Once the generator is certified to ship to the CWF, they may ship the waste streams identified during the certification process. In either case, generators that apply the BTP to waste packages for concentration averaging purposes must consult with *EnergySolutions* prior to shipment to ensure the waste complies with the Class A limits.

Documentation Requirements

The following information details the documentation requirements for waste shipments that utilize the BTP for concentration averaging. Generators may provide this information during the waste profiling process or with subsequent shipments using the attached form shown in Figure 1. Generators may provide a conceptual approach to *EnergySolutions* for preplanning efforts prior to submitting detailed characterization data in order to ensure the approach is acceptable. For actual waste shipments that utilize the BTP, generators must provide the following specific information prior to scheduling.

General Information

- A description of the physical, chemical, and radiological properties of the waste including but not limited to the following: weight, volume, drawings, pictures, lab analysis, characterization approach and results, waste generation narrative, and how the waste was determined to be “blendable” or considered a “discrete item(s)”.
- A description of how radionuclide concentrations are determined for manifesting purposes.
- A description of how waste volume and mass in manifested packages will be determined.

Blendable Waste

- A description of each blendable waste stream(s) mixed for averaging purposes.
- As applicable, a description of how waste was blended to ensure compliance with physical mixing requirements in BTP (Table 1).
- A technical basis must be provided in accordance with the criteria outlined in the BTP for cartridge filters that are considered blendable waste. This documentation should also include process knowledge about the use of the cartridge filter.

Discrete Item Waste

- Type of discrete item(s) (e.g., activated metals, cartridge filters, contaminated materials, etc.).
- Description on number of discrete items placed in waste packages.
- Description of classification controlling radionuclides.
- Radiological characterization listing each radionuclide and associated activity for each discrete item.
- Volume and mass of each discrete item if providing radioactivity of each item instead of concentration (applicable for demonstrating compliance with the factor of 2 and 10 Class limit criteria referenced in Section 3.3 of the BTP).
- Determination if waste in package is from single waste type (Refer to Figure 3 in BTP).
 - Demonstrate compliance with applicable Table 2 or 2x Class limit for primary gamma emitters controlling waste classification in each item.
 - Demonstrate compliance with applicable Table 3 or 10x Class limits in each item.
 - Demonstrate compliance that all other radionuclides are less than 10x applicable Class limit in each item.
- Description of sectioned components, if applicable (Refer to Figure 4 in BTP).
 - Determination if all sectioned pieces of original component are placed in one package.
 - Determination if all pieces are greater than 0.01 ft³.
 - Evaluation of each piece with respect to Table 2 and Table 3 radionuclide activity limits.

- Description of encapsulation of discrete items, if applicable (Refer to Figure 5 in BTP)
 - Demonstrate compliance with applicable Table 2 or 2x Class limit for primary gamma emitters controlling waste classification in each item.
 - Demonstrate compliance with applicable Table 3 or 10x Class limits in each item.
 - Demonstrate that waste loading is greater or equal to 14 percent of volume used for concentration averaging.
 - Demonstrate that final waste volume is less than or equal to 9.4 m³ (331.9 ft³).
 - Documentation demonstrating compliance with the encapsulation criteria in the *EnergySolutions* Containerized Waste Facility Waste Acceptance Criteria (CWF WAC).

EnergySolutions will review the information provided and document its approval on a waste stream basis if the generator uses the same approach for multiple shipments within a waste stream. For one time shipments under a specific waste stream, *EnergySolutions* will review the information specific to the shipment and provide approval prior to the shipment being scheduled for delivery to the Clive disposal facility.

**Figure 1. Concentration Averaging Request Form for Waste
Utilizing the NRC Concentration Averaging and Encapsulation BTP**

Generator Information

Generator Name: _____
 Waste Stream ID: _____
 Contact Name: _____
 Contact Email: _____
 Contact Phone: _____
 Submittal Date: _____

Waste Information (Check applicable boxes to affirm)

Description of the waste: _____
 (Attach any available drawings, pictures, characterization data, and basis of determination for designating the waste as blendable or discrete in accordance with the BTP)
 Description of radiological characterization approach: _____
 Description of how waste volume and mass in manifested packages will be determined: _____

☐ Blendable Waste Stream (Refer to BTP Section 3.2)?

Description of how waste was mixed to ensure compliance with physical mixing requirements in Table 1 of BTP: _____
 For intact cartridge filters, description of how the cartridge filter is determined to meet blendable waste criteria (refer to BTP Section 3.3.3): _____

☐ Discrete Item Waste Stream (Refer to BTP Section 3.3)?

Type of discrete item(s) (e.g., activated metals, cartridge filters, contaminated materials, etc.): _____

List classification controlling radionuclides: _____

- ☐ Multiple discrete items in waste package?
- ☐ Discrete items less than 0.01 ft³?
- ☐ Radiological characterization listing each radionuclide and associated activity and concentration for each discrete item attached?
- ☐ Discrete items from single waste type (Refer to Figure 3 in BTP)?
 - ☐ Analysis attached demonstrating compliance with applicable Table 2 or 2x Class limit for primary gamma emitters controlling waste classification in each item?
 - ☐ Analysis attached demonstrating compliance with applicable Table 3 or 10x Class limits in each item?
 - ☐ Analysis attached demonstrating compliance that all other radionuclides are less than 10x applicable Class limit in each item?
- ☐ Description of sectioned components, if applicable (Refer to Figure 4 in BTP): _____
 - ☐ All sectioned pieces of original component are placed in one package?
 - ☐ Analysis attached for each piece demonstrating compliance with Table 2 and Table 3 radionuclide activity limits?

☐ Description of encapsulation of discrete items, if applicable (Refer to Figure 5 in BTP):

-
- ☐ Analysis attached demonstrating compliance with applicable Table 2 or 2x Class limit for primary gamma emitters controlling waste classification in each item?
 - ☐ Analysis attached demonstrating compliance with applicable Table 3 or 10x Class limits in each item?
 - ☐ Analysis attached demonstrating that waste loading is greater or equal to 14 percent of volume used for concentration averaging?
 - ☐ Analysis attached demonstrating that final waste volume is less than or equal to 9.4 m³ (331.9 ft³)?
 - ☐ Analysis attached demonstrating compliance with the encapsulation criteria in the EnergySolutions Containerized Waste Facility Waste Acceptance Criteria (CWF WAC)?

EnergySolutions Review of Concentration Averaging Request

Approved	☐	Technical Services (Print)	Date
Denied	☐	Signature	
Comments:			
Approved	☐	Radiation Safety Officer (Print)	Date
Denied	☐	Signature	
Requires approval from Utah Division of Waste Management and Radiation Control? ☐ Y ☐ N			
Comments:			