DEPARTMENT OF THE ARMY
PITTSBURGH DISTRICT, CORPS OF ENGINEERS
WILLIAM S. MOORHEAD FEDERAL BUILDING
1000 LIBERTY AVENUE
PITTSBURGH, PA 15222-4186

June 2, 2009

REPLY TO
Project Management Branch

MARK CRITZ
OFFICE OF CONGRESSMAN JOHN P. MURTHA
P.O. BOX 780
JOHNSTOWN, PA 15907

Dear Mr. Critz

Enclosed for your information are the final work plans for the Shallow Land Disposal Area. The work plans include the following documents:

1. Accident Prevention Plan (APP)
2. Backfill and Restoration Plan (BRP)
3. Contractor Quality Control Plan (CQCP)
4. Radiation Protection Plan (RPP)
5. Regulation Compliance Plan (RCP)
6. Site Operations Plan (SOP)
7. Sampling and Analysis Plan (SAP)
8. Waste Management Transportation and Disposal Plan (WMTD)
9. Water Management Plan (WMP)

This project is being conducted by the U.S Army Corps of Engineers under the Formerly Utilized Sites Remedial Action Program (FUSRAP). Also included for your use are two CD's with the above information on them.

If you have any questions or need additional information please feel free to contact me at 412-395-7377 or email me at william.j.lenart@usace.army.mil.

Sincerely,

William J. Lenart

William J. Lenart
Project Manager SLDA

FINAL

WATER MANAGEMENT PLAN

SHALLOW LAND DISPOSAL AREA
FUSRAP SITE REMEDIATION
PARKS TOWNSHIP
ARMSTRONG COUNTY, PENNSYLVANIA

May 2009

US Army Corps of Engineers ®
Buffalo District

Prepared for:
U.S. ARMY CORPS OF ENGINEERS
BUFFALO DISTRICT
Buffalo, New York
PITTSBURGH DISTRICT
Pittsburgh, Pennsylvania

Contract Number W912P4-07-D-0002

Prepared by:
CABRERA SERVICES, INC.
473 Silver Lane
East Hartford, Connecticut 06118

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WATER MANAGEMENT PLAN (WMP)
SLDA FUSRAP SITE, PARKS TOWNSHIP, ARMSTRONG COUNTY, PENNSYLVANIA

Contract Number W912P4-07-D-0002

WMP APPROVALS

By their specific signature, the undersigned certify that this WMP is approved for use during remediation of the SLDA FUSRAP Site, Parks Township, Armstrong County, Pennsylvania.

APPROVED BY:

John Eberlin – Project Manager
Cabrera Services, Inc.

5/19/09
Date

Dave Watters, CHP – Senior Vice President
Cabrera Services, Inc.

5/21/09
Date

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

AEC	Atomic Energy Commission
ASTM	American Society for Testing and Materials
CABRERA	Cabrera Services, Inc.
CQCSM	Contractor Quality Control Systems Manager
decon	decontamination
DQCR	Daily Quality Control Report
frac	fractionation
FSS	Final Status Survey
FUSRAP	Formerly Utilized Sites Remedial Action Program
gpm	gallons per minute
HDPE	High Density Polyethylene
MED	Manhattan Engineer District
NPDES	National Pollutant Discharge Elimination System
NRC	US Nuclear Regulatory Commission
PADEP	Pennsylvania Department of Environmental Protection
Plan	Water Management Plan
QC	Quality Control
RCA	Radiological Control Area
RCOC	Radiological Contaminant of Concern
RPP	Radiation Protection Plan
SSHP	Site Safety and Health Plan
SLDA	Shallow Land Disposal Area
SOP	Site Operations Plan
US	United States
USACE	US Army Corps of Engineers
WMP	Water Management Plan
WWTF	Wastewater Treatment Facility

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1.0 INTRODUCTION

1.1 BACKGROUND

Cabrera Services, Inc, (CABRERA) has been selected by the United States (US) Army Corps of Engineers (USACE) - Buffalo District under Contract Number W912P4-07-D-0002 to remediate the Shallow Land Disposal Area (SLDA) Formerly Utilized Sites Remedial Action Program (FUSRAP) Site located in Parks Township, Armstrong County, Pennsylvania (hereafter referred to as the "Site"). The remediation is being completed under the USACE's FUSRAP, which was established to identify, investigate and clean up or control sites previously used by the Atomic Energy Commission (AEC) and its predecessor, the Manhattan Engineer District (MED).

1.2 PURPOSE

This Water Management Plan (WMP or Plan) describes the purpose and methods for using water and managing wastewater generated during remediation of the above-referenced Site. The Plan identifies the sources and uses of potable water for dust suppression and equipment decontamination. This WMP describes the methods for preventing surface water run-on and controlling surface runoff water, including methods for collecting, storing, and managing wastewater from active excavations and waste handling areas. This Plan also includes information on discharge permitting, anticipated effluent limits, wastewater treatment methods, and effluent monitoring and reporting for wastewater that will be generated during the project. Treated wastewater will be discharged to the Kiskiminetas River under a National Pollution Discharge Elimination System (NPDES) permit issued by Pennsylvania Department of Environmental Protection (PADEP). A description of CABRERA's project organization, key personnel, and overall strategy for completing Site remediation is presented in the *Site Operations Plan* (SOP) (CABRERA, 2009a).

1.3 SITE INFORMATION

Contaminants in soil and debris at the Site have the potential to be present in wastewater generated during remediation. The SLDA Site has been identified as containing various concentrations of residual radioactive material in soil and debris from previous AEC operations, including the following radionuclides: Americium-241 (Am-241), Plutonium-239 (Pu-239), Plutonium-241 (Pu-241), Radium-228 (Ra-228), Thorium-232 (Th-232), Uranium-234 (U-234), Uranium-235 (U-235), and Uranium-238 (U-238). The remediation project at the SLDA FUSRAP Site is being performed to address these radiological contaminants of concern (RCOCs). A detailed description of site history and contamination is provided in the SOP.

1.4 APPROACH TO WATER AND WASTEWATER MANAGEMENT

1.4.1 Approach to Water Management

CABRERA will use potable water for:

- Dust suppression during excavation, material handling, and backfilling operations, as needed;

- Decontaminating construction equipment, wastewater collection and treatment equipment, and small tools used in site remediation; and
- Irrigation of new vegetation during site restoration.

Potable water will be purchased and obtained from the Kiskimere Municipal Authority. The volume of water used for dust suppression will be minimized by the following methods:

- Implementing engineering controls to minimize the weight of contaminated soil requiring transport from excavations to the material processing building;
- Covering exposed piles with tarps;
- Minimizing the area of exposed bare earth at any one time; and

As indicated in Section 1.4.1, some wastewater generated during the project may be reused for dust suppression in contaminated areas of Radiological Control Areas (RCAs). As discussed in this Plan, wastewater reused for this purpose will be applied using separate equipment (i.e., tanks, hose, nozzles) from that used for storage and application of potable water to avoid cross contamination.

1.4.1 Approach to Wastewater Management

CABRERA will minimize the potential spread of radiological contamination during site remediation by implementing stormwater diversion as well as wastewater collection and management measures. Additional methods to avoid spreading radiological contamination are addressed in the accompanying project SOP and *Radiation Protection Plan* (RPP) (CABRERA, 2009b).

1.4.1.1 Water Diversion

Water diversion measures will be implemented to minimize the spread of contamination and avoid collecting and managing large quantities of wastewater. Water diversion measures will consist of the following:

- Limiting areas where work with potentially-contaminated soil and debris will occur to RCAs,
- Implementing sedimentation and erosion controls surrounding RCAs, and
- Temporary grading of soil (e.g. berms) as applicable to prevent surface runon of uncontaminated water, and to prevent potentially contaminated runoff from leaving RCAs.

1.4.1.2 Wastewater Collection and Management

Wastewater will be generated during active remediation operations on the Site by collecting water in RCAs during excavation of contaminated material, water accumulating in the Waste Processing Building sump, and any water that accumulates in the secondary containment area near the Wastewater Treatment Facility (WWTF). Wastewater will also be generated during dewatering that will occur prior to excavation activities commencing. Collection of water will have the following effects:

- Minimize potential migration of radiological contamination via runoff,

- Facilitate efficient project execution, and
- Minimize the weight of contaminated soil requiring off-site transport and disposal.

A portion of collected stormwater/wastewater may be reused for dust control in contaminated areas of the Site undergoing remediation, as described in Section 2.2.2. The majority of collected wastewater will be conveyed to the onsite WWTF consisting of modular storage tanks and filtration units (actual components to be determined after completion of the Field Testing/Treatability Study, see Appendix B).

Components of the WWTF, its operation, and wastewater management methods are described in further detail in Section 3.7 of this Plan.

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2.0 METHODS FOR WATER USE

The section identifies methods and equipment for using water for dust control and equipment decontamination. Dust control is described below.

2.1 OBTAINING AND STORAGE OF POTABLE WATER FOR SITE USE

CABRERA will purchase potable water from the Kiskimere Municipal Authority. The water will be extracted from a metered location within the boundaries of the SLDA site.

The potable water will be added to a water truck, and will be used for dust control and equipment decontamination as necessary. Potentially-contaminated hoses and nozzles will be stored separately from hoses and nozzle(s) used for dust suppression outside RCAs to avoid cross contamination. Potable water may also be placed in smaller containers as needed.

2.2 DUST CONTROL METHODS

Dust control measures will be implemented during active remediation to prevent spreading contamination as well as to minimize remediation worker and public exposure to respirable dust and airborne particulates. The dust control program will consist of both dust suppression measures and ambient air monitoring to verify the success of dust suppression. Dust controls to be implemented during the project are summarized below; a detailed description of the dust control program is presented in the project *Site Safety and Health Plan* (SSHP) which is Appendix A of the *Accident Prevention Plan* (CABRERA, 2009c) and RPP.

2.2.1 Dust Sources

Activities that may generate fugitive dust on this project include:

- Excavating contaminated soil and debris;
- Sizing debris using an excavator;
- Temporary stockpiling of excavated soil and debris within RCAs;
- Clearing and grubbing; and
- Vehicle traffic on haul roads.

2.2.2 Dust Control Methods

Control methods that will be used to suppress dust generated during remediation, include the following:

- Wetting remediation equipment and excavation faces as needed;
- Applying water on equipment buckets during excavation and loading/unloading as needed;
- Covering temporary soil stockpiles overnight and on weekends as well as during windy conditions;
- Hauling waste leaving exclusion zones in covered haulers;

- Keeping vehicle speeds to below 10 miles per hour on site; and
- Applying water during soil handling and to access and haul roads at the Site, as needed.

A spray nozzle and pump system will be used to suppress fugitive dust while preventing overly wet conditions, avoiding ponding and runoff.

Water for dust suppression will be obtained from the Kiskimere Municipal Authority as discussed in Section 2.1. Potentially-contaminated wastewater may be selectively reused for dust suppression within contaminated portions of active excavation areas, but will not be used outside RCAs. As indicated above, pumps, hoses, and associated fittings will be segregated between clean potable water and potentially-contaminated wastewater to prevent cross contamination.

2.2.3 Dust Monitoring

Site activities in all areas that could potentially cause the release of dust, will be monitored for dust particulates and radioactivity in accordance with the procedures described in the SSHP and RPP. In the event that there is visible dust from areas outside the remediation areas but within the boundaries of the SLDA, dust suppression measures will be used to the extent practicable and necessary to minimize and control on-site exposures to and off-site releases of airborne radioactive material.

3.0 METHODS FOR MANAGING WASTEWATER

This section describes wastewater management, including methods that will minimize wastewater generation and avoid spreading contamination during remediation, including:

- Diversion of uncontaminated surface storm water;
- Erosion and sedimentation controls;
- Excavation dewatering;
- Collection of water in excavations;
- Collection of water from Waste Processing Building; and
- Decontamination of personnel and equipment.

3.1 SURFACE WATER DIVERSION

Uncontaminated surface water may be encountered in the vicinity of active excavation areas during remediation. In general, uncontaminated surface water will be directed away from excavations during remediation, by gravity flow, to minimize wastewater quantities as well as facilitate efficient project operations. Water diversion will be accomplished using Polyethylene sheeting, sandbags, shallow ditches/swales, and berms as needed. Temporary ditches/swales will be configured to minimize ponding along the exterior face of berms and allow unobstructed flow along the ditches/swales. These features will be constructed of overburden soil excavated from the top of trenches 1-9, after it is sampled and confirmed to be suitable for onsite fill. Berms will be constructed upgradient of the trenches to direct water away from the trench excavations. The berms will be removed upon completion of remediation, Final Status Survey (FSS) efforts, and backfilling activities for individual RCAs.

Prior to any excavation activities, a portion of the intermittent stream Dry-Run will be relocated from its existing alignment to a new alignment that is set back from the excavation areas. The new alignment will allow for excavation activities to proceed without infringing upon the natural flow characteristics of the intermittent stream. The proposed location for the Dry Run bypass is depicted in Figure 1. The new alignment will be a well graded channel with erosion protection or gravity piping.

3.2 EROSION AND SEDIMENTATION CONTROLS

It is anticipated that an Erosion and Sediment Control Plan will be required in order to comply with the Pennsylvania Clean Stream Law (35 P.S. §691.1 et seq.) and regulations in 25 Pennsylvania Code Chapter 102. Erosion and sedimentation controls will be implemented in accordance with PADEP's Erosion and Sediment Pollution Control Manual.

At a minimum the following erosion and sedimentation controls will be implemented during remediation of the SLDA FUSRAP Site to minimize potential spread of contamination and wastewater quantities:

- Silt fence will be installed and maintained as necessary to minimize the potential for surface migration of contaminated soils in storm water runoff;

- Vehicles entering and leaving the Site will not enter RCAs, avoiding direct tire contact with contaminated soil and preventing tracking of contamination off site;

Straw bales may be used in addition to silt fences for localized sediment traps around sensitive receptors within RCAs or in the immediate vicinity of any excavation areas or equipment storage areas, as necessary. Sedimentation and erosion controls will be installed prior to initiating earthwork and will be maintained for the duration of excavation and site restoration activities.

3.3 EXCAVATION DEWATERING

Dewatering of the trenches will be necessary to facilitate excavation and FSS. It is anticipated that dewatering will be necessary prior to and during active excavation for remediation of most of the trenches, with dewatering effluent directly piped to the WWTF for subsequent on-site treatment and discharge. Actual rates and methods of dewatering will be determined after completion of the Field Testing/Treatability Study.

3.4 WATER COLLECTION IN EXCAVATIONS

Potentially-contaminated wastewater generated within RCAs by dust suppression, precipitation, draining of water-saturated soil, groundwater seepage, and decontamination of remediation equipment within RCAs will be collected and conveyed to the WWTF.

During excavation the infiltration of groundwater within the excavation will be controlled through a series of field constructed catch basins or sumps. The floor of the excavation will be sloped along the natural contours as dictated by the excavation depth. Sumps will be constructed and moved as excavation progresses in each trench. Since the excavation sequence is from highest elevation to lowest, this will enable the excavations to constantly maintain a natural slope based on the excavations' lateral and vertical limits. The water will be channelized to an elevation plane at the lowest open excavation and pumped out into a 6" high density polyethylene (HDPE) force main that will be installed adjacent to Trench 1, and will be piped to the influent modutanks in the WWTF. Tees and valves will be installed for Trench 10 (to be utilized when excavating Trench 10). The force main will remain in place throughout the duration of the project to allow for pumping from any location to the WWTF.

In order to account for groundwater infiltration and storm events the total capacity for a pump or series of pumps exiting a trench is anticipated to be at least 250-300 gallons per minute (gpm) (see Appendix A). It is not anticipated that a booster pump will be required along the force main, due to the elevation difference between the trench areas and the area where the WWTF will be located. The dewatering design and expected flow rates will be determined by the Field Testing/Treatability Study.

3.5 WATER COLLECTION FROM MATERIAL SORTING & PROCESSING BUILDING

Water that drains out of the trench material stockpiles in the Material Sorting and Processing Building will be collected in a sump beneath the building and directly piped to the WWTF. Details regarding the Material Sorting and Processing Building are contained in the SOP.

3.6 WATER FROM DECONTAMINATION ACTIVITIES

Temporary decontamination (decon) facilities will be constructed onsite, including both personnel and equipment decon facilities and pads, to avoid spreading contamination. Dry decontamination will be performed whenever possible to minimize the generation of wastewater, and to minimize suspended solids in collected wastewater.

Small tools and other equipment (i.e., field meters, etc.) will be wrapped in plastic prior to being moved between contaminated areas of the Site and will be decontaminated prior to being moved to uncontaminated areas of the Site or offsite, minimizing water use and wastewater volumes. Small quantities of water collected from decon facilities will be collected for onsite treatment in the WWTF, sampling/laboratory analysis, and subsequent discharge to the Kiskiminetas River.

3.7 WASTEWATER COLLECTION, TREATMENT, AND DISCHARGE

This section identifies anticipated permit and effluent discharge limit requirements for wastewater that will be generated during remediation, and describes equipment and methods that will be used to collect, temporarily store, transfer, treat, monitor, and convey wastewater for discharge to the Kiskiminetas River (see Figure 1). Methods that minimize generation of contaminated wastewater and prevent contaminant migration are discussed earlier in this Section.

Wastewater collection and treatment methods described in this section have been selected to meet anticipated effluent limits based on the anticipated physical, chemical, and radiological characteristics of wastewater that will be generated during the project. Actual components of the Wastewater Treatment Facility will be determined after the Field Testing/Treatability Study is completed.

3.7.2 Wastewater Treatment Facility

The Wastewater Treatment Facility will be located in the northeast portion of the site (see Figure 1). The process flow design will be flexible, and may be modified in the event that the contaminant concentrations vary over the life of the project, or new constituents are discovered. Secondary containment for the WWTF will consist of a HDPE liner that will be placed underneath a layer of crushed stone. The liner (which will at a minimum be 40-mil cross-linked HDPE) will be fully welded together at all seams to ensure no leakage can occur. Geotextile will be placed on top of the liner to ensure that no punctures occur when placing the crushed stone cover layer. A berm will be constructed around the perimeter of the WWTF area, and the area will be graded to allow for water to collect in a sump, which will be piped to the influent storage tanks. The berm will be included within the area covered by the liner.

Wastewater will be pumped out of the excavations and conveyed to the WWTF via a 6" HDPE force-main (see Figure 1). All water that is pumped to the WWTF will be pumped into influent modutanks for settling, prior to being pumped through the remaining components. It is anticipated that an inclined plate clarifier, ion exchange units, sand filter units, granular activated carbon units, and bag filter houses may be used for filtration of suspended solids and organics. Actual components will be determined after the Field Testing/Treatability Study.

Treated water will then be conveyed to effluent storage tanks. An initial sample of the treated wastewater will be collected from the effluent storage tanks prior to the first discharge to the Kiskiminetas River, in order to verify that treated wastewater meets the limits of the NPDES

permit. Samples will then be collected during discharge as stipulated in the NPDES permit and submitted for laboratory analysis to verify compliance with the NPDES permit limits.

Spent bag filters/sand vessels/carbon vessels and settled solids removed from the bottom of the modular storage tanks will be solidified as necessary to eliminate free liquids and disposed with other radioactive remediation wastes in accordance with the Waste Management, Transportation and Disposal Plan.

The following subsections describe equipment that will be used to collect and treat wastewater within the Wastewater Treatment Facility and excavations. A description of "typical" equipment is provided; actual components will be determined following the completion of the Field Testing/Treatability Study.

3.7.2.1 Storage Tanks

Collected wastewater intended for treatment and discharge will be stored in two 200,000-gallon capacity aboveground modular storage tanks. Fractionation (frac) tanks may also be used as components in the water treatment process. The frac tanks consist of totally-enclosed steel vessels with inlet and outlet ports as well as manways to allow access to clean out the interior of the tank prior to demobilization. The number of frac tanks used will depend on actual project needs.

Secondary containment will be constructed in the area beneath the storage tanks and filtration system components (see Section 3.7.2.2) to collect any inadvertent minor spillage from hoses during pumping operations. The secondary containment will consist of layer of clean sand (if needed to level out uneven spots) underlying a single sheet of 40-mil high density Polyethylene plastic, which will then be covered with a protective layer of clean crushed stone obtained from an off-site borrow source, and will at a minimum be able to contain 120% of the storage capacity of the WWTF.

3.7.2.2 Filtration System

The radionuclides anticipated to be present in wastewater are relatively insoluble and will be present in wastewater primarily as suspended solids. Accordingly and in consideration of likely effluent limits, it is anticipated that one purpose of the WWTF will be to reduce the concentration of suspended solids. Another purpose will be to remove dissolved organic compounds likely to be present.

A filtration system will be used to reduce the concentration of suspended solids in wastewater after initial settling in the influent modutanks, which anticipated components include granular activated carbon vessels, an inclined plate clarifier, sand / clay vessels, an ion exchange process, and bag filter houses.

Actual components will be determined after completion of the Field Testing/Treatability Study.

3.7.2.3 Pumps

Pumps will be used to collect wastewater and transfer water and wastewater into and between storage tanks and through the filtration units. Feed and booster pumps will be provided to pump the water through the filtration system. Pumps, as well as accessory hose, nozzles, and other fittings, will not be interchanged between clean potable water and potentially-contaminated wastewater.

Excavation and water management will be closely monitored to minimize the volume of wastewater generated. Wastewater will be conveyed from the RCAs to the storage tanks and between tanks only after those tanks are manually gauged to verify there is sufficient capacity to accept the incoming wastewater.

3.7.2.4 Accessories

Hose, fittings, valves, nozzles, generators and other accessories used to convey wastewater will be stored in a lockable container in a portable on-site Connex stored trailer. Spill pans will be placed beneath generators and wastewater pumps to catch incidental drippage.

3.7.3 Permitting and Effluent Discharge Limits

A permit to discharge treated wastewater associated with this remediation project will be obtained for discharge to the Kiskiminetas River in accordance with National Pollutant Discharge Elimination System (NPDES) requirements as administered by the Commonwealth of Pennsylvania. Effluent discharge limits will be specified in the above-referenced permit as determined by PADEP for non-radiological parameters. RCOC concentrations in wastewaster for discharge are provided in Table 3-1 and reflect the US Nuclear Regulatory Commission (NRC) liquid effluent limits in Title 10 Code of Federal Regulations Part 20 (10 CFR 20), Appendix B, Table 2, Column 2.

Discharge to the Kiskiminetas River will be performed following receipt of laboratory results for samples of treated wastewater that verify that NPDES permit and Table 3-1 RCOC concentrations have been met.

Table 3-1 Discharge Limits for Radionuclides to the Kiskiminetas River

Radionuclide	NRC Effluent Limit[a] (MicroCuries [µCi]/Milliliter[mL])
Americium-241	2×10^{-8}
Plutonium-239	2×10^{-8}
Plutonium-241	1×10^{-6}
Radium-228	6×10^{-8}
Thorium-232	3×10^{-8}
Uranium-234	3×10^{-7}
Uranium-235	3×10^{-7}
Uranium-238	3×10^{-7}

NOTES:

a) US Nuclear Regulatory Commission (NRC) effluent limits for direct discharges to surface waters (10 CFR 20, Appendix B, Table 2, Column 2)

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4.0 MAINTENANCE AND INSPECTIONS

Water and wastewater equipment and temporary facilities on the site will be maintained in accordance with manufacturer's instructions and good housekeeping practices. Inspections will be performed and corrective action taken if the operability of any of the equipment, temporary facilities, or management methods is not functioning as intended. Quality Control (QC) duties for inspection, reporting, and corrective action are the responsibility of CABRERA's onsite Contractor QC Systems Manager (CQCSM). Inspections and corrective actions for the various water and wastewater management systems described herein are summarized below, and will be recorded and documented in Daily Quality Control Reports (DQCRs) provided to the USACE [see the project *Contractor Quality Control Plan* (CABRERA, 2009d)].

4.1 WATER AND WASTEWATER FACILITIES

An operational inspection will be performed daily for all water and wastewater management facilities, such as generators, pumps, hoses, storage tanks, frac tanks, filtration units, secondary containment areas, decontamination facilities, etc. Inspection will minimize the potential that these systems will cause a release of potentially contaminated wastewater.

Installation of extra temporary berms and sandbags will be evaluated if long-term weather forecasts identify the potential for an extraordinarily severe rain event. Forecasts of inclement weather (e.g., thunderstorms that could be active during the anticipated excavation season) will be the basis to ensure that all equipment is either drained or stabilized in such a manner to prevent damage to valves, hoses, and tanks that could result in release and/or leakage.

Daily inspections of the water treatment system will be performed. Evidence of any leaks will be corrected immediately prior to commencing any work.

4.2 EROSION CONTROL MEASURES

Erosion and sedimentation control measures will be inspected during all phases of remediation to prevent contaminant migration and minimize the generation of potentially-contaminated wastewater. Inspection of these control measures will be performed once per day to ensure that controls and preventive measures are operating as designed. Daily inspections will be performed in active excavation locations to ensure the proper performance of run-on and runoff controls. Inspections will also be made after each rainfall and daily during extensive periods of rainfall.

Informal inspections of uncontaminated support zone areas on the site (e.g., equipment and material laydown areas, haul roads, etc.) located near but outside RCAs will be performed at least once per week and more frequently as judged appropriate by CABRERA's CQCSM and Site Radiation Safety Leader to verify that controls are functioning properly. These inspections will be made after each rainfall and on a daily basis during extensive periods of rainfall.

Silt accumulated in erosion control structures will be removed upon identification. Silt fences will be inspected and any damaged silt fence will be repaired or replaced in a timely manner. Erosion and sedimentation controls will be removed upon completion of remediation.

Any site-specific control measures different from those described herein will be discussed with USACE prior to implementation.

4.3 DUST CONTROL MEASURES

Preventive maintenance and inspection activities will be performed once per day in all areas that could be potential sources for the release of dust, such as active excavations, locations of debris sizing operations, temporary stockpiles of soil and debris, and waste containment bag loading and temporary on-site storage areas. Each remediation worker will be responsible for observing his/her work area for the potential and actual generation of dust. Remediation workers will promptly notify CABRERA's Site Manager or CQCSM of areas of actual or potential release of dust, who will ensure that additional suppression measures are implemented to minimize dust generation.

Corrective maintenance or repair activities will be conducted whenever damage or disturbance is discovered. Corrective maintenance items may include:

- Wetting of dry soils;
- Cleanup of minor spills of soil in work areas; and
- Maintaining covers over soil stockpiles.

5.0 REFERENCES

CABRERA, 2009a, *Site Operations Plan, SLDA FUSRAP Site*, Cabrera Services, Inc., May 2009.

CABRERA, 2009b, *Radiation Protection Plan, SLDA FUSRAP Site*, Cabrera Services, Inc., May 2009.

CABRERA, 2009c, *Accident Prevention Plan, SLDA FUSRAP Site*, Cabrera Services, Inc., May 2009.

CABRERA, 2009d, *Contractor Quality Control Plan, SLDA FUSRAP Site*, Cabrera Services, Inc., May 2009.

USACE, 2005, *Remedial Investigation Report, Shallow Land Disposal Area Site, Parks Township, Armstrong County, Pennsylvania,* October 2005.

USACE, 2006, *Feasibility Study and Proposed Plan, Shallow Land Disposal Area Site, Parks Township, Armstrong County, Pennsylvania,* September 2006.

USACE, 2007, *Final Record of Decision, Shallow Land Disposal Area Site, Parks Township, Armstrong County, Pennsylvania*, August 2007.

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FIGURES

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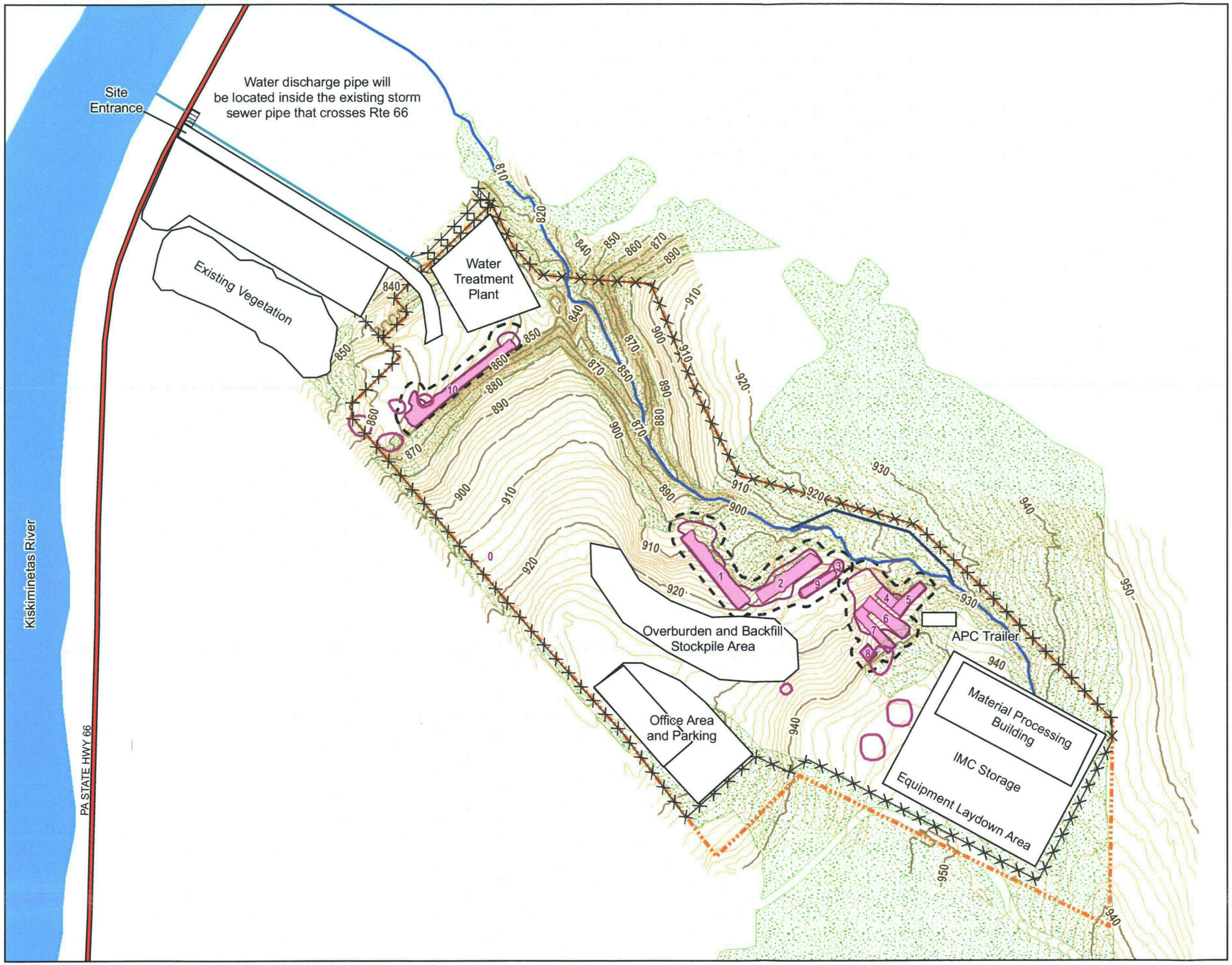

N

Topography

Elevation

- 10 foot contour
- 1 foot contour
- Treated Water discharge pipe
- Stormwater catch basin
- Extent of Subsurface Contamination
- Surface Contamination
- Trenches
- Layback
- Dry Run Proposed Bypass Alignment
- Dry Run
- Fencelines
- Project Boundary
- Roads
- PA STATE HWY 66
- Vegetation

0 75 150 300 450 600 Feet

Site Layout

Shallow Land Disposal Area
Armstrong County, PA

Date: March 2009
Project #: SLDA
File Name:
Prepared By: K. Jackson

Figure 1

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

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APPENDIX A

Engineering Evaluation/Dewatering Calculations

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Civil • Structural • Geotechnical • Materials Testing • Consulting

Task 2: Water Diversion and Trench Dewatering Design

Shallow Land Disposal Area (SLDA), Parks Township

FUSRAP Project

Armstrong County, Pennsylvania

prepared for:
Cabrera Services, Inc.
633 Stablestone Drive
Chesterfield, Missouri 63017

prepared by:
Glynn Geotechnical Engineering
415 South Transit Street
Lockport, New York 14094

GGE 07-1196

January 21, 2008

I. Scope: The purpose of this calculation is to estimate the average upper limit infiltration rate and other hydrology factors for a given excavation area related to the SLDA site in order to ultimately design a system capable of dewatering excavation areas within the site.

II. Calculation Parameters:

- This calculation is primarily based on data and interpretation offered in the *Shallow Land Disposal Area, Remedial Investigation Report*, October 2005.
- Information was also obtained through portions of the *Final Feasibility Study for SLDA* specifically, Appendix B and the calculations involving dewatering rates for alternatives four and five.
- Rainfall totals are based on data from the U.S. Soil Conservation Service.
- The calculations are based on a unit excavation area to a predetermined depth.
- The calculations are focused on upper limit hydrology parameters to ensure the proposed future design reflects the capability to sustain dewatering operations.
- The calculation is based on a 100 ft wide by 30 ft wide plan excavation area with known excavation bottom and 1:1 side slopes. Understanding that the exact excavation methodology and sequence will ultimately dictate infiltration and subsequent dewatering rates and water treatment plant capabilities.
- Assuming all storm water run-off is diverted from the excavation area, water infiltration is based on three (3) sources: 1) existing pore water 2) groundwater infiltration, and 3) direct rainfall over excavation area.
- The total rate is a modified summation of the three above water sources.
- The purpose of the calculation is to provide estimated removal rates. Dewatering mechanisms, schemes, layout and design shall be developed at a later date.

III. Excavation Area Definition:

- The excavation area is based on a 100 ft long by 30 ft wide configuration with setback slopes set at 1:1.

- The depth is based on the maximum depth as represented on sheet 4-8 of the Feasibility Study, *Trench Area Cross Sections*. Depth is approximately 22-24 ft, for this calculation use 25 depth.
- Please refer to attached calculation sheets and values.
- Prior to excavation, a storm water run-off diversion berm shall be built from clean off-site soils or overburben to prevent infiltration of surface water run-off. The berm should be a minimum of 3 feet high with 1:1 slopes with silt fencing surrounding the overall trench perimeter to protect from soil and sediment erosion.

IV. Infiltration at Maximum Excavation Depth:

- This calculation involves the infiltration of natural groundwater flow into an open excavation area. The excavation area outlined in section III was used with the groundwater table 3 feet below the ground surface for a total depth of water of 22 feet. The depth of water value is conservative as the groundwater elevations demonstrated for trench number 10 are lower however, in trench number 6 the groundwater elevations are very near the surface. Therefore the excavation depth was derived from trench 10 and the groundwater elevations were used from data from trench 6.
- As investigated and as stated several times in the RI, the site hydrology is complex and consists of multiple distinct geological layers. Site cross sections were interpolated from data gathered during well construction and boring analysis. These cross sections generally demonstrate the site's geological characteristics however as stated in the RI, "From the geotechnical perspective, the soils in most areas of the site can be considered cohesive materials of apparently low hydraulic conductivity."
- Given the above, we still investigate table 2-4 and 2-5 of the RI to find site hydraulic conductivity values. Generally speaking, the values do correspond to low hydraulic conductivity values however, there are a few locations near the trenches that show "k" values on the order of $1x10^{-3}$ cm/sec. For our calculations we will use a range of "k" values in order to predict the higher limit infiltration rates.
- Estimating the infiltration rate simply treated the excavation area as an open face and calculating the groundwater movement using Darcy's Law (the Dupuit approach yields similar values). Please refer to attached sheet for equations and methodology.
- For the given excavation configuration of 100 ft by 30 ft with excavation depth set at 25 feet and groundwater table at 3 ft below ground surface and the confining layer at excavation bottom, the estimated groundwater flows are as follows:

- For $k=5x10^{-4}$ cm/sec, Q=28.3 gpm
- For $k=1x10^{-3}$ cm/sec, Q=56.3 gpm
- For $k=5x10^{-5}$ cm/sec, Q=2.8 gpm

V. Pore Water Volume:

- This calculation is simply an estimate of water within the trench itself as investigated by data presented in the RI.
- Note that this water source is a one time point source and once removed will no longer be a constant source of water flow. The rate at which pore water is removed is directly proportional to the excavation methods used. If the excavation is in one (1) foot lifts and require verification sampling time, then the rate of pore water removal will be contingent upon verification sampling times. If excavation can proceed directly to excavation depth, then the rate of pore water removal will be much greater.
- The highest pore water percentage or "n" value shown on table 2-4 of the RI is 27 percent, for this calculation, we will use 35 percent or n=0.35 based on data from trench composition.
- Based on excavation time the required rates to remove the pore water within the prescribed excavation area with the given parameters is as follows:

Time of Excavation to Full Depth (Day)	**Required Rate of Removal for Excavation Time (gallons per minute)**	**Required Rate of Removal for Excavation of 1ft per day (gpm)**
1	260	19.0
2	130	18.2
3	86	17.4
4	65	16.7
5	52	15.9
10	26	12.5
15	17	9.4
20	13	6.7
22	11.8	5.7

- The calculations present a formula to determine the amount of pore water as a function of excavation depth.

VI. Rainfall Volume:

- Rainfall is based over the total footprint of the proposed excavation area. Assuming the excavation area is protected from all surrounding run-off.
- Rainfall calculations are based on average rainfall for the area and most importantly based on a storm event. For these calculations we will use the average rainfall as presented in previous calculations and a 25-year storm event.
- The average rainfall for this area is approximately 40 inches a year. Assuming this average is concentrated to one rain event every 7 days with steady state rainfall and removal, the average removal rate is approximately 4.0 gallons per minute (see attached calculation sheet).
- The 25-year, 24-hour rain event presents interesting challenges. The assumption here is that the removal rate has to equal the rainfall intensity and accumulation over the excavation area. In order to keep the excavation floor "dry" the removal rate must be equal to or greater than the rainfall volume for a given time period. The SCS 24-hour distribution shows that a most of the rainfall is from hour 11 to hour 13. Below are the average removal rates per time periods within the SCS distribution graph.

Time Period of 25-year, 24-hour Storm (hr)	Average Required Removal Rate (gpm)
0-11.5	15.6
11.5 - 12.75	202.0
12.75 – 24.0	15.6

VII. Summary:

The water removal rates associated with the given excavation should not be simply added together to yield a total removal design rate. The two water source components that should be considered a baseline for design are the values associated with natural groundwater flow infiltration and average rainfall events as shown below:

$Q_{Groundwater}$ = 56.3 gpm (for k=1x10^{-3} cm/sec) (Q=28.3 gpm for k=5x10^{-4} cm/sec)
$Q_{Avg.Rainfall}$ = 4.0 gpm

Therefore a baseline removal rate of approximately:

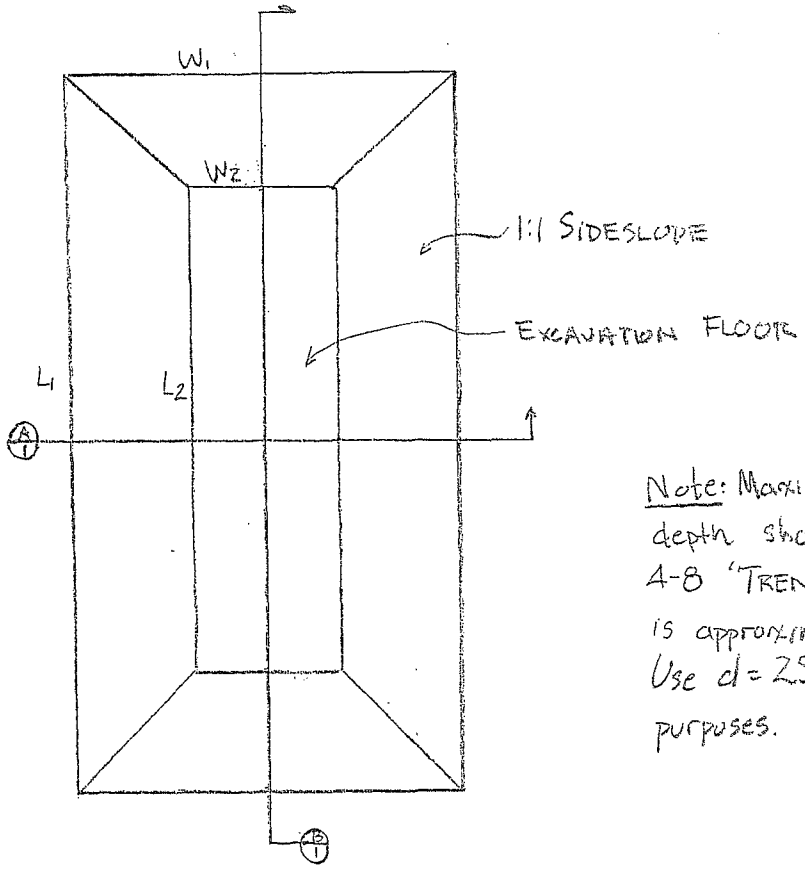
$Q_{Baseline}$ = 60 gpm

- The removal rates associated with the pore water are contingent upon the excavation methodology and verification sampling requirements. The total volume of excavation is known as well an estimated "n" value to yield a total volume of water. If excavation were to proceed in 1 foot lifts per day with a total excavation depth of 25, then the removal rate would be approximately 10.4 gpm. Before a definitive removal rate can be added to a baseline design, the excavation and sampling systems must be known. In addition, the conservative baseline design system could possibly have enough capacity to remove both groundwater infiltration and pore water given that the excavation advancement is contingent upon a turn-around time for verification sampling.

- A 25-year, 24-hour storm produces a maximum removal rate of approximately 270 gpm during the period of highest intensity. Adding this value to a baseline design would most likely not be the most cost efficient system as the frequency of this storm is on the order of once every 25 years. However, weight should still be given to the possibility of the storm by designing a contingency system capable of both removing the water to keep the excavation floor from flooding and capable of storing the removed water prior to treatment.

Calculation sheets for each section are attached

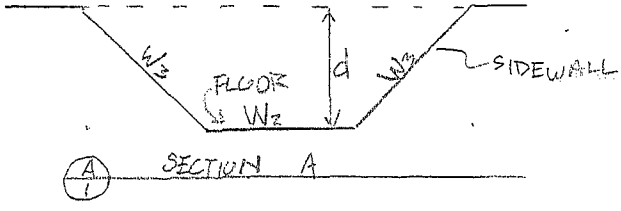
Definition of Excavation Area

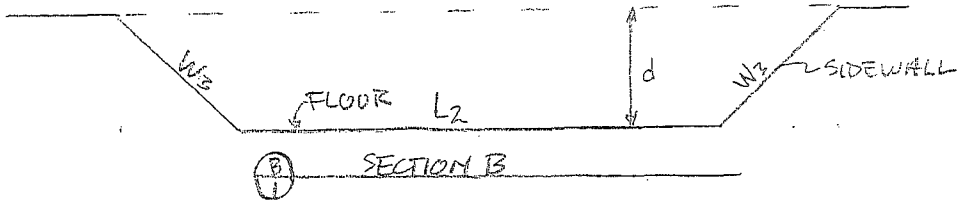


DIMENSIONS

$L_1 = 150\,ft$
$L_2 = 100\,ft$
$W_1 = 80\,ft$
$W_2 = 30\,ft$
$W_3 = 35.4\,ft$
$d = 25\,ft$

Note: Maximum excavation depth shown on sheet A-8 "TRENCH CROSS-SECTIONS" is approximately 22-23 ft. Use $d = 25\,ft$ for calc purposes.





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SUBJECT: Definition of Excavation Area			
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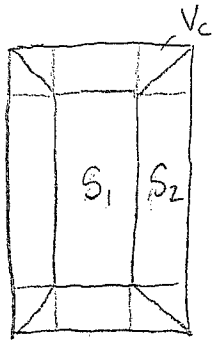
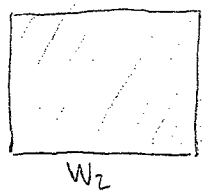
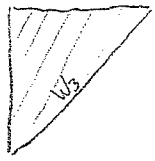
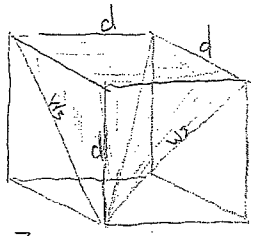
PROJECT NO: 07-1196	SCALE: N/A	DATE: 1-17-08	BY: LEW

Volume of Excavation Area



$S_1 =$ 

$S_2 =$ 

$V_c =$ 

$= \frac{1}{3} b \cdot h$
$= \frac{1}{3} d^2 \cdot d$
$= \frac{1}{3} d^3$

Total Volume

$V_{TOT} = S_1 \cdot L_2 + S_2 \cdot (2 \cdot L_2 + 2 \cdot W_2) + 4 \cdot V_c$

$V_{TOT} = d \cdot W_2 \cdot L_2 + d^2 \cdot \frac{1}{2} \cdot (2L_2 + 2W_2) + 4 \cdot \frac{1}{3} d^3$

$V_{TOT} = (25 \cdot 30 \cdot 100) + 25^2 \cdot \frac{1}{2} \cdot (2 \cdot 100 + 2 \cdot 30) + 4 \cdot \frac{1}{3} (25)^3$

$V_{TOT} = 75{,}000 + 312.5(200 + 60) + 4 \cdot (5208)$

$V_{TOT} = 75{,}000 + 81{,}250 + 20{,}832$

$V_{TOTAL} = 177{,}082\ ft^3 \cong 6{,}560\ Yd^3$

Surface Area

S_{TOTAL} = FLOOR + SIDEWALL + CORNERS

$S_{TOTAL} = L_2 \cdot W_2 + [2 \cdot (W_2 + L_2)] \cdot W_3 + 4 \cdot [2 \cdot (\frac{1}{2} \cdot d \cdot W_3)]$

$S_{TOTAL} = 30 \cdot 100 + [2 \cdot (100 + 30)] \cdot 35.4 + 4 \cdot [2 \cdot (\frac{1}{2} \cdot 25 \cdot 35.4)]$

$S_{TOTAL} = 3000 + 260 \cdot 35.4 + 4 \cdot 885$

$S_{TOTAL} = 3000 + 9{,}204 + 3540$

$S_{TOTAL} = 15{,}744\ ft^2 \cong 583\ Yd^2$

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SUBJECT: Definition of Excavation Area			
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GROUNDWATER INFILTRATION RATES

ASSUME ⇒ LAMINAR FLOW
⇒ HOMOGENEOUS & ISOTROPIC
⇒ EXCAVATION AT MAX DEPTH
⇒ HYDRAULIC CONDUCTIVITY = 5×10^{-4} cm/sec = 1.42 ft/day
⇒ GROUNDWATER DEPTH = d = 22 ft

EQUATION

⇒ CALCULATE VERTICAL PROJECTION OF EXPOSED EXCAVATION WALL AREA AND CALCULATE FLOW

EQUATION (DARCY)

$Q = kA(dh/dl)$

$= (1.42)(7660)(0.5)$

$Q = 5440 \text{ ft}^3/\text{day}$

$\Rightarrow Q = 28.3 \text{ gpm}$

for $k = 1 \times 10^{-3} = 2.83$ ft/day

$Q = kA(dh/dl)$

$= 2.83(7660)(0.5)$

$Q = 10,840 \text{ ft}^3/\text{day}$

$\Rightarrow Q = 56.3 \text{ gpm}$

for $k = 5 \times 10^{-5} = 0.142$ ft/day

$Q = kA(dh/dl)$

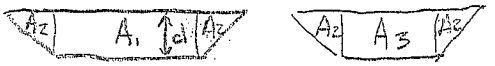
$= .142(7660)(0.5)$

$Q = 544 \text{ gpm}$

$Q = 2.83 \text{ gpm}$

AREA

A = VERTICAL PROJECTION AREA



$A = 2 \cdot A_1 + 2A_3 + 8(A_2)$

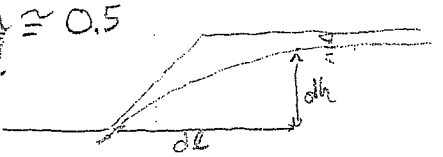
$= 2(L_2 \cdot d_2) + 2(W_2 \cdot d) + 8(\frac{1}{2} d^2)$

$= 2(100 \cdot 22) + 2(30 \cdot 22) + 8(\frac{1}{2} \cdot 22^2)$

$= 4400 + 1320 + 1936$

$A = 7660 \text{ ft}^2$

$\Rightarrow \frac{dh}{dl} \cong 0.5$



AREA AS FUNCTION OF DEPTH

$A(x) = 2 \cdot x \cdot L_2 + 2 \cdot x \cdot W_2 + 8\left[(22 - x)dx - \frac{x^2}{2}\right]$

$= 200x + 60x + 8[22x - x^2/2]$

$= 260x + 176x - 4x^2$

$A(x) = 436x - 4x^2$

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	CLIENT: Cabrera - USACE			
	PROJECT NO: 07-1196	SCALE: N/A	DATE: 1-17-08	BY: LEW

Pore Water Volume

Use $\eta = 0.35$ $\therefore$ $V_{WAT} = V_{EXC} \cdot n$ ⇒ use water table @ 3' from ground surface or d' = 22 ft.

$V_{WAT} = V_{EXC} \cdot n$

$= d' \cdot W_2 \cdot L_2 + d'^2 \cdot \frac{1}{2}(2L_2 + 2W_2) + 4 \cdot \frac{1}{3} d'^3$

$= 22(30 \cdot 100) + (22^2 \cdot \frac{1}{2} \cdot (2 \cdot 100 + 2 \cdot 30) + 4\frac{1}{3} 22^3$ 25'

$= [66000 + 62,920 + 14,200] \cdot n$

$= [143,120\ ft^3] \cdot 0.35$

$V_{WAT} = 50,100\ ft^3 = 374,750$ gallons

Rate of Removal Based on Time of Excavation

Time of Excav to Full Depth (Day)	Required Rate (gpm) (constant rate)
1	260
2	130
3	86
4	65
5	52
6	43
7	37
8	32
9	29
10	26
15	17
20	13
30	9

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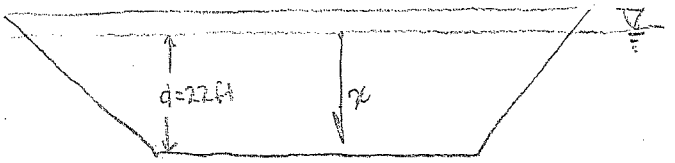
Pore Water Volume as Function of Depth

x = depth of excavation beginning at water table



$$V_{TOT}(x) = x(W_2 \cdot L_2) + \int_0^x (2L_2 + 2W_2)(22-x)\,dx + 4 \cdot \int_0^x (22-x)(22-x)\,dx$$

$$= x(100 \cdot 30) + \int_0^x (2 \cdot 100 + 2 \cdot 30)(22-x)\,dx + 4 \cdot \int_0^x (484 - 44x + x^2)\,dx$$

$$= 3000x + \int_0^x 260(22-x)\,dx + 4\int_0^x 484 - 44x + x^2\,dx$$

$$= 3000x + 260\left[22x - \frac{x^2}{2}\Big|_0^x\right] + 4\cdot\left[484x - 22x^2 + \frac{x^3}{3}\Big|_0^x\right]$$

⟹ Calculate Volume of water 1ft excavation per day

Dewatering 1 ft excavation per day (DAY)	Required Removal Rate (GPM)
1	19.0
2	18.2
3	17.4
4	16.7
5	15.9
6	15.2
7	14.5
8	13.8
9	13.1
10	12.5
15	9.4
20	6.7
22	5.7

Pore water function (gal)

$V_{TOT} = 10656x - 218x^2 + \frac{4}{3}x^3$

$(0.35)(7.48\,gal/ft^3)$

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SUBJECT: Pore Water Volume			
CLIENT: Cabrera-USACE			
PROJECT NO: 07-1196	SCALE: N/A	DATE: 1-20-08	BY: HPW

RAINFALL IN EXCAVATION AREA

- CALCULATE AUG RAINFALL AND 25-YEAR STORM

AUG RAINFALL

$R_{AUG} = 40 \text{ inches/year} = 3.33 \text{ ft/yr}$

=> assume steady state rain once every 7 days distributed throughout the year

$= \frac{40 \text{ inch}}{\text{year}} \quad \frac{1 \text{ year}}{365 \text{ days}} = \frac{0.10959 \text{ in}}{\text{day}} \Rightarrow$ concentrate 1 rain every 7 days

$= \frac{0.10959 \text{ in}}{\text{day}} \quad \frac{7 \text{ days}}{1 \text{ rain event}} = \frac{0.77 \text{ in}}{\text{event in day}}$

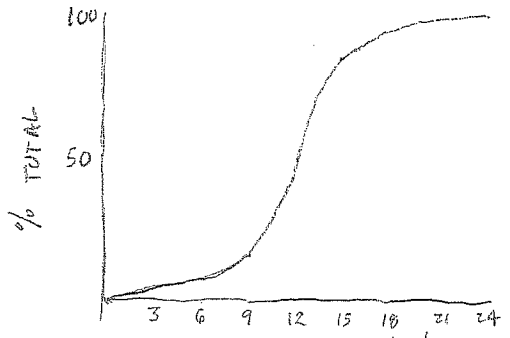
=> calculate required rate to constantly remove water

$$\frac{.77 \text{ in}}{\text{day}} \times \frac{(150 \text{ ft} \times 480 \text{ ft})}{12 \text{ in/ft}} \times \frac{7.48 \text{ gal}}{\text{ft}^3} \times \frac{\text{day}}{24 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}}$$

REQUIRED RATE = 4.0 gpm

25-YEAR STORM

- TYPE II STORM
- SCS - 24 hr RAINFALL DISTRIBUTION
- 4.5 inch EVENT



SCS-24hr Distribution

Q_{AUG} FOR 0 - 11.5 hr = 15.6 gpm

Q_{AUG} FOR 11.5 - 12.75 hr = 202 gpm

Q_{AUG} FOR 12.75 - 24 hr = 15.6 gpm

(see attached spread sheet)

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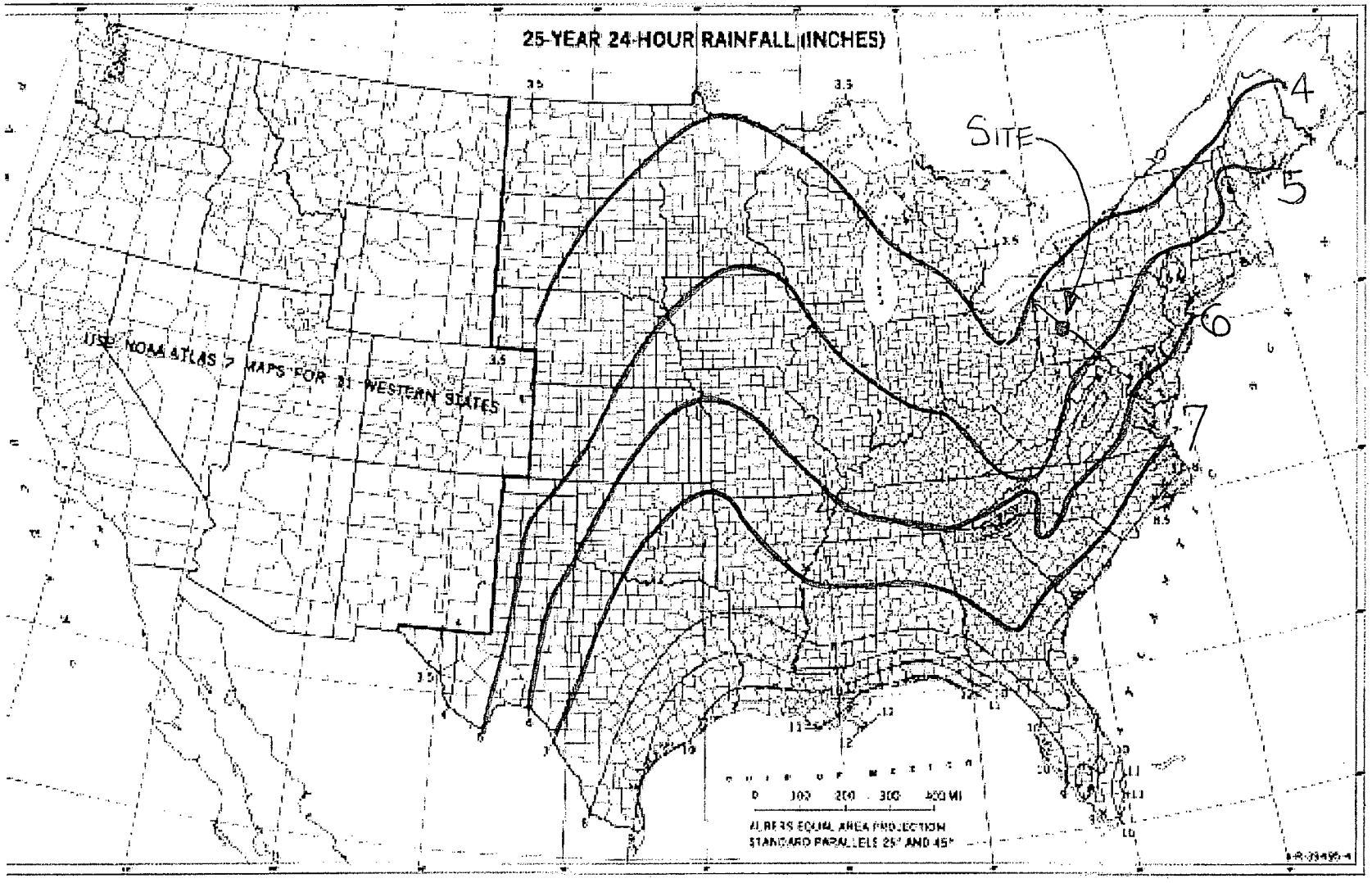
	SUBJECT: Rainfall Data			
	CLIENT: Cabrera - USACE			
	PROJECT NO: 07-1196	SCALE: N/A	DATE: 1/18/08	BY: LEW



For Project site 25-year 24hr rainfall total=

4.5 inch

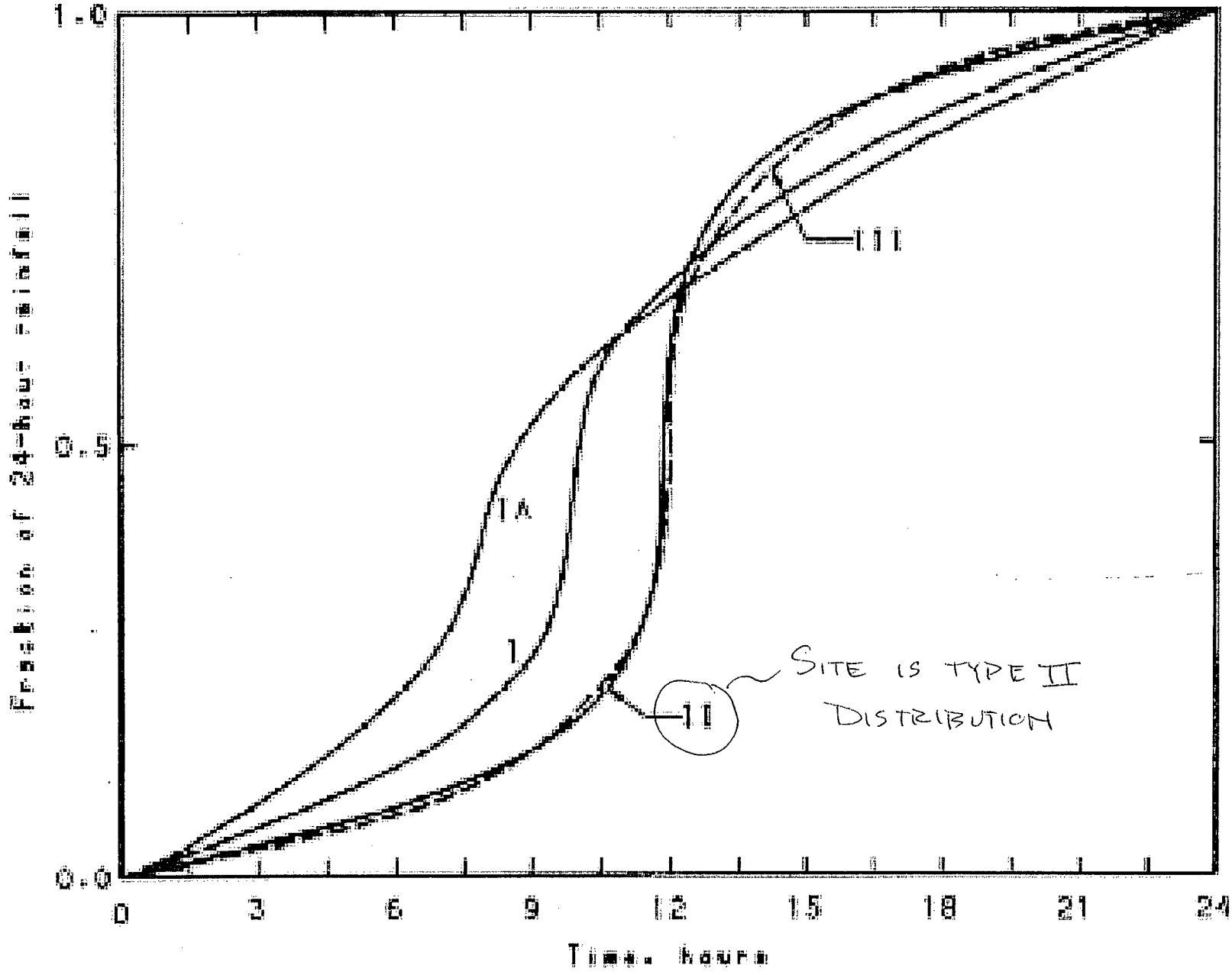


Figure B-1.—SCS 24-hour rainfall distributions.

25-Year, 24 hour Rain Event
Required Pumping Rates

Time (hour)	% of total	Percent of 25 year storm (4.5 inch)	Rainfall During Period (inch)	Rainfall in Excavation Area during 15 min period (gal)	Required Pumping Rate (gpm)
0.00	0.00	0.000000		0	0
0.25	0.33	0.014850	0.014850	111.078	7.4052
0.50	0.66	0.029700	0.014850	111.078	7.4052
0.75	1.00	0.045000	0.015300	114.444	7.6296
1.00	1.33	0.059850	0.014850	111.078	7.4052
1.25	1.66	0.074700	0.014850	111.078	7.4052
1.50	2.00	0.090000	0.015300	114.444	7.6296
1.75	2.33	0.104850	0.014850	111.078	7.4052
2.00	2.66	0.119700	0.014850	111.078	7.4052
2.25	3.00	0.135000	0.015300	114.444	7.6296
2.50	3.33	0.149850	0.014850	111.078	7.4052
2.75	3.66	0.164700	0.014850	111.078	7.4052
3.00	4.00	0.180000	0.015300	114.444	7.6296
3.25	4.33	0.194850	0.014850	111.078	7.4052
3.50	4.66	0.209700	0.014850	111.078	7.4052
3.75	5.00	0.225000	0.015300	114.444	7.6296
4.00	5.33	0.239850	0.014850	111.078	7.4052
4.25	5.66	0.254700	0.014850	111.078	7.4052
4.50	6.00	0.270000	0.015300	114.444	7.6296
4.75	6.33	0.284850	0.014850	111.078	7.4052
5.00	6.66	0.299700	0.014850	111.078	7.4052
5.25	7.00	0.315000	0.015300	114.444	7.6296
5.50	7.33	0.329850	0.014850	111.078	7.4052
5.75	7.66	0.344700	0.014850	111.078	7.4052
6.00	8.00	0.360000	0.015300	114.444	7.6296
6.25	8.33	0.374850	0.014850	111.078	7.4052
6.50	8.66	0.389700	0.014850	111.078	7.4052
6.75	9.00	0.405000	0.015300	114.444	7.6296
7.00	9.33	0.419850	0.014850	111.078	7.4052
7.25	9.66	0.434700	0.014850	111.078	7.4052
7.50	10.00	0.450000	0.015300	114.444	7.6296
7.75	10.33	0.464850	0.014850	111.078	7.4052
8.00	11.33	0.509850	0.045000	336.6	22.44
8.25	12.00	0.540000	0.030150	225.522	15.0348
8.50	12.66	0.569700	0.029700	222.156	14.8104
8.75	13.33	0.599850	0.030150	225.522	15.0348
9.00	14.00	0.630000	0.030150	225.522	15.0348
9.25	15.00	0.675000	0.045000	336.6	22.44
9.50	16.00	0.720000	0.045000	336.6	22.44
9.75	17.00	0.765000	0.045000	336.6	22.44
10.00	18.00	0.810000	0.045000	336.6	22.44

10.25	19.00	0.855000	0.045000	336.6	22.44
10.50	20.00	0.900000	0.045000	336.6	22.44
10.75	22.00	0.990000	0.090000	673.2	44.88
11.00	24.00	1.080000	0.090000	673.2	44.88
11.25	27.00	1.215000	0.135000	1009.8	**67.32**
11.50	32.00	1.440000	0.225000	1683	**112.2**
11.75	38.00	1.710000	0.270000	2019.6	**134.64**
12.00	50.00	2.250000	0.540000	4039.2	**269.28**
12.25	62.00	2.790000	0.540000	4039.2	**269.28**
12.50	68.00	3.060000	0.270000	2019.6	**134.64**
12.75	73.00	3.285000	0.225000	1683	**112.2**
13.00	76.00	3.420000	0.135000	1009.8	**67.32**
13.25	78.00	3.510000	0.090000	673.2	44.88
13.50	80.00	3.600000	0.090000	673.2	44.88
13.75	81.00	3.645000	0.045000	336.6	22.44
14.00	82.00	3.690000	0.045000	336.6	22.44
14.25	83.00	3.735000	0.045000	336.6	22.44
14.50	84.00	3.780000	0.045000	336.6	22.44
14.75	85.00	3.825000	0.045000	336.6	22.44
15.00	86.00	3.870000	0.045000	336.6	22.44
15.25	86.66	3.899700	0.029700	222.156	14.8104
15.50	87.33	3.929850	0.030150	225.522	15.0348
15.75	88.00	3.960000	0.030150	225.522	15.0348
16.00	88.66	3.989700	0.029700	222.156	14.8104
16.25	89.33	4.019850	0.030150	225.522	15.0348
16.50	90.00	4.050000	0.030150	225.522	15.0348
16.75	90.33	4.064850	0.014850	111.078	7.4052
17.00	90.66	4.079700	0.014850	111.078	7.4052
17.25	91.00	4.095000	0.015300	114.444	7.6296
17.50	91.33	4.109850	0.014850	111.078	7.4052
17.75	91.66	4.124700	0.014850	111.078	7.4052
18.00	92.00	4.140000	0.015300	114.444	7.6296
18.25	92.33	4.154850	0.014850	111.078	7.4052
18.50	92.66	4.169700	0.014850	111.078	7.4052
18.75	93.00	4.185000	0.015300	114.444	7.6296
19.00	93.33	4.199850	0.014850	111.078	7.4052
19.25	93.66	4.214700	0.014850	111.078	7.4052
19.50	94.00	4.230000	0.015300	114.444	7.6296
19.75	94.33	4.244850	0.014850	111.078	7.4052
20.00	94.66	4.259700	0.014850	111.078	7.4052
20.25	95.00	4.275000	0.015300	114.444	7.6296
20.50	95.33	4.289850	0.014850	111.078	7.4052
20.75	95.66	4.304700	0.014850	111.078	7.4052
21.00	96.00	4.320000	0.015300	114.444	7.6296
21.25	96.33	4.334850	0.014850	111.078	7.4052
21.50	96.66	4.349700	0.014850	111.078	7.4052
21.75	97.00	4.365000	0.015300	114.444	7.6296

Required Pumping Rates

22.00	97.33	4.379850	0.014850	111.078	7.4052
22.25	97.66	4.394700	0.014850	111.078	7.4052
22.50	98.00	4.410000	0.015300	114.444	7.6296
22.75	98.33	4.424850	0.014850	111.078	7.4052
23.00	98.66	4.439700	0.014850	111.078	7.4052
23.25	99.00	4.455000	0.015300	114.444	7.6296
23.50	99.33	4.469850	0.014850	111.078	7.4052
23.75	99.66	4.484700	0.014850	111.078	7.4052
24.00	100.00	4.500000	0.015300	114.444	7.6296

4.500000

Task 2: Water Diversion and Trench Dewatering Design (Construction Elements)

Shallow Land Disposal Area (SLDA), Parks Township

FUSRAP Project

Armstrong County, Pennsylvania

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GGE 07-1196

January 28, 2008

I. Scope: The purpose of this calculation is to supplement the Task 2: Water Diversion and Trench Dewatering Design calculations submitted to Cabrera Services on January 21, 2008. The initial calculations focused primarily on the estimated volumes of water and rates from the various hydrologic water sources. This supplemental report expands on those volumes and rates as they relate to discussions with Sevenson Environmental Services, Inc. and their input regarding schedule, excavation methodology, and certification sampling. In addition to hydrologic parameters, this supplemental report presents an overall plan design scheme for dewatering. As well as the parameters presented in the initial calculations, Section II outlines other parameters as discussed with Cabrera and Sevenson. (note: meeting with Sevenson conducted on January 24, 2007)

II. Design and Calculation Parameters:

- Overall excavation areas are based on Figure 4-3 of the Feasibility Study. Note that the excavation areas generally extend outside of the delineated trench boundary. For calculation purposes, trench footprint area will be adjusted in order that the summation of the total trench footprint area equals the overall excavation area as defined in Figure 4-3. This design parameter was based on a phone conversation with Jennifer Thompson of Cabrera on January 24, 2007.
- Excavation depths are based on the preliminary calculations and Table 4-9 of the RI Report.
- Baseline trench volumes for pore water are based on volumes given in Table 4-9 of the RI Report.
- The order and sequence of excavation is generally based on Sevenson's preliminary construction schedule as dated on January 23, 2008.
- Excavation sequence is generally from the trench of highest elevation to the trench of lowest elevation. Water management within the trenches should follow the natural grade of the excavation floor bottom.

III. Excavation Area Definition:

- Prior to any trench excavation, a storm water run-off diversion berm shall be built from clean off-site soils or overburben to prevent infiltration of surface water run-off into the trench area. The berm should be a minimum of 2 feet high with 1.5:1 slopes with silt fencing surrounding the overall trench perimeter to protect from soil and sediment erosion. A cross section of the berm and silt fence is presented in Figure No. 1. The alignment of the berm and silt fence shall be based on the current open excavation area as dictated by the contractor and shall generally be up gradient (ground topography) of the excavation area with protection along the lateral extents. The silt fence and berm protection shall only be removed upon completion of backfill of the protected trench or trenches.
- The existing intermittent "Dry Run" stream alignment shall be protected from run-off prior to excavation with appropriate stream protection devices.
- The flow alignment of the intermittent "Dry Run" stream shall be temporarily rerouted for the duration of construction activities by either construction of a protected open channel or pipe system and shall flow by gravity.
- Overall trench boundaries are presented in Figure No. 2. The modified trench boundaries are also presented per the design parameters as discussed in bullet one of Section II. Tables 1-1 through 1-10 outline the associated trench characteristics as defined in Figure No. 2.

IV. Design Parameters:

- Tables 1-1 through 1-10 provide the data that must be combined with the logistics and overall proposed schedule and sequencing of excavation in order to determine a design capacity for the dewatering system.
- Based on the construction schedule and other hydrologic factors, the time at which the dewatering system will encounter the most water is when trenches 2 and 1 are open or in the process of being backfilled with trench 3 is being dewatered for excavation.
- The worst case for design purposes considers the following:
    - Trench 1 is fully open to excavation limits
    - Trench 2 is fully open to excavation limits
    - Trench 3 is being dewatered for excavation
- The sum of maximum infiltration for trenches 1 and 2 of approximately 52 gallons per minute.

- The total amount of pore water in trench 3 is approximately 890,000 gallons. The total excavation time allotted for the excavation of trench 3 is 65 days. Use half of the time for dewatering based on an 8-hour day. Therefore the dewatering rate for trench 3 is approximately 60 gallons per minute. In addition, add one-half of the natural infiltration rate associated with trench 3 of 35 gallons per minute.
- The summation of the pore water, infiltration rates based on the construction schedule and hydrologic parameters provides a design dewatering flow rate that must have the capacity for:

$$Q = 52 \text{ gpm} + 60 \text{ gpm} + 35 \text{ gpm}$$

$$Q_{(\text{Trench } 1,2,\& 3)} = 150 \text{ gpm}$$

- Should a 0.5 inch rainfall occur within a 2-hour with both trench 1 and 2 fully open, then the flow rate increases by (61.8 gpm + 77.3 gpm). Giving a total Q with a 0.5-inch storm event of:

$$Q_{(\text{Trench } 1,2,\& 3 \text{ w/rain})} = 290 \text{ gpm}$$

V. Dewatering Schemes:

- Dewatering of the trenches should occur "step-wise" both laterally and vertically. The general depth of excavation is approximately 15 feet with trench 10 being the greatest at 22 feet. In order to dewater a trench, we recommend the following steps.
    1. Perform initial test well locations along the centerline of the trench to determine water level.
    2. Construct well sumps equally spaced within the excavation footprint sequence (use initial 50 ft radius influence spacing).
    3. Ensure the effective well bottom is at least 5 feet below the natural groundwater table.
    4. Install well sump in as shown in Figure 4.
    5. The pumps shall be 6" dry prime pumps capable of pumping at least 200 gpm, though the flow rate into the sumps will be at a much lower rate.
- When excavation floor is within 2 feet of the water level in the sumps, the sumps shall be deepened to at least 5 feet below excavation floor. The final sump elevation bottom shall be at least 2 feet below the excavation floor as dictated by lateral well spacing.
- During excavation the infiltration and any seepage within the excavation shall be controlled through a series of "field" constructed catch basins. The floor of the excavation shall be sloped along the natural contours as dictated by the excavation depth. The slope shall

- Water management within the trench should be relatively straightforward to complete. Generally speaking, the excavation sequence is from highest elevation to lowest. This will enable the excavation to constantly maintain a natural slope based on the excavation's lateral and depth limits.
- The water can be channelized to a elevation plane at the lowest open excavation and pumped out from there. The total capacity for a pump or series of pumps exiting a trench must be at least 250 gpm with the capacity of at least 50 feet of head pressure.
- The water treatment facility should have the capacity to store a modified volume for a 25-year, 24 hour storm for excavation areas 1 and 2 (approximately 175,000 gallons).

Table 1-1
Trench Characteristics

Trench Number	1

I. *Trench Quantities*

Item	Units	Quantity
Area of Trench (proper)	ft^2	10,471.5
Adjusted Base Area of Trench (total)	ft^2	16,160.6
Depth to Bedrock Layer	ft	12.3
Depth to Water Table (below ground surface)	ft	3.0
Volume of Trench (proper)	ft^3	128,799.5
Adjusted Trench Perimter	ft	770.0
Total Footprint (w/setback slope)	ft^2	29,780.0
Adjusted Trench Volume (total)	ft^3	257,022.0
Porosity "n" of Trench (proper)	ratio	0.35
Porosity "n" Outside Trench (proper)	ratio	0.20

II. *Pore Water*

Item	Units	Quantity
Pore Water I Trench (proper)	Gallons	254,953.8
Pore Water outside Trench (proper)	Gallons	128,966.1
Total Pore Water	**Gallons**	**383,919.9**

II. *Infiltration (Darcy's Law)*

Item	Units	Quantity
Permeability ("k" value)	cm/sec	0.000500
Maximum exposed vertical surface	ft^2	7,161.0
Gradient	n/a	0.5
Max. Infiltration Rate	**gal/min**	**26.4**

II. *Rainfall*

Item	Units	Quantity
1/2-inch (2-hour period)	gal	9,281
1-inch rainfall (2-hour period)	gal	18,563
25-year, 24-hour rainfall event	gal	83,533

1/2-inch (2-hour period)		gal/min	77.3
1-inch rainfall (2-hour period)		gal/min	154.7
25-year, 24-hour rainfall event		gal/min	58.0

Table 1-2
Trench Characteristics

Trench Number	2

I. *Trench Quantities*

Item	Units	Quantity
Area of Trench (proper)	ft^2	7,802.4
Adjusted Base Area of Trench (total)	ft^2	13,889.7
Depth to Bedrock Layer	ft	14.2
Depth to Water Table (below ground surface)	ft	3.0
Volume of Trench (proper)	ft^3	110,794.1
Adjusted Trench Perimter	ft	614.0
Total Footprint (w/setback slope)	ft^2	23,784.0
Adjusted Trench Volume (total)	ft^3	259,137.2
Porosity "n" of Trench (proper)	ratio	0.35
Porosity "n" Outside Trench (proper)	ratio	0.20

II. *Pore Water*

Item	Units	Quantity
Pore Water I Trench (proper)	Gallons	228,778.9
Pore Water outside Trench (proper)	Gallons	159,605.0
Total Pore Water	**Gallons**	**388,383.9**

II. *Infiltration (Darcy's Law)*

Item	Units	Quantity
Permeability ("k" value)	cm/sec	0.000500
Maximum exposed vertical surface	ft^2	6,876.8
Gradient	n/a	0.5
Max. Infiltration Rate	**gal/min**	**25.3**

II. *Rainfall*

Item	Units	Quantity
1/2-inch (2-hour period)	gal	7,413
1-inch rainfall (2-hour period)	gal	14,825
25-year, 24-hour rainfall event	gal	66,714

1/2-inch (2-hour period)		gal/min	61.8
1-inch rainfall (2-hour period)		gal/min	123.5
25-year, 24-hour rainfall event		gal/min	46.3

Table 1-3
Trench Characteristics

Trench Number	3

I. *Trench Quantities*

Item	Units	Quantity
Area of Trench (proper)	ft^2	794.1
Adjusted Base Area of Trench (total)	ft^2	1,015.1
Depth to Bedrock Layer	ft	10.7
Depth to Water Table (below ground surface)	ft	3.0
Volume of Trench (proper)	ft^3	8,496.9
Adjusted Trench Perimter	ft	137.0
Total Footprint (w/setback slope)	ft^2	3,018.0
Adjusted Trench Volume (total)	ft^3	18,704.1
Porosity "n" of Trench (proper)	ratio	0.35
Porosity "n" Outside Trench (proper)	ratio	0.20

II. *Pore Water*

Item	Units	Quantity
Pore Water I Trench (proper)	Gallons	16,007.9
Pore Water outside Trench (proper)	Gallons	8,621.5
Total Pore Water	**Gallons**	**24,629.5**

II. *Infiltration (Darcy's Law)*

Item	Units	Quantity
Permeability ("k" value)	cm/sec	0.000500
Maximum exposed vertical surface	ft^2	1,054.9
Gradient	n/a	0.5
Max. Infiltration Rate	**gal/min**	**3.9**

II. *Rainfall*

Item	Units	Quantity
1/2-inch (2-hour period)	gal	941
1-inch rainfall (2-hour period)	gal	1,881
25-year, 24-hour rainfall event	gal	8,465

1/2-inch (2-hour period)		gal/min	7.8
1-inch rainfall (2-hour period)		gal/min	15.7
25-year, 24-hour rainfall event		gal/min	5.9

Table 1-4
Trench Characteristics

Trench Number	4

I. *Trench Quantities*

Item	Units	Quantity
Area of Trench (proper)	ft^2	1,961.5
Adjusted Base Area of Trench (total)	ft^2	6,335.6
Depth to Bedrock Layer	ft	14.9
Depth to Water Table (below ground surface)	ft	3.0
Volume of Trench (proper)	ft^3	29,226.4
Adjusted Trench Perimter	ft	178.0
Total Footprint (w/setback slope)	ft^2	9,165.0
Adjusted Trench Volume (total)	ft^3	114,159.3
Porosity "n" of Trench (proper)	ratio	0.35
Porosity "n" Outside Trench (proper)	ratio	0.20

II. *Pore Water*

Item	Units	Quantity
Pore Water I Trench (proper)	Gallons	61,109.0
Pore Water outside Trench (proper)	Gallons	96,724.0
Total Pore Water	**Gallons**	**157,833.0**

II. *Infiltration (Darcy's Law)*

Item	Units	Quantity
Permeability ("k" value)	cm/sec	0.000500
Maximum exposed vertical surface	ft^2	2,118.2
Gradient	n/a	0.5
Max. Infiltration Rate	**gal/min**	**7.8**

II. *Rainfall*

Item	Units	Quantity
1/2-inch (2-hour period)	gal	2,856
1-inch rainfall (2-hour period)	gal	5,713
25-year, 24-hour rainfall event	gal	25,708

1/2-inch (2-hour period)		gal/min	23.8
1-inch rainfall (2-hour period)		gal/min	47.6
25-year, 24-hour rainfall event		gal/min	17.9

Table 1-5
Trench Characteristics

Trench Number	5

I. *Trench Quantities*

Item	Units	Quantity
Area of Trench (proper)	ft^2	2,496.6
Adjusted Base Area of Trench (total)	ft^2	3,872.6
Depth to Bedrock Layer	ft	14.4
Depth to Water Table (below ground surface)	ft	3.0
Volume of Trench (proper)	ft^3	35,951.0
Adjusted Trench Perimter	ft	231.0
Total Footprint (w/setback slope)	ft^2	6,319.0
Adjusted Trench Volume (total)	ft^3	79,715.5
Porosity "n" of Trench (proper)	ratio	0.35
Porosity "n" Outside Trench (proper)	ratio	0.20

II. *Pore Water*

Item	Units	Quantity
Pore Water I Trench (proper)	Gallons	74,511.5
Pore Water outside Trench (proper)	Gallons	45,922.4
Total Pore Water	**Gallons**	**120,433.9**

II. *Infiltration (Darcy's Law)*

Item	Units	Quantity
Permeability ("k" value)	cm/sec	0.000500
Maximum exposed vertical surface	ft^2	2,633.4
Gradient	n/a	0.5
Max. Infiltration Rate	**gal/min**	**9.7**

II. *Rainfall*

Item	Units	Quantity
1/2-inch (2-hour period)	gal	1,969
1-inch rainfall (2-hour period)	gal	3,939
25-year, 24-hour rainfall event	gal	17,725

1/2-inch (2-hour period)		gal/min	16.4
1-inch rainfall (2-hour period)		gal/min	32.8
25-year, 24-hour rainfall event		gal/min	12.3

Table 1-6
Trench Characteristics

Trench Number	6

I. *Trench Quantities*

Item	Units	Quantity
Area of Trench (proper)	ft^2	5,431.8
Adjusted Base Area of Trench (total)	ft^2	9,410.5
Depth to Bedrock Layer	ft	15.6
Depth to Water Table (below ground surface)	ft	3.0
Volume of Trench (proper)	ft^3	84,736.1
Adjusted Trench Perimter	ft	215.0
Total Footprint (w/setback slope)	ft^2	14,605.0
Adjusted Trench Volume (total)	ft^3	172,965.0
Porosity "n" of Trench (proper)	ratio	0.35
Porosity "n" Outside Trench (proper)	ratio	0.20

II. *Pore Water*

Item	Units	Quantity
Pore Water I Trench (proper)	Gallons	179,177.7
Pore Water outside Trench (proper)	Gallons	100,528.7
Total Pore Water	**Gallons**	**279,706.4**

II. *Infiltration (Darcy's Law)*

Item	Units	Quantity
Permeability ("k" value)	cm/sec	0.000500
Maximum exposed vertical surface	ft^2	2,709.0
Gradient	n/a	0.5
Max. Infiltration Rate	**gal/min**	**10.0**

II. *Rainfall*

Item	Units	Quantity
1/2-inch (2-hour period)	gal	4,552
1-inch rainfall (2-hour period)	gal	9,104
25-year, 24-hour rainfall event	gal	40,967

1/2-inch (2-hour period)		gal/min	37.9
1-inch rainfall (2-hour period)		gal/min	75.9
25-year, 24-hour rainfall event		gal/min	28.4

Table 1-7
Trench Characteristics

Trench Number	7

I. *Trench Quantities*

Item	Units	Quantity
Area of Trench (proper)	ft^2	4,444.1
Adjusted Base Area of Trench (total)	ft^2	5,854.4
Depth to Bedrock Layer	ft	14.7
Depth to Water Table (below ground surface)	ft	3.0
Volume of Trench (proper)	ft^3	65,328.3
Adjusted Trench Perimter	ft	227.0
Total Footprint (w/setback slope)	ft^2	11,245.0
Adjusted Trench Volume (total)	ft^3	110,585.9
Porosity "n" of Trench (proper)	ratio	0.35
Porosity "n" Outside Trench (proper)	ratio	0.20

II. *Pore Water*

Item	Units	Quantity
Pore Water I Trench (proper)	Gallons	136,125.4
Pore Water outside Trench (proper)	Gallons	47,928.1
Total Pore Water	**Gallons**	**184,053.6**

II. *Infiltration (Darcy's Law)*

Item	Units	Quantity
Permeability ("k" value)	cm/sec	0.000500
Maximum exposed vertical surface	ft^2	2,655.9
Gradient	n/a	0.5
Max. Infiltration Rate	**gal/min**	**9.8**

II. *Rainfall*

Item	Units	Quantity
1/2-inch (2-hour period)	gal	3,505
1-inch rainfall (2-hour period)	gal	7,009
25-year, 24-hour rainfall event	gal	31,542

1/2-inch (2-hour period)		gal/min	29.2
1-inch rainfall (2-hour period)		gal/min	58.4
25-year, 24-hour rainfall event		gal/min	21.9

Table 1-8
Trench Characteristics

Trench Number	8

I. *Trench Quantities*

Item	Units	Quantity
Area of Trench (proper)	ft^2	1,296.2
Adjusted Base Area of Trench (total)	ft^2	1,296.2
Depth to Bedrock Layer	ft	15.3
Depth to Water Table (below ground surface)	ft	3.0
Volume of Trench (proper)	ft^3	19,831.9
Adjusted Trench Perimter	ft	185.0
Total Footprint (w/setback slope)	ft^2	3,992.0
Adjusted Trench Volume (total)	ft^3	41,485.2
Porosity "n" of Trench (proper)	ratio	0.35
Porosity "n" Outside Trench (proper)	ratio	0.20

II. *Pore Water*

Item	Units	Quantity
Pore Water I Trench (proper)	Gallons	41,739.5
Pore Water outside Trench (proper)	Gallons	20,935.5
Total Pore Water	**Gallons**	**62,675.0**

II. *Infiltration (Darcy's Law)*

Item	Units	Quantity
Permeability ("k" value)	cm/sec	0.000500
Maximum exposed vertical surface	ft^2	2,275.5
Gradient	n/a	0.5
Max. Infiltration Rate	**gal/min**	**8.4**

II. *Rainfall*

Item	Units	Quantity
1/2-inch (2-hour period)	gal	1,244
1-inch rainfall (2-hour period)	gal	2,488
25-year, 24-hour rainfall event	gal	11,198

1/2-inch (2-hour period)		gal/min	10.4
1-inch rainfall (2-hour period)		gal/min	20.7
25-year, 24-hour rainfall event		gal/min	7.8

Table 1-9
Trench Characteristics

Trench Number	9

I. *Trench Quantities*

Item	Units	Quantity
Area of Trench (proper)	ft^2	2,693.5
Adjusted Base Area of Trench (total)	ft^2	3,648.0
Depth to Bedrock Layer	ft	13.8
Depth to Water Table (below ground surface)	ft	3.0
Volume of Trench (proper)	ft^3	37,170.3
Adjusted Trench Perimter	ft	300.0
Total Footprint (w/setback slope)	ft^2	8,640.0
Adjusted Trench Volume (total)	ft^3	78,908.4
Porosity "n" of Trench (proper)	ratio	0.35
Porosity "n" Outside Trench (proper)	ratio	0.20

II. *Pore Water*

Item	Units	Quantity
Pore Water I Trench (proper)	Gallons	76,157.1
Pore Water outside Trench (proper)	Gallons	41,595.7
Total Pore Water	**Gallons**	**117,752.8**

II. *Infiltration (Darcy's Law)*

Item	Units	Quantity
Permeability ("k" value)	cm/sec	0.000500
Maximum exposed vertical surface	ft^2	3,240.0
Gradient	n/a	0.5
Max. Infiltration Rate	**gal/min**	**11.9**

II. *Rainfall*

Item	Units	Quantity
1/2-inch (2-hour period)	gal	2,693
1-inch rainfall (2-hour period)	gal	5,386
25-year, 24-hour rainfall event	gal	24,235

1/2-inch (2-hour period)		gal/min	22.4
1-inch rainfall (2-hour period)		gal/min	44.9
25-year, 24-hour rainfall event		gal/min	16.8

Table 1-10
Trench Characteristics

Trench Number	10

I. *Trench Quantities*

Item	Units	Quantity
Area of Trench (proper)	ft^2	12,240.2
Adjusted Base Area of Trench (total)	ft^2	13,995.8
Depth to Bedrock Layer	ft	21.3
Depth to Water Table (below ground surface)	ft	3.0
Volume of Trench (proper)	ft^3	260,716.3
Adjusted Trench Perimter	ft	1,030.0
Total Footprint (w/setback slope)	ft^2	36,170.0
Adjusted Trench Volume (total)	ft^3	531,760.9
Porosity "n" of Trench (proper)	ratio	0.35
Porosity "n" Outside Trench (proper)	ratio	0.20

II. *Pore Water*

Item	Units	Quantity
Pore Water I Trench (proper)	Gallons	586,420.6
Pore Water outside Trench (proper)	Gallons	306,075.4
Total Pore Water	**Gallons**	**892,496.0**

II. *Infiltration (Darcy's Law)*

Item	Units	Quantity
Permeability ("k" value)	cm/sec	0.000500
Maximum exposed vertical surface	ft^2	18,849.0
Gradient	n/a	0.5
Max. Infiltration Rate	**gal/min**	**69.4**

II. *Rainfall*

Item	Units	Quantity
1/2-inch (2-hour period)	gal	11,273
1-inch rainfall (2-hour period)	gal	22,546
25-year, 24-hour rainfall event	gal	101,457

1/2-inch (2-hour period)		gal/min	93.9
1-inch rainfall (2-hour period)		gal/min	187.9
25-year, 24-hour rainfall event		gal/min	70.5

APPENDIX B

Field Testing/Treatability Study Scope

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ADA

APONOWICH, DRISCOLL & ASSOCIATES, INC.

March 7, 2008

Mr. Andy Wright
Sevenson Environmental Services Inc.
2749 Lockport Rd.
Niagara Falls, NY 14305

Subject: SLDA Scope of Work

Dear Mr. Wright:

Please find ADA's proposed scope of work for the requested services. This is the basis for the cost estimate provided under separate cover.

Wastewater Treatability Study. Following additional characterization of the wastewater from the site, ADA will prepare a standard operating procedure for the treatability and performance testing to be prepared in the Waste Stream laboratory in Buffalo, NY. The scope includes visiting the laboratory to assist and direct laboratory personnel in the performance of the proposed treatability processes, assumed to be settling/filtration, granular activated carbon, and ion exchange.

It is anticipated that the ion exchange process will be the primary radiological contamination removal process. After initial consultations with ion exchange vendors, a proposed approach to ion exchange will be developed and specific media obtained. An initial equilibrium isotherm will be developed using site wastewater to establish the viability of the approach.

After the initial isotherm work is completed, a column evaluation test will be performed in the Waste Stream laboratory to optimize the design of the proposed system and to predict its scaled-up performance and breakthrough curve.

These results will be summarized in a report to Sevenson Environmental proposing an ion exchange media design, loading rates, and predicting bed life prior to exhaustion.

Wastewater Treatment Plant Design. ADA will prepare the process design, materials balance, and preliminary design report for the wastewater treatment plant, for submittal to Sevenson Environmental, and ultimately USACE. Following receipt and incorporation of comments, the preliminary design report will be finalized and become the basis for the final design.

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TPDRISCOLL@MINDSPRING.COM

Although subject to the results of the initial characterization and treatability studies, the preliminary design has assumed the following processes will be used:

- Influent equalization
- Pumping
- Chemical feed systems (caustic and polymer)
- Inclined plate clarifier
- Pumping
- Dual-media filtration
- Granular activated carbon
- Ion exchange
- Bag filters

The final design will include the preparation of drawings for USACE review and for Sevenson Environmental's construction, not for bidding purposes. As currently envisaged, the design drawings would include a process flow diagram and material balance, a site layout, and a hydraulic profile. Catalog cut sheets will be developed for the systems to be installed. No operation and maintenance manual is included. All drawings will be prepared and stamped as necessary by a Pennsylvania P.E.

Wastewater Treatment Plant Plan and Discharge Permit Assistance. ADA will assist Sevenson in preparing the wastewater treatment plant plan relating to collection, treatment, testing and analysis of the contaminated water. ADA will assist Sevenson in preparing the permit application for either a discharge to the local POTW, or for an NPDES permit for direct discharge to a local waterway. The application will be prepared and stamped as necessary by a Pennsylvania P.E.

As indicated previously, the cost estimates have included a total of 2 trips to Buffalo/Niagara Falls for the treatability studies and project meetings, and 1 trips to Pittsburgh to view the site and to meet with local project officials and state regulatory agencies.

If you have any questions, please don't hesitate to call.

Terence P Driscoll

Regards

Terence P. Driscoll
Vice President

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Task 2: Water Diversion and Trench Dewatering Design

(Field Effort Description of Tasks)

Shallow Land Disposal Area (SLDA), Parks Township

FUSRAP Project

Armstrong County, Pennsylvania

prepared for:
Cabrera Services, Inc.
633 Stablestone Drive
Chesterfield, Missouri 63017

prepared by:
Glynn Geotechnical Engineering
415 South Transit Street
Lockport, New York 14094

GGE 07-1196

February 18, 2008

SLDA, Parks Township, FUSRAP Project
Field Effort Description of Tasks
Armstrong, PA
GGE No. 07-1196

February 18, 2008

Scope: This Field Effort Description of Tasks is presented as a general outline of tasks and work to be completed in order to confirm, to a limited degree, and to expound upon previous investigative conclusions as presented in the Remedial Investigation (RI). This document describes the general means and methods for the investigative actions but does not include any access agreements, discharge permits, equipment considerations or any other authorization for the work as established by others.

I. General Project History : In order to verify and refine the conceptual trench dewatering and diversion design, a field investigative study is needed to confirm design considerations which may further influence the final dewatering design. Previously, slug tests and packer tests were performed within the site as presented in the RI. Approximately five (5) slug tests were performed in areas outside of the trench areas anywhere from 150 ft to 800 ft away from trench boundaries. This slug test data provides a range of hydraulic conductivity values for those areas outside of the trench excavation areas. Packer tests were performed at approximately 11 locations at varying depths also located outside of the trench excavation areas. A majority of the packer tests were performed at depths below the first confining layer below the excavation limit and were generally performed to gain knowledge in the lower strata. Neither slug nor packer test data were collected in the footprint of the trench excavation areas.

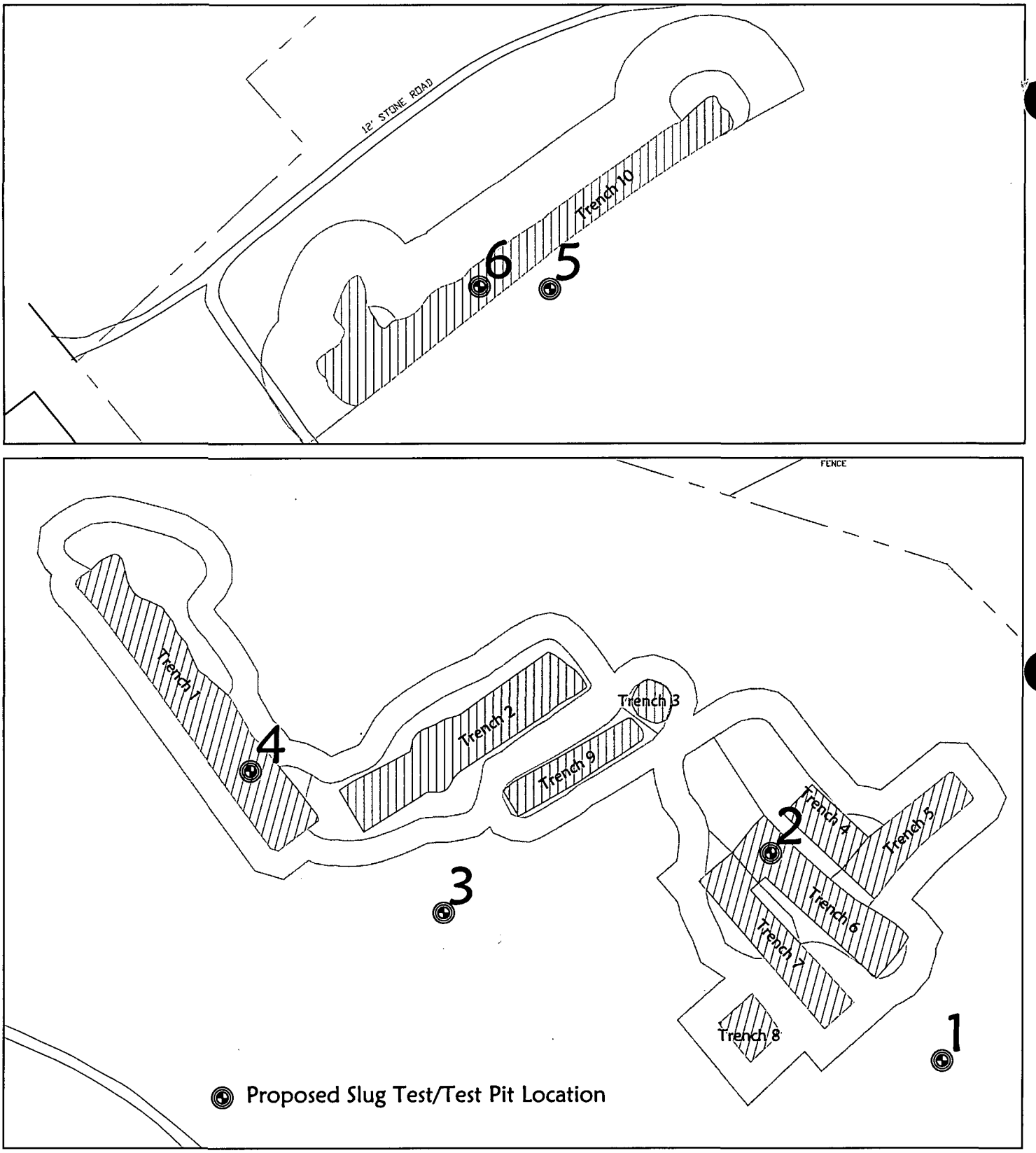
In light of the previous data collected in the RI, the primary objectives of the field effort tasks are twofold, **1)** collect new hydraulic conductivity data for points inside the trench excavation areas, and **2)** confirm existing hydraulic conductivity data for areas outside the trenches.

II. General Description of Tasks: This section outlines the two testing methods that could possibly be employed in order to gather the required data. **Figure A** shows the proposed locations of the selected testing method. Either one or a combination of both test methods may be used to acquire the necessary field data. The placement of the test locations incorporates both primary objectives of the field effort.

- **Slug Test**: This test involves using a drill rig to construct a simple 4-6 inch diameter borehole with fully slotted PVC casing, sand pack, and well head protection casing. The testing wells shall be located both within the trench and outside of the trench to predetermined depths (10-15 ft bgs). A slug would be introduced into the well and removed and based upon the stabilization rate, a hydraulic conductivity would be measured. The advantage of this method is that it does not produce any discharge water and produces minimal spoils. The wells are abandoned in place after testing.

- **Test Pit**: This test involves using an excavator to dig an open pit approximately 5 ft x 5 ft x 10-15 ft deep. The exact measurements of the pit are measured in the field based upon conditions encountered. The pit shall be dug at least 3 feet below the groundwater surface encountered, then pumped or excavated dry and allowed to stabilize. The volume of water and time of stabilization provide the necessary data. In addition, a visual classification of the soils could be ascertained. Soils shall be re-buried in the pit after completion of testing.

III. Logistical Considerations: Should a test pit be constructed and water discharged, considerations should be made for excavation pit soils and water containment. The prime contractor (Sevenson) has the ability to construct the test pits and should slug tests be performed a specialty contractor would be selected to drill the well points, install the wells, and collect the slug test data.



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www.glynngroup.com

PROJECT: SLDA, Task 2: Water Diversion and Trench Dewatering Design			FIGURE:
SUBJECT: Proposed Test Locations			A
CLIENT: Cabrera, USACE			
PROJ. NO.: 07-1196	SCALE: 1"=100'	DATE: 02.18.08	BY: LEW

FINAL

WASTE MANAGEMENT, TRANSPORTATION AND DISPOSAL (WMTD) PLAN

SHALLOW LAND DISPOSAL AREA
FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM (FUSRAP)
SITE REMEDIATION

PARKS TOWNSHIP

ARMSTRONG COUNTY, PENNSYLVANIA

May 2009

US Army Corps of Engineers ®

Prepared for:

U.S. ARMY CORPS OF ENGINEERS
BUFFALO DISTRICT
Buffalo, New York
PITTSBURGH DISTRICT
Pittsburgh, Pennsylvania

Contract Number W912P4-07-D-0002

☑ APPROVAL RECOMMENDED	5/14/09 Date	FJB Initials
☐ APPROVAL RECOMMENDED SUBJECT TO COMMENTS INDICATED	Date	Initials
☐ DISAPPROVAL RECOMMENDED	Date	Initials
APPROVED / DISAPPROVED	5/14/09 Date	James D Boyle Signature

Prepared by:

CABRERA SERVICES, INC.

473 Silver Lane
East Hartford, Connecticut 06118

WASTE MANAGEMENT, TRANSPORTATION, AND DISPOSAL (WMTD) PLAN SLDA FUSRAP SITE, PARKS TOWNSHIP, ARMSTRONG COUNTY, PENNSYLVANIA

Contract Number (No.) W912P4-07-D-0002

WMTD PLAN APPROVALS

By their specific signature, the undersigned certify that this Plan is approved for use during remediation of the SLDA FUSRAP Site, Parks Township, Armstrong County, Pennsylvania.

APPROVED BY:

John Eberlin 5/19/09

Cabrera Services, Inc. - Project Manager — Date
John Eberlin

Edward Johnson President for DW 5/21/09

Cabrera Services, Inc. – Senior Vice President — Date
David Watters, CHP

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ACRONYMS, ABBREVIATIONS, AND SYMBOLS

1,1-DCA	1,1-Dichloroethane
1,1,1-TCA	1,1,1-Trichloroethane
8-OH	8-Hydroxyquinoline
Ra-228	Radium-228
Th-232	Thorium-232
U-234	Uranium-234
U-235	Uranium-235
U-238	Uranium-238
Pu-239	Plutonium-239
Am-241	Americium-241
Pu-241	Plutonium-241
ARCO	Atlantic Richfield Company
B&W	Babcock and Wilcox, now BWXT
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CABRERA	Cabrera Services, Inc.
CFR	Code of Federal Regulations
CSP	Criticality Safety Plan
CQC	Contractor Quality Control
DAW	Dry Active Waste
DOT	U.S. Department of Transportation
DU	Depleted Uranium
EM	Engineering Manual
EPA	U.S. Environmental Protection Agency
EU	Enriched Uranium
FID	flame ionization detector
FOL	Field Operations Lead
FSP	Field Sampling Plan
ft^3	Cubic Feet
FUSRAP	Formerly Utilized Sites Remedial Action Plan
g	Gram
GC	Gas Chromatograph
GTCC	Greater Than Class C
Haz Cat	Hazard Categorization
HEPA	High Efficiency Particulate Air
HPGe	High Purity Germanium
IP-1	Industrial Packaging-1
IP-2	Industrial Packaging-2
IP-3	Industrial Packaging-3
ISOCS	*In-Situ* Object Counting System
LLRW	Low Level Radioactive Waste
LDR	Land Disposal Restrictions
LSA	Low Specific Activity
µCi	microCurie
MBA	Material Balance Area
MC&A	Material Control and Accountability
MLLRW	Mixed Low Level Radioactive Waste
NIST	National Institute of Standards and Technology
NRC	U.S. Nuclear Regulatory Commission
NUMEC	Nuclear Materials and Equipment Corporation
PCB	Polychlorinated Biphenyl
pCi	picocurie
PADEP	Pennsylvania Department of Environmental Protection
Pa. Code	Pennsylvania Code
PCP	Process Control Plan or Procedures
PFLT	Paint Filter Liquid Test
PID	photoionization detector
PM	Project Manager
QA	Quality Assurance
QAPP	Quality Assurance Program Plan
QC	Quality Control
R&D	Research and Development
RCRA	Resource Conservation and Recovery Act
RPP	Radiation Protection Plan
REGe	Reverse Electrode Germanium
SAP	Sampling and Analysis Plan
SSHP	Site Safety and Health Plan
SLDA	Shallow Land Disposal Area
SOP	Site Operations Plan
SNM	Special Nuclear Material
SRSL	Site Radiation Safety Lead
SVOC	Semi-Volatile Organic Compound

TBP	Tri-butyl Phosphate
TCE	Trichloroethene
ThC	Thorium Carbide or Thorium Monocarbide
ThO_2	Thorium Dioxide
ThO_2-UO_2	Thorium Dioxide-Uranium Dioxide
Trans-1,2-DCE	Trans-1,2-Dichloroethene
U	Uranium
UC	Uranium Carbide or Uranium Monocarbide
UC_2	Uranium Dicarbide
UF_6	Uranium Hexafluoride
UO_2	Uranium Dioxide
U.S.	United States
USACE	U.S. Army Corps of Engineer
UTS	Universal Treatment Standards
VC	Vinyl Chloride
VOC(s)	Volatile Organic Compound(s)
WAC	Waste Acceptance Criteria
WMTD	Waste Management, Transportation and Disposal

1.0 INTRODUCTION

1.1 Purpose and Objectives

Cabrera Services Inc. (CABRERA) has been selected by the United States (US) Army Corps of Engineers – Buffalo District (USACE) under Contract Number W912P4-07-D-0002/0001 to remediate the Shallow Land Disposal Area (SLDA) Site in Armstrong County Pennsylvania, hereafter referred to as the "SLDA Site" or "Site."

The overall objective of this project is to remove waste from the existing burial trenches, as well as contaminated soil in and around the waste, and process, package and transport the waste to an offsite disposal facility. Waste and contaminated soil removal will be sufficient to support the next phases of the project which include Final Status Survey and ultimate termination of the U.S. Nuclear Regulatory Commission (NRC) license for the SLDA Site, SNM-2001.

The purpose of this Waste Management, Transportation and Disposal (WMTD) Plan is to establish requirements for the following:

- remove waste previously disposed (buried) at the SLDA Site, as well as soil mixed with and around the waste;
- process this waste to meet the disposal site waste acceptance criteria (WAC); and
- package and ship this waste for off-site disposal at an appropriate, licensed and permitted disposal site.

Waste will be appropriately characterized to identify radiological contaminants and contaminant concentrations to address the requirements in Title 10 Code of Federal Regulations (10 CFR) Part 61, as well as non-radiological hazardous waste characteristics as required by the U.S. Environmental Protection Agency (EPA) in Title 40 CFR (40 CFR), Parts 262 and 265, and Pennsylvania Department of Environmental Protection (PADEP) in Pennsylvania Code (Pa. Code), Title 25, Chapters 260 to 270. Characterization of waste for radiological and non-radiological hazardous constituents will assure waste is acceptable for acceptance and disposal off-site. The designated off-site disposal facility for the SLDA Site waste is EnergySolutions in Clive, Utah (hereafter referred to as EnergySolutions).

Waste will be prepared, packaged, marked, labeled and transported in accordance with applicable U.S. Department of Transportation (DOT) requirements in Title 49 CFR (49 CFR), Subchapter C, NRC requirements in 10 CFR Parts 20, 61 and 71, and the EnergySolutions Waste Acceptance Criteria (WAC), provided in Appendix A. Engineering Manual (EM) 1110-35-01, *Management Guidelines for Working with Radioactive and Mixed Waste,* requires that USACE verify that the facility regulator (in this case, the State of Utah) has been contacted to ensure that the waste proposed for shipment and disposal meets the waste acceptance criteria. The State of Utah has deferred such responsibility to EnergySolutions under the facility license. Therefore, the review of the WAC and subsequent notification to transport by EnergySolutions will serve to meet the EM requirement for this project.

1.2 Site Information

The SLDA site was formerly owned by Nuclear Materials and Equipment Corporation (NUMEC), which also operated the Apollo Nuclear Fuel Fabrication Facility. In the 1960s and 1970s, the site was used by NUMEC to dispose of radioactive waste (contaminated primarily

with uranium and thorium) in accordance with the regulations found in the now rescinded 10 CFR 20.304. During this period, NUMEC also disposed of non-radioactive wastes on the site. The Atlantic Richfield Company (ARCO) purchased all of the NUMEC stock in 1967. In 1971, ARCO then sold the stock to Babcock and Wilcox (B&W), who later became BWX Technologies (BWXT).

Waste materials were placed into a series of trenches, including nine trenches in a topographically elevated area in the eastern/central part of the site (Trenches 1 through 9) and one in a topographically lower area about 305 meters (1,000 feet) northwest of the upper trenches (Trench 10). The upper and lower trench areas occupy approximately five acres, with an estimated total trench surface area of approximately 1.2 acres. The disposal trenches were numbered 1 through 10 based on their respective assumed dates of construction, with 1 being the oldest trench and 10 being the most recently constructed.

Wastes placed within the SLDA trenches consisted of process wastes (slag, crucibles, spent solvent, unrecoverable sludges, organic liquids, debris, etc.); laboratory wastes (sample vials, reagent vials, etc.); old or broken equipment; building materials; protective clothing; general maintenance materials (paint, oil, pipe, used lubricants, etc.); solvents (trichloroethene, methylene chloride, etc.); and trash (shipping containers, paper, wipes, etc.). Some of the wastes were placed in cardboard and metal drums, some were bagged, and some, particularly pieces of equipment and building materials, were placed in trenches with no special packaging or containers.

Between 1961 and 1970, the trenches at the SLDA site were excavated in the order of their numbering and reportedly capped with four feet of soil once disposal operations ceased. The estimated average waste thickness in Trenches 1 through 9 reportedly ranged from 2.6 to 4.8 meters (8.5 to 15.8 feet). The estimated waste thickness in Trench 10 is 5.5 meters (18.1 feet). The total estimated volume of potentially contaminated waste and soil in the ten trenches is between 17,970 and 27,520 cubic meters (23,500 and 36,000 cubic yards).

The wastes placed in the disposal trenches were generated primarily from activities conducted under NUMEC's Apollo Facility license. The Apollo Facility processed uranium and, to a much lesser extent, thorium. Processing operations included conversion of uranium hexafluoride (UF_6) to uranium dioxide (UO_2) by the ammonium diuranate process, and subsequent metallurgical and ceramic processes to produce uranium compounds and nuclear fuel components. The entire UF_6 conversion process resulted in uranium-235 (U-235) enriched uranium-bearing nuclear fuel compounds such as uranium metal, UO_2, uranium monocarbide (UC), and uranium dicarbide (UC_2). A corollary process for thorium produced thorium dioxide (ThO_2), ThO_2-UO_2, and UC-thorium monocarbide (ThC) as sintered pellets, powder, and other particulate forms. Process wastes, including off-specification products and incinerated high-efficiency particulate air (HEPA) filters and rags, were recycled at the Apollo facility in a nitric acid solvent extraction scrap recovery process to recover usable uranium. The Apollo plant processed uranium at a capacity of 350 to 400 metric tons/year.

The uranium-contaminated materials placed in the trenches are present at various levels of enrichment, ranging from depleted to highly enriched uranium. Activity percentages indicate levels of enrichment from less than 0.2 percent U-235 (by weight) to greater than 45 percent U-235.

Non-radiological contaminants buried in the disposal trenches were not specifically documented as were radionuclides. The Nuclear Material Discard Reports (NMDRs) that comprise the bulk of the waste disposal documentation list only the radiological materials of interest (U-235, total U, and thorium). Any other information, such as the presence of specific metals or compounds, or the waste origin process, was qualitative. Raffinate (waste aqueous phase from the solvent extraction step) was treated prior to discharge into a local stream outfall, although NUMEC records indicate that some raffinate may have been disposed of at the SLDA. Recoverable used solvent was recycled.

Fuel fabrication and other metal working operations used lubricants, solvents (e.g., trichloroethene [TCE], methylene chloride, etc.), and acids that may have been disposed of in the SLDA. Spent equipment disposed of in the SLDA may have contained lubricants and hydraulic fluids. The process control and research and development (R&D) laboratories were also sources of wastes disposed of at the SLDA. Spent solvent, unrecoverable sludges and filtration media, and other process wastes were disposed of in the SLDA but are not quantified in the records.

In general, the solvents disposed of in the SLDA consisted of tributyl phosphate (TBP), TCE and other chlorinated solvents, and kerosene. Review of the historical database and compounds detected at the SLDA indicates that volatile organic compounds (VOCs) of concern include TCE; trans-l,2-dichloroethene (trans-1,2-DCE); vinyl chloride (VC); 1,1,1-trichloroethane (1,1,1-TCA); 1,1-dichloroethane (1,1-DCA); chloromethane; and benzene, toluene, ethylbenzene, and xylenes (BTEX). Trans-1,2-DCE and VC are possible degradation products of TCE, and l,l-DCA may be a degradation product of 1,1,1-TCA. BTEX are common constituents of fuels and solvents.

The historical records did not indicate the burial of metallic compounds other than those directly associated with Apollo operations. Metals processed at the Apollo facility include beryllium, zirconium, and beryllium and zirconium compounds or alloys. In addition, the scrap recovery process utilized nitric acid, which forms soluble nitrate salts with most metals. This may have resulted in the inadvertent disposal of small amounts of other metallic compounds. If acids were also disposed of in the trenches, they may have leached and mobilized various naturally-occurring metals in the site soils. The Apollo process also used basic compounds such as ammonium hydroxide; lime was used to neutralize hydrofluoric acid waste prior to disposal.

Two semivolatile organic compounds (SVOCs) are known to be associated with operations at Apollo: TBP and 8-hydroxyquinoline (8-OH). Other potential SVOCs present at the site include phthalates (from the disposal of gloves and other plastic materials) and kerosene constituents.

The primary radiological contaminants of concern (RCOC) in soil and buried waste include americium-241 (Am-241), plutonium-239 (Pu-239), plutonium-241 (Pu-241), radium-228 (Ra-228), thorium-232 (Th-232), uranium-234 (U-234), U-235 and uranium-238 (U-238). Uranium isotopes are present in various enrichments, ranging from depleted uranium (DU) to highly enriched uranium (uranium enriched to 20 percent or greater in the isotope U-235).

As a result of the historical review, interviews with personnel and past characterization efforts, the estimate of waste and soil contained in each of the disposal trenches is identified in Table 1-1.

Table 1-1: Waste Description and Estimated Volumes

Source of Waste	Waste Description	Estimated Volume (ft^3)	Primary Contaminant(s)
Disposal Trench 1	Drums and bags of waste, miscellaneous debris.	125,000	Uranium, beryllium
Disposal Trench 2	Drums of organic liquids, powders, sand, leached solids (ash and residue).	110,000	Uranium, enriched uranium, organic liquids
Disposal Trench 3	Contaminated soil	5,000	Uranium (enrichment unknown)
Disposal Trench 4 and 5	Uranium-beryllium scrap solutions, empty shipping containers, various process waste, debris, equipment, demolition debris and DAW	85,000	Uranium (enrichment unknown), beryllium
Disposal Trench 6	Drums, 2-quart bottles, leached ashes and solids, scrap metal, glass, debris and process waste.	110,000	Uranium, enriched uranium, thorium
Disposal Trench 7	Drums, boxes, 2-quart bottles, spent organic solutions, other liquid waste, contaminated oil, zirconium-beryllium, scrap recovery waste, misc. scrap, vacuum chamber.	100,000	Uranium, enriched uranium, beryllium, organic solutions
Disposal Trench 8	Drums, leached residues and scrap, contaminated soil, DAW	30,000	Uranium and enriched uranium
Disposal Trench 9	Contaminated soil, equipment, scrap wood.	55,000	Uranium (enrichment unknown), plutonium
Disposal Trench 10	Laboratory waste, building demolition debris, equipment and scrap metal, contaminated truck.	370,000	Uranium, enriched uranium, thorium

2.0 ORGANIZATIONAL STRUCTURE

Key project personnel are described in Section 3 of the *Site Operations Plan* (SOP) (CABRERA, 2009d). This description includes the organizational structure of the project team, personnel responsibilities and authority, lines of reporting, phone numbers of key project personnel, a table of key project personnel, and an organizational chart.

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3.0 WASTE MANAGEMENT

The process for initial screening of trench waste *in situ*, waste removal and initial segregation of waste, waste processing, and preparation of waste for disposal are discussed in the following sections.

3.1 Nuclear Criticality Safety and Material Control and Accountability Plans

The contaminants at the SLDA site include radionuclides that are considered special nuclear material (SNM). The U.S. Nuclear Regulatory Commission (NRC) defines SNM as:

> *(1) Plutonium, Uranium- 233, Uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51 of the act, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing but does not include source material.*

Of these radionuclides, Uranium-235 is the primary constituent in SNM at the SLDA site. As indicated in the SLDA Remedial Investigation (RI) and Feasibility Study (FS), the Uranium-235 enrichment (equivalent to the weight percent of Uranium-235 in the mix of primary Uranium isotopes: Uranium-234, Uranium-235 and Uranium-238) in waste within the disposal trenches has a range of approximately 0.2 to greater than 40 percent.

Fissile material, although sometimes used as a synonym for fissionable material, is any material fissionable by thermal (slow) neutrons. The three primary fissile materials are Uranium-233, Uranium-235, and Plutonium-239. The NRC defines fissile material as:

> *Materials that contain Plutonium-238, Plutonium-239, Plutonium-241, Uranium-233, Uranium-235, or any combination of these nuclides. Unirradiated natural uranium and depleted uranium, and natural uranium or depleted uranium that have only been irradiated in thermal reactors are not included in this definition.*

Fission is defined as:

> *The process of splitting a heavy nucleus into two lighter nuclei. Spontaneous fission is a type of radioactive decay for some nuclides, such as Californium-252. In other nuclides fission is induced through the reaction of an incident radiation with the nucleus. Neutron-induced fission of Uranium-235 is a common example. Considerable energy is released during the fission reaction and this energy can be used to produce heat and electricity.*

Although not included in this definition, the energy released during a fission reaction can be significant. The production of heat and electricity are beneficial uses of the nuclear fission process, and if the fission process is maintained within very specific controls can be extremely safe. However, the potential energy released from an inadvertent fission reaction (nuclear criticality incident) can result in significant consequences, primarily to personnel in the immediate vicinity handling the material.

Since the primary SNM in SLDA waste is Uranium-235, which is fissile, it is necessary to incorporate requirements into project plans to assure the material is handled safely from the time it is removed from the disposal trenches until transported for offsite disposal. Of particular importance is the need to manage SNM such that the mass and configuration of fissile material are maintained in accordance with control limits to prevent an inadvertent nuclear chain reaction,

i.e., nuclear criticality.

Although the SNM at the SLDA site are in low concentrations, with a limited mass of enriched uranium available, and the potential for a nuclear criticality incident is extremely low, it is necessary to establish precautionary controls to ensure these conditions are maintained throughout all project activities. These controls are established in the SLDA Nuclear Criticality Safety Plan. Although many definitions of Nuclear Criticality Safety include "prevention or termination of inadvertent nuclear chain reactions", the key component of the SLDA Nuclear Criticality Safety Plan focuses on "prevention."

Because of the inherent properties of SNM discussed above, the NRC also has specific regulations regarding control and accountability in 10 CFR 73 and 10 CFR 74. To assure compliance with these regulations, the SLDA project has developed a *Material Control and Accountability (MC&A) Plan* (Appendix F). This Plan tracks the quantities of SNM removed from the trenches through receipt of the material at the offsite disposal site, maintains records of these "material transactions", and institutes security measures as required by the NRC.

Since the Criticality Safety and MC&A Plans are so closely related, the SLDA project has prepared these plans such that they work together to assure the safe handling and disposal of SNM from the SLDA site.

3.2 *In Situ* Screening and Visual Observation of Trench Material

Following removal of the upper 3 feet of cover soil in each trench (overburden soil), additional soil will be carefully excavated until indications of buried waste are observed. Once this point is reached, further soil removal will be guided by field radiological measurements using portable survey instruments and an *In-Situ Object Counting System* (ISOCS) and visual observation for drums, other containers or objects, and oversized debris. A gamma walkover survey will be performed over 100% of each lift of material and supplemented by ISOCS measurements based upon the potential for enriched uranium to be present. The ISOCS analysis result will be used to estimate the concentration, SNM mass and Uranium enrichment in the soil. This information will then be used to determine if there is a mass of soil, or an object, that needs to be segregated from the bulk waste. The results of the visual observations (and flame ionization detector/photoionization detector (FID/PID) screening) will be used to determine if potential mixed waste should be segregated from the bulk waste. The visual observations will also identify drums, containers, and large debris for removal from the bulk waste.

3.3 Waste Removal and Initial Segregation

The FOL and the Waste Manager will use the screening results and visual observations to plan the excavation of each one foot lift of waste material. The *in situ* screening and visual observation results coupled with FID/PID screening will be used to initially screen the waste to determine if the material should be managed as potential low level radioactive waste (LLRW) or mixed low level radioactive waste (MLLRW).

3.3.1 Management of Waste Based on Initial SNM Mass Estimate

Once the *in situ* screening is complete, the SNM Accountability Officer will review the results, estimate the U-235 mass and determine the maximum volume or mass of waste allowed to be removed from the trench. This will include a review of the current inventory of waste present in all MBAs, either in temporary storage or being processed. The Accountability Officer is

responsible for monitoring the SNM inventories in all MBAs to ensure that the total exhumed inventory will not exceed the SLDA project SNM inventory limits shown in the *Material MC&A Plan* (Appendix F).

The Waste Manager and FOL will direct removal of the volume of waste based on the SNM Accountability Officer's determination of SNM allowance. If a larger object is observed during removal of the waste volume and removal of the object requires excavation to depth greater than the one foot lift, the Site Radiation Safety Leader (SRSL) will coordinate any additional screening surveys that will be required to estimate the SNM content and comply with the *Criticality Safety Plan* [Appendix A of the *Radiation Protection Plan (RPP)* (CABRERA, 2009a)]. The SNM Accountability Officer will assess the SNM mass in or on this object against the current SNM inventory. If the SNM mass will result in exceeding the allowed above ground SNM inventory if the object is removed, the object will be set aside within the trench, with removal pending available SNM inventory. In order to maintain a smooth work flow, SNM in the later stages of processing and packaging will be expedited for shipping.

If the initial SNM screening indicates that the SNM enrichment is > 20%, the mass of the suspect material will be evaluated to ascertain if a Category II condition (> 1 kg) exists. If so, the material must be transferred to the designated Category II SNM storage area. Up to 5 kg of >20% enrichment material may be stored in the Category II storage area, provided all conditions in the MC&A Plan are met. All materials stored in the Category II storage area must be placed in a container that can be sealed and labeled (e.g., drum, B-25 box, etc.). The SNM Accountability Officer will track the inventory of the Category II storage area and inform the Corporate Radiation Safety Officer and Project Manager when the inventory approaches 80% of the limits provided in the MC&A Plan. Any shipments of Category II SNM will require a security plan that meets the requirements of 10 CFR 73.67(c), which will be prepared and submitted for USACE and NRC review at least 6 months prior to any shipments of this kind.

3.3.2 Mixed Waste Segregation

In order to minimize the generation of potential mixed waste (MLLRW), field crews will attempt to identify and segregate potential MLLRW early in the process. This practice will minimize the inadvertent combination of MLLRW with LLRW, in order to minimize the added costs for managing large amounts of MLLRW. Potential MLLRW will be identified from the FID/PID headspace and on-site Gas Chromatography (GC) analysis that is described in the *Sampling and Analysis Plan* (SAP) (CABRERA, 2009b). The analysis is expected to identify potential waste issues from solvent like liquids in containers and sludge from broken containers including leaking drums. These potential mixed wastes are assumed to exceed the EnergySolutions WAC and will require treatment prior to disposal. The WAC limits are based on RCRA Land Disposal Restrictions (LDR) from EPA, shown in 40 CFR Part 268.

Intact containers and drums will be removed using the drum handling requirements specified in Attachment D of the SSHP, which is Appendix A of the *Accident Prevention Plan (APP)* (CABRERA, 2009c). The lids of intact drums will be punctured to allow gases in the drum headspace to vent prior to drum movement. Each drum will be removed individually and placed in close proximity to the excavation for initial screening to determine the potential U-235 mass and uranium enrichment. Liquid leakage into surrounding waste materials from ruptured drums will be minimized through the use of absorbent materials. Each drum will then be placed in an

overpack for transport to the Material Sorting and Processing Facility. Small intact containers will be collected as efficiently as practicable using mechanical or hand methods. Absorbent material will be used to help managed the spread of liquid chemicals from broken containers.

Potential mixed waste will be excavated directly from the trench and placed into either an Articulated hauler (or a lined intermodal container if the waste is wet) for transport to the Material Sorting and Processing Facility for further hazard categorization (Haz Cat) characterization.

3.3.3 Debris Segregation

The decision to segregate large debris is at the discretion of the excavation crew. Large debris will be segregated and gathered at the edge of the excavation. The debris will be loaded into an articulated hauler for transport to the Material Sorting and Processing Facility when a sufficient quantity of debris is gathered to warrant transport. It is unlikely that debris will be found that will require sizing at the trench rather than the Material Sorting and Processing Facility.

3.3.4 Bulk Excavation

The remaining waste will be bulk excavated. The waste will be loaded into an Articulated Hauler for transport to the Material Sorting and Processing Facility.

3.4 Waste Processing

Waste will be processed to meet the requirements specified in the EnergySolutions WAC provided in Appendix A. Waste that cannot be processed to meet these specifications will be set aside for determination of an appropriate alternate disposal option. All soils with radiological constituents below the DCGLs, and which have been identified as RCRA characteristic, will be set aside and stored in accordance with its RCRA characteristics in a designated location pending determination of the appropriate method of disposal. Soil and soil-like material, as defined in the EnergySolutions WAC, will be processed as indicated in Appendix E, Chart 1. Solid debris will be processed as indicated in Appendix E, Chart 2. Other solid waste will be processed as indicated in Appendix E, Chart 3. Liquid waste will be processed as indicated in Appendix E, Chart 4.

3.4.1 Material Sorting and Processing Facility

A temporary structure will be erected on a paved (asphalt and/or concrete) surface to accept, sort, process, and package waste for transport. As indicated in the SOP, in order to provide sufficient space for material sorting and processing operations it is anticipated that the temporary facility will be a sprung type structure 150 feet by 400 feet by 40 feet high. The structure will be equipped with an air extraction system, which will enable the air to be HEPA filtered to remove dust particulates and carbon treated to remove VOC vapor. The floor of the building will be paved, made impermeable to contamination migration, and constructed with a sump to allow the collection of water from seepage of wet waste material. Water collected in the sump will be pumped to the onsite water treatment plant.

A design package for the Material Sorting and Processing Facility including the structural design, the floor design, and the air handling/treatment will be engineered and the specifications developed for USACE review and approval.

3.4.2 Bulk Waste

The waste will arrive from the trench in an Articulated Hauler and unloaded at the receiving portion of the Material Sorting and Processing Facility. A Wheeled Loader will transfer the waste from the receiving area to the Screen Plant equipped with a vibratory screen (i.e., grizzly) with four-inch openings to separate soil (four-inch minus) from debris (four-inch plus). Material not passing through the grizzly will be deposited in a temporary (debris waste stream) stockpile to the side of the screen plant. Material passing through the grizzly will discharge to a conveyor that will deposit soil in a separate (screened waste stream) stockpile. The screened waste will be assessed for compliance with the disposal facility WAC definitions of a compactable soil like material and a moisture content near optimum. If appropriate, the soil will be screened further to remove additional debris using finer mesh screens and to reduce moisture content. Decisions to further process the soil will be coordinated between the Waste Manager, FOL, and USACE.

Process Sampling and On-Site Laboratory Analyses

The waste will be sampled after screening for VOC headspace and SNM characterization at the on-site laboratory. The headspace results are used as a qualitative indicator to determine if VOCs are present in the soil. If VOCS are detected during headspace analysis, a sample may be obtained for GC analysis at the on-site laboratory. The results of the GC analysis will be used to assist with waste handling and segregation determinations. Based on the GC results, the waste will be combined with similar wastes from one of the following waste streams:

- VOCs below RCRA characteristic limits and the waste is managed as LLRW
- VOCs above RCRA characteristic limits (but less than LDR/Universal Treatment Standards (UTS) limits defined in 40 CFR 268.48) requiring the waste to be managed as a mixed waste
- VOCs above RCRA LDRs requiring the waste to be managed as a mixed waste. The waste will require treatment (to below LDR/UTS limits) prior to disposal. The disposal facility's WAC has the same LDR limits.

Waste Characterization Sampling and Laboratory Analysis

The soil and debris waste streams will be temporarily staged in 250-CY stockpiles (or a smaller sized stockpile as appropriate to meet requirements defined in the disposal facility waste acceptance criteria) using the Loader. One composite sample will be collected from each of these stockpiles and laboratory analysis performed to verify compliance with the waste profile accepted by the disposal facility WAC. Radiological and chemical analyses for disposal characterization are described in the Field Sampling Plan (FSP) portion of the SAP. Soil and debris waste streams will be loaded into lined intermodal containers using the Loader following receipt of disposal characterization laboratory results verifying LLRW disposal classification.

Stockpiles of soil and debris exhibiting RCRA hazardous waste characteristics will be divided into five smaller (approximately 50 CY) piles using the Loader and samples will be collected from these new stockpiles for laboratory analysis. These lab results will be used to further segregate these stockpiles into LLRW and MLLRW soil and debris waste streams for the purpose of minimizing off-site disposal cost. The project SAP provides a more detailed description of waste sampling and laboratory analysis.

All soils with radiological constituents below the DCGLs, regardless of RCRA characteristic

limits, will be stockpiled appropriately on-site, as required by USACE.

3.4.3 Potential Mixed Waste Processing

Potential mixed wastes suspected to be RCRA hazardous that were excavated in bulk at the trench due to leaking drums or sludge like material will be delivered to the same dedicated area of the Material Sorting and Processing Facility used for the containers and drums discussed above. Absorbent material may be added to the waste to remove free liquids.

The waste material will then be processed through the screening plant to remove debris larger than four inches. If possible, the screened waste may be further screened down to a ¾ inch mesh if necessary to achieve a WAC waste classification of a compactable soil like material. The screened waste will be sampled at the end of the conveyor for VOCs headspace (and potential GC analysis) and SNM characterization at the on-site laboratory. The sample results will be used to determine the appropriate disposal waste stream (defined above) The waste material will be placed into a stockpile area for that waste stream and characterized for waste profile compliance with the disposal facility WAC as defined in the SAP. TCLP analyses will be performed at an off-site laboratory for the analytes defined in the FSP. Waste determined to be MLLRW above LDR/UTS will be evaluated for treatment using either on-site or off-site options.

3.4.4 Debris Processing

Oversized debris delivered directly from the trenches or debris separated at the screening plant will be sized to comply with size restrictions in the disposal facility WAC. Disposal cost is higher for oversized debris (dimensions greater than 12 feet by 10 inches by 10 inches) than LLRW debris smaller than those dimensions at that facility. Smaller-sized debris also facilitates more efficient use of waste packages (containers), reducing waste transport cost.

Large pieces of LLRW debris will be reduced in size (i.e., sized) to below the above-reference dimensions to achieve cost savings. An excavator equipped with a hydraulic shear will be used to reduce large pieces of debris to a more manageable size. Cutting torches may also be used for sizing select debris. Some debris will be further reduced in size for blending with the soil waste stream using a mechanical shredder. Four-inch plus material rejected by the Screen Plant will also be processed through the shredder for size reduction. Some of the sized (i.e., less than four-inch diameter material) debris will be blended into the soil waste stream using the loader.

3.4.5 Processing of Containers and Drums

Containers and drums delivered to the Material Sorting and Processing Facility will be managed in an area of the facility dedicated to the sampling, hazardous categorization, VOC characterization, treatment (if required), and packaging for disposal. The dedicated area will include appropriate ventilation to prevent the accumulation of hazardous or radioactive fumes and secondary containment for potential spills. The area will also be equipped to facilitate container and drum sampling. The SSHO, SRSL, Waste Manager and FOL will coordinate waste processing to ensure safe and efficient operations. The remainder of this section provides the process flow of containers and drums to packaging and disposal.

Container and Drum Sampling

Container samples will be obtained as described in the Field Sampling Plan (FSP). Each container will be assessed for Haz Cat following the procedure in Appendix G of this WMTD

Plan. The Haz Cat will evaluate the contents of the containers and drums for the following categories:

- Air Reactivity;
- Phase Determination;
- Flame Ignitability;
- Beilstein's Test;
- Water Solubility and Reactivity;
- Hexane Solubility;
- Inorganic Oxidizers;
- Peroxides;
- PH;
- Sulfide and Cyanide

Compatible container contents will either be combined into a drum or packaged separately in a lab pack type package depending on the volume of containers generated. The characterization samples from the compatible containers will be composited and analyzed for waste profiling. Treatment and disposal options will be evaluated and a cost effective solution selected. The Waste Manager will be responsible to arrange manifesting and shipping papers for the container treatment and disposal. The container will be stored in a RCRA compliant storage area pending transportation.

3.5 Processed Waste Sampling Profile and Disposal Facility Acceptance

Each waste stream will be sampled and the waste confirmed to meet the criteria in 10 CFR 61 for Class A waste, the only classification of LLRW accepted at EnergySolutions. Sampling will be performed, as specified in the SLDA SAP, to:

- Identify and quantify radioactivity in waste to properly classify the waste in accordance with 10 CFR 61 and the EnergySolutions WAC.
- Determine the U-235 mass and uranium enrichment to verify the waste meets the EnergySolutions WAC and determine the appropriate waste packaging for transport and disposal in accordance with DOT regulations and 10 CFR 71, if applicable.
- Determine the hazardous characteristics of the waste to guide further processing of the material and verify the waste meets the EnergySolutions WAC.
- Address each of the parameters listed on the EnergySolutions Waste Profile Record.

EnergySolutions cannot accept the following waste:

- Waste that is determined to be greater than Class A, i.e., Class B, Class C or greater than Class C (GTCC).
- Waste containing special nuclear material in excess of the concentrations or quantity specified in the WAC.
- Non-radioactive hazardous waste.

- Mixed waste that contains hazardous materials not identified in the RCRA Part B permit.

Waste that falls into any one of the previously listed categories cannot be shipped to EnergySolutions for disposal. This waste, if any, will be set aside and stored in accordance with its characteristics in a designated location pending determination of the appropriate method of disposal.

Waste streams or packaged waste that is not Class A waste, e.g. Class B or Class C waste, will be set aside for determination of the appropriate disposal option. Each waste stream will also be sampled to determine the U-235 mass per disposal package and uranium enrichment. Waste that does not meet the disposal site SNM limitations as indicated in the EnergySolutions WAC will also be set aside for determination of the appropriate disposal option.

A waste profile will be completed for each waste stream using the EnergySolutions Radioactive Waste Profile Record, form EC-0230, provided in Appendix B. For waste containing SNM, the EnergySolutions SNM Exemption Certification, form EC-0230-SNM, provided in Appendix C shall be completed. For waste containing polychlorinated biphenyls (PCBs), the EnergySolutions PCB Certification, form EC-98279, provided in Appendix D shall be completed. Prior to completing these forms, the preparer shall verify the forms used are the most recent revision.

3.6 Waste Packaging

Waste will be packaged to assure compliance with the EnergySolutions WAC and assure compliance with the DOT and 10 CFR 71, if applicable, for transportation. This includes selection of the appropriate shipping container, verification the container meets the specified design criteria as evidenced by the certification documents, loading waste in the designated packages, and marking and/or labeling each package in accordance with regulatory and disposal site requirements.

If the waste contains fissile material, it is necessary to determine if the material is "fissile excepted" per DOT and if the material is subject to the requirements in 10 CFR 71.

Waste will be packaged for shipment as follows (see Notes below):

- Waste that is "fissile excepted", solid and meets the definition of low specific activity (LSA)-I will be shipped in an Industrial Packaging-1 (IP-1).
- Waste that is "fissile excepted", liquid, meets the definition of LSA-I and shipped exclusive use will be shipped in an IP-1.
- Waste that is "fissile excepted", liquid, meets the definition of LSA-I and shipped non-exclusive use will be shipped in an IP-2.
- Waste that is a solid and meets the definition of LSA-II will be shipped in an IP-2.
- Waste that is a liquid, meets the definition of LSA-II and shipped exclusive use will be shipped in an IP-2.
- Waste that is a liquid, meets the definition of LSA-II and shipped non-exclusive use will be shipped in an IP-3.

- Waste that meets the definition of LSA-III and shipped exclusive use will be shipped in an IP-2.
- Waste that meets the definition of LSA-III and shipped non-exclusive use will be shipped in an IP-3.
- Waste that does not meet the definition of LSA and the radionuclide activity does not exceed the A_2 activity limit, or for multiple radionuclides, the sum of the A_2 fractions does not exceed unity, will be shipped in a Type A package.
- Waste that does not meet the definition of LSA and the radionuclide activity does exceed the A_2 activity limit, or for multiple radionuclides, the sum of the A_2 fractions exceeds unity, will be shipped in a Type B package.

Note 1: For waste meeting the definition of LSA, a Type A package may be used in lieu of an IP-1, IP-2 or IP-3.

Note 2: Waste containing fissile material subject to the requirements in 10 CFR 71 shall be shipped in a Type A or Type B package as specified in the regulation.

3.7 Waste Transportation

Waste will be transported from the SLDA Site by the transportation subcontractor. As there is no on-site rail access, waste packages (intermodal containers) will be transported by truck to the Alaron rail transload facility in Wampum, PA for transport by rail to EnergySolutions. The Waste Manager will ensure that each waste shipment is accompanied by properly completed shipping documents and use appropriate documents as required by Federal, State, and local laws and regulations. The NRC Uniform Low Level Radioactive Waste Manifest (540/541 forms) and an NRC Form 741 Nuclear Material Transfer Form will be completed for each SLDA waste container. In addition, for any low level mixed waste shipments, a RCRA Uniform Hazardous Waste Manifest and the Land Disposal Restriction Notification and/or Certification will be required. Final shipping documents will be submitted to a USACE representative for review and approval a minimum of five calendar days prior to the first shipment of waste, and seven calendar days for subsequent shipments. All completed manifests requiring shipper's certifications will be signed by a USACE representative prior to release of each shipment.

3.7.1 Procedure for Material Loading

Prior to loading material for transport, the Waste Manager will:

- Obtain the SNM information from the applicable MBA from the Accountability Officer.
- Ensure all prior EnergySolutions pre-shipment notifications are complete and authorization to ship has been received.
- Verify the SLDA Site has the most recent copy of the EnergySolutions license, including amendments.
- Verify the waste has been prepared for shipment in accordance with the EnergySolutions license and WAC, as well as applicable DOT and NRC regulations.
- For bulk packages, verify that the USACE required disposal marking is applied to at least two sides of the package prior to shipment.

- Verify the SLDA Site has a copy of package certification records and packaging has been performed in accordance with requirements specified in the certification, if applicable.
- Verify all waste packaging records are complete.

The Waste Manager will prepare a loading plan for each shipment prior to arrival and loading of the truck based on the inspection, characterization, and survey data generated by the waste processing. The Waste Manager will oversee waste loading and will be responsible for ensuring the following requirements are met:

- Conduct and document a visual inspection of the conveyance and ensure any discrepancies are corrected prior to loading. This inspection shall include all vehicle safety devices, brakes, and tie-down devices as applicable.
- The Waste Manager shall inspect all packages as they are loaded to ensure that the packages are in full compliance DOT and NRC regulations, as applicable, and requirements for shipment to EnergySolutions. Incompatible materials shall be segregated and re-inspected.
- Upon completion of loading, visually verify that all packages are loaded.
- Verify the proper use of blocking, bracing, dunnage, and tie-down, as appropriate.
- Verify the conveyance is properly marked, labeled and placarded, as applicable.
- Perform and document a contamination and radiation survey of the waste conveyance and ensure that the results are in compliance with DOT and other applicable requirements.

3.7.2 Post Loading Requirements

The Waste Manager is responsible for ensuring that the following requirements are met:

- Review all paperwork to ensure legibility.
- Verify the conditions in the SLDA Transportation Security Plan and shipper's Transportation Security Plan are understood and shipment will be performed in accordance with Plan requirements.
- Verify that the transporter's representative understands all special instructions such as maintenance and prior notification requirements.
- Have the transporter's representative and USACE sign all required forms. The USACE signature block must be marked "on behalf of the USACE".
- Make any additional pre-shipment notifications. This might include pre-notifications required by individual states or corrections to information already provided in previous notifications. Forward copies of the Radioactive Shipment Manifest cover sheets to the conveyance recipient, as applicable.

3.7.3 Post Shipment Requirements

Following shipment, the Waste Manager shall ensure the following requirements are met:

- Verify all records are complete for the shipment and copies filed at the SLDA Site.

- Arrange for regularly scheduled in-transit updates from MHF Logistical Solutions until the conveyance reaches the disposal facility.
- Verify receipt notification is obtained once the shipment arrives at the final destination and shipment records updated, as necessary.
- Resolve any shipment discrepancies that may be identified as a result of inspections of the conveyance and/or package waste at Energy Solutions.
- Receive the Disposal Certification Form from Energy Solutions, compare to the shipment records for accuracy and attach to the shipment file.

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4.0 HEALTH AND SAFETY

The SLDA APP and RPP describes the health and safety and radiological guidelines and controls that will be used at the SLDA Site during site development, waste processing, and waste loading and shipping activities. These guidelines were developed to protect onsite personnel, visitors, and the public from physical harm and exposure to hazardous materials during these activities.

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5.0 QUALITY ASSURANCE / QUALITY CONTROL

5.1 Equipment Calibration and Quality Control

5.1.1 Radiological Instrumentation Calibration/QC Requirements

Equipment and instruments used in the SLDA Site waste processing operation will be maintained and calibrated to manufacturer's specifications. A project file will be kept for all equipment used in field analyses. Current calibration/maintenance records will be kept onsite for review and inspection of all instruments used during the survey. The records will include, at a minimum, the following:

- Name of the equipment.
- Manufacturer.
- Equipment identification (model and serial number).
- Date of calibration.
- Calibration due date.

Instrumentation will be maintained and calibrated to manufacturers' specifications to ensure that required traceability, sensitivity, accuracy and precision of the equipment/instruments are maintained. Instruments will be calibrated at a facility possessing appropriate NRC and/or Agreement State licenses for its calibration sources, which shall be NIST-traceable. Field instruments will be source checked daily in order to ensure that the calibration is current. Written records of daily checks will be maintained in the project file.

5.1.2 Instrumentation Quality Control and Trending

Instruments will be quality control (QC)-checked by comparing the instrument's response to ambient background and to appropriate alpha, beta, or gamma radiation sources before daily use. More frequent checks may be required at the discretion of the SRSL. The results of the ambient background and source checks will be recorded in a field instrument logbook, instrumentation logs, and/or electronically.

Source checks will consist of counts for a pre-determined time with the designated source position in a reproducible geometry and performed at a designated location. Instrument response to the designated QC check source will be plotted on control charts and evaluated against the average established at the start of the field activities. A performance criterion of ± 20% of this average will be used as an investigation action level. The SRSL will investigate results exceeding this criterion and will make appropriate corrections to instrument readings if response variation is due to factors beyond personnel control, such as large humidity or temperature changes. The SRSL has authority to decide whether or not the instrument is acceptable to use or must be removed from service.

During QC checks, instruments used to obtain radiological data should be inspected in accordance with applicable protocols for physical damage, current calibration, and erroneous readings. The individual performing these tasks shall document the results in accordance with the associated instrument protocol. Instrumentation that does not meet the specified requirements of calibration, inspection, or response check will be removed from operation. If the

instrument fails a QC response check, any data obtained up to that point, but after the last successful QC check will be considered invalid due to faulty instrumentation.

5.1.3 Instrumentation Decontamination

All instruments shall be decontaminated, as necessary, and according to the specifications presented in the SSHP and/or RPP following measurement activities and shall be protected from contamination until they are ready for use.

5.2 Reporting

A Contractor Quality Control (CQC) Report shall be prepared each day that personnel are on the SLDA Site. When waste is in transport, the CQC shall indicate the status of the shipment. This information shall be included until the shipment is received and accepted by EnergySolutions. The CQC shall identify the current location of the waste, any unanticipated delays or occurrences, communications with EnergySolutions, and the anticipated arrival date.

5.3 Record Keeping

5.3.1 SNM Records

Requirements for SNM recordkeeping are provided in Appendix F.

5.3.2 Shipment Records

Records of all waste shipments shall be maintained for the duration of the SLDA project. Following completion of the project, or as specified by USACE, records of shipments completed shall be turned over to USACE. Package certification records shall be maintained as specified by DOT and NRC regulations, as applicable.

5.3.3 Logbooks

Field records shall be maintained sufficient to document waste processing and shipping activities. Information shall be recorded with indelible ink in a permanently bound notebook with sequentially numbered pages.

A Project Field Logbook will be kept for the duration of the project. The information contained in the Field Logbook will be recorded as in the above paragraph and of sufficient quality to allow for cross-referencing of work tasks with the required forms and paperwork. Entries will be made as close as possible to real time, and always on the day of occurrence.

5.3.4 Analytical Records

Analytical records, including on-site and off-site analytical records, field instrument survey records, and quality assurance/quality control records for laboratory and field instruments shall be maintained at the Site for the duration of the project. Field analytical records will include field data forms for recording results and measurements and the QA/QC checks for field surveys.

5.3.5 Field Performances and System Audits

As necessary, site project audits and evaluations will be conducted in accordance with CABRERA OP AP-004, *Radiological Compliance Audit* (see SAP).

5.3.6 Electronic Data

Electronic data files created during project activities will be backed up daily. The backup copy

will be stored in a location separate from the original data file to avoid the potential loss of project data.

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6.0 REFERENCES

CABRERA, 2009a, *Radiation Protection Plan, SLDA FUSRAP Site*, Cabrera Services, Inc., May 2009.

CABRERA, 2009b, *Sampling and Analysis Plan, SLDA FUSRAP Site*, Cabrera Services, Inc., May 2009.

CABRERA, 2009c, *Accident Prevention Plan, FUSRAP Site*, Cabrera Services, Inc., May 2009.

CABRERA, 2009d, *Site Operations Plan, SLDA FUSRAP Site*, Cabrera Services, Inc., May 2009.

DOT, US Department of Transportation, Title 49, Code of Federal Regulations.

EPA, US Environmental Protection Agency, Title 40, Code of Federal Regulations, Chapter 1, Parts 262, 265, and 268.

NRC, US Nuclear Regulatory Commission; Department of Energy, Title 10, Code of Federal Regulations, Parts 0 to 199.

PADEP, Pennsylvania Department of Environmental Quality, Title 25, Pennsylvania Code, Article VII, Chapters 260-270.

USACE, US Army Corp of Engineers, Engineering Manual (EM) 1110-35-01, *Management Guidelines for Working with Radioactive and Mixed Waste.* July, 2005.

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APPENDIX A

EnergySolutions Utah Waste Acceptance Criteria

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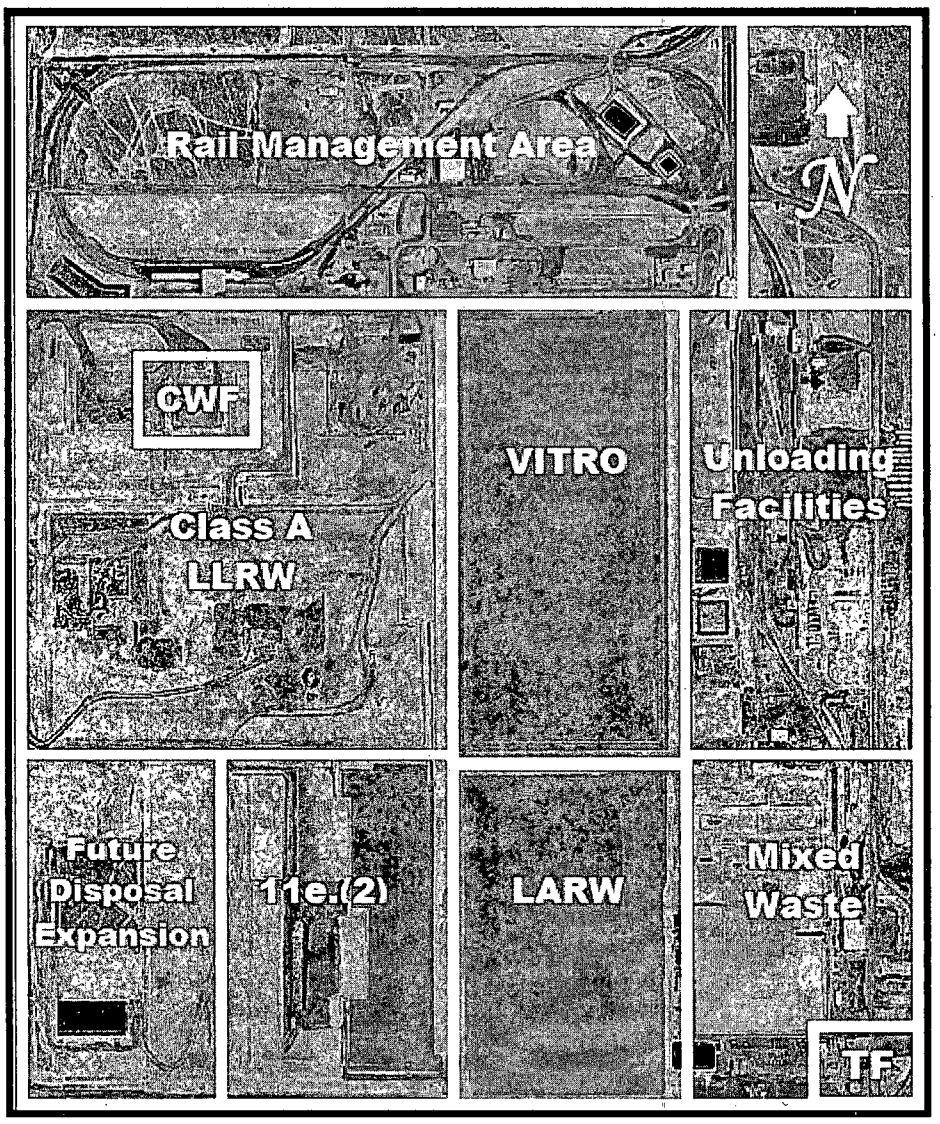
ENERGYSOLUTIONS

Bulk Waste Disposal and Treatment Facilities Waste Acceptance Criteria

Revision 7

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



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SECTION 1

INTRODUCTION

1.1 PURPOSE

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

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

The BWF WAC provides information on Energy*Solutions*' waste acceptance processes including:

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

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

1.2 SCOPE

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

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

1.3 RESPONSIBILITIES

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

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

SECTION 2

SITE AND FACILITY DESCRIPTION

2.1 SELECTION OF THE CLIVE DISPOSAL SITE LOCATION

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

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

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

2.2 LICENSES, PERMITS, AND AUTHORIZATIONS

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

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

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

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

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

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

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

Section 3 details the various waste types and waste forms that are acceptable at Energy*Solutions*. Waste streams that are subject to multiple regulations must meet the requirements for each applicable regulation.

2.3 SITE LOCATION AND ACCESS

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

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

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

2.4 DISPOSAL AND TREATMENT FACILITIES

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

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

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

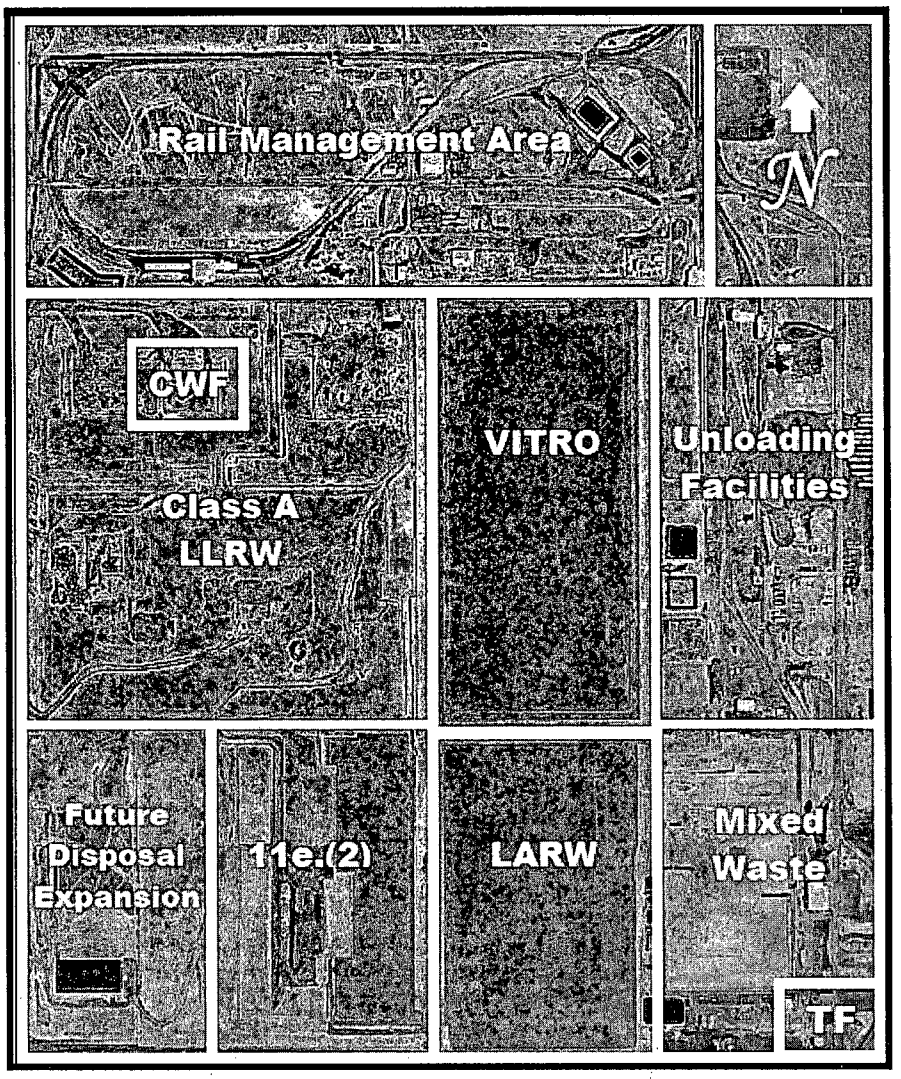


Figure 2-1. Energy*Solutions*' Disposal and Treatment Facilities

Bulk Waste Facility

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

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

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

Containerized Waste Facility

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

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

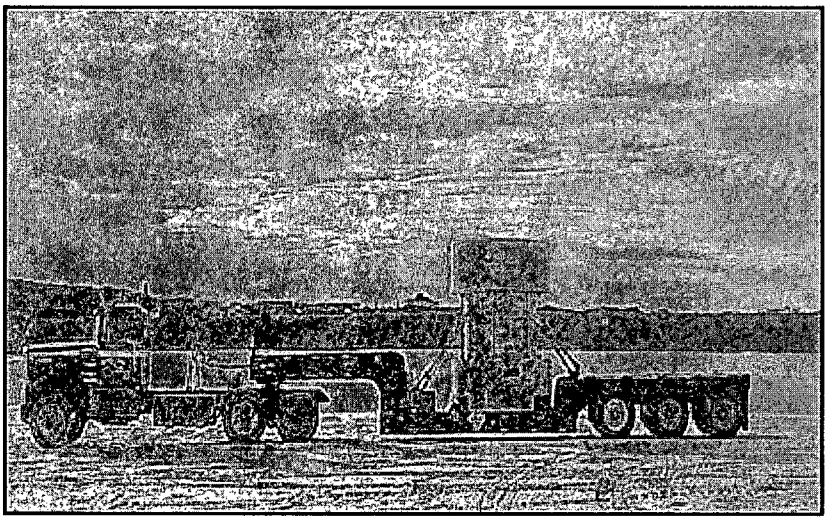


Figure 2-2. Cask Shipment at the Containerized Waste Facility

Treatment Facility

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

Treatment Facility is designed for radioactive waste that requires treatment for RCRA constituents and for liquid radioactive wastes requiring solidification prior to disposal. Energy*Solutions*' Mixed Waste treatment and solidification capabilities include:

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

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

Currently, all waste processed at the Treatment Facility are disposed in the Mixed Waste disposal embankment. The Treatment Facility includes open and covered waste storage areas for storing, sampling, and staging Mixed Waste shipments, including the following buildings and areas:

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

2.5 ALARA CRITERIA FOR THE BULK WASTE AND TREATMENT FACILITIES

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

ALARA Criteria may be disposed at the BWF since the waste is sampled and, in most cases, removed from the shipping container.

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

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

External Contact Dose Rate Limits

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

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

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

Resin External Contact Dose Rate Limits

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

Removable Surface Contamination Limits

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

Requests for Exceptions

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

SECTION 3

WASTE CRITERIA

3.1 ACCEPTABLE RADIOACTIVE WASTES

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

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

3.1.1 Class A Low-Level Radioactive Waste

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

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

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

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

Classification Tables from UAC R313-15-1008

Table I

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

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

Table II

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Waste Classification Labels on Packages

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

LLRW Compact Export Approval

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

3.1.2 NORM/NARM Waste

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

3.1.3 Class A Mixed Low-Level Radioactive Waste

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

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

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

3.1.3.1 Acceptable Hazardous Waste Codes

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

3.1.3.2 LDR Compliant Mixed Waste

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

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

3.1.3.3 Mixed Waste Requiring Treatment

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

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

Chemical Stabilization

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

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

Formula development may also be applied to Mixed Waste with very low levels of organic contaminants that require chemical destruction in order to meet total concentration based standards versus a leach standard as determined by the Toxicity Characteristic Leaching Procedure (TCLP) test. Mixed Waste requiring chemical stabilization may be sized and homogenized using various equipment including shredders, vibrating screens, and mixers. In order to evaluate chemical compatibility with the stabilization treatment process, generators shipping waste with Hazardous Waste Codes D001, D002, or D003 must provide a list of specific chemicals in each container with the shipping paperwork.

Macroencapsulation of Hazardous Debris and Radioactive Lead Solids

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

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

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

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

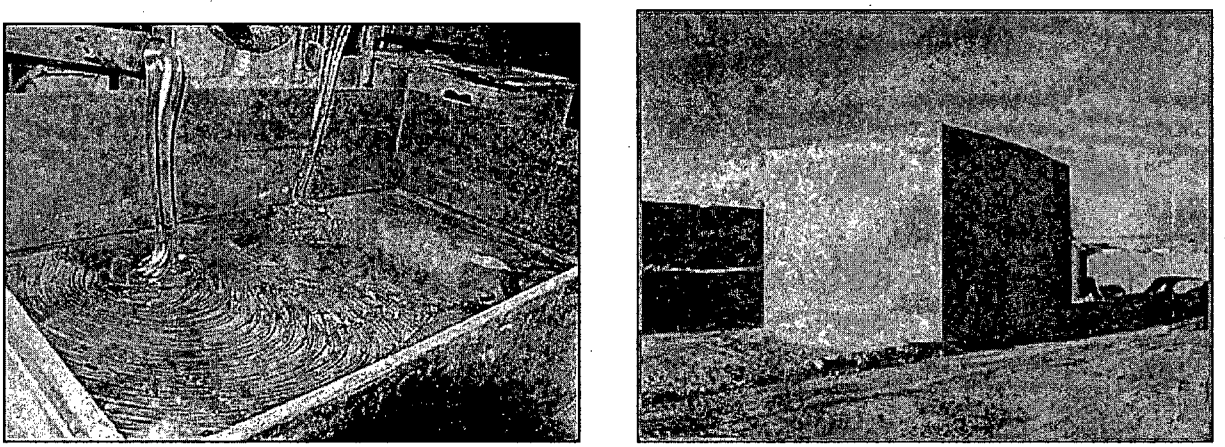


Figure 3-1. Macroencapsulation of Hazardous Debris

Therefore, packaged waste subject to macroencapsulation (MACRO) may contain other material that does not meet the debris definition (e.g., paint chips, scale, etc.) to the extent that the mixture is "comprised primarily of debris". Consistent with the ALARA principle, this definition provides generators with flexibility in managing waste streams requiring treatment without having to sort and segregate non-debris items prior to treatment. However, as noted in 40 CFR 268.2(h), "deliberate mixing of other hazardous material with debris to change its treatment classification (i.e., from waste to hazardous debris) is not allowed under the dilution prohibition in § 268.3."

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

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

Debris Spray Washing

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

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

Microencapsulation

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

Thermal Treatment of Organics

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

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

Mixed Waste streams are heated in the VTD system at sufficient temperatures to volatize the organic constituents which are then condensed and collected as a liquid. The thermally treated residue is then

sampled to verify LDR compliance. In some cases, the treatment residue will require additional treatment to stabilize hazardous metals prior to disposal. The organic liquid condensate will require further treatment to comply with LDR treatment standards.

Mercury Treatment

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

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

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

3.1.4 11e.(2) Byproduct Material

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

3.1.4.1 Radionuclide Concentration Limits

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

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

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

All debris must be less than 10 inches in at least one dimension and no longer than 12 feet in any dimension. Debris that exceeds this size limit (e.g., 11e.(2) oversize debris) is not acceptable for disposal under the 11e.(2) license. Generators with 11e.(2) contaminated debris that are unable to size the debris prior to shipment must contact Energy*Solutions*' Customer Service representative to make necessary arrangements for Energy*Solutions* to size the debris upon receipt.

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

3.1.4.3 Certification of 11e.(2) Byproduct Material

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

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

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

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

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

3.1.5 Special Nuclear Material

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

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

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

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

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

3.1.5.1 Condition 1 - Percent Enrichment of Uranium-235

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

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

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

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

3.1.5.2 Condition 2 – Specified Limits for Waste Containing SNM

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

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

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

SNM Isotope Concentration Limits

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

Spatial Distribution Requirements

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

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

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

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

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

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

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

$$10{,}000\,\frac{pCi}{g} \times 600{,}000\ g = 6.0x10^9\ pCi = 6.0\,mCi\ Pu - 239$$

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

Bulk Chemical Requirements

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

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

Unusual Moderator Limits

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

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

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

Soluble Uranium Limits

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

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

3.1.5.3 Condition 3 – Characterization of Waste Containing SNM

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

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

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

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

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

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

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

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

3.1.5.4 Condition 4 – Generator's Certification

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

3.1.6 Polychlorinated Biphenyl (PCB) Radioactive Waste

Energy*Solutions* is authorized to receive and dispose of most types of PCB/radioactive and PCB/mixed wastes defined by the EPA in 40 CFR 761. The EPA issued Energy*Solutions* a TSCA Coordinated Approval for receipt and disposal of drained PCB Articles and PCB Containers that contained PCBs at concentrations equal to or greater than 500 ppm. Wastes received under the TSCA Coordinated Approval must be disposed in the Mixed Waste disposal embankment. All PCB waste shipped to the Mixed Waste disposal facility must be accompanied with a Uniform Hazardous Waste Manifest. As required by 40 CFR 761, the Uniform Hazardous Waste Manifest must include the date the PCB waste was removed from service. Articles and containers of PCB waste must also be dated with the removed from service date per 40 CFR 761.65(c)(8). Empty PCB containers that contained PCBs at concentrations less than 500 ppm may be disposed in the Class A LLRW Facility; however, this waste will require a Uniform Hazardous Waste Manifest and include the removed from service date on each outer container. A Uniform Hazardous Waste Manifest is not required for any other PCB wastes disposed at the Class A LLRW Facility.

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

Energy*Solutions*' Ground Water Quality Discharge Permit (GWQDP) and State-Issued Part B Permit prohibit the receipt of any PCB liquids except for 1) intact, non-leaking PCB Small Capacitors or 2) PCB waste that will be treated via VTD. Shipments of PCB wastes containing unauthorized free liquids will not be accepted by Energy*Solutions* unless re-profiled to a VTD waste stream. Generators shipping PCB wastes in re-usable containers must be lined to prevent PCB contamination on the internal surfaces of the container. Containers contaminated with PCBs will be returned to the shipper as a PCB Container.

3.1.6.1 PCB Remediation Waste

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

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

* Requires disposal in Energy*Solutions*' Mixed Waste disposal embankment.

3.1.6.2 PCB Bulk Product Waste

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

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

* Requires disposal in Energy*Solutions*' Mixed Waste disposal embankment.

3.1.6.3 PCB Articles

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

Energy*Solutions* received a TSCA Coordinated Approval from the EPA to receive and dispose of drained PCB Articles. PCB Articles must be drained of all liquid to the maximum extent practical but in no case shall the liquid exceed one percent of the waste volume (all free liquid must be absorbed). PCB Articles that have been drained must be filled with sufficient absorbent material to absorb all remaining liquid. Some PCB Articles also require flushing with solvents for a specified time period (e.g., PCB Transformers). Energy*Solutions* is also able to process PCB Large Capacitors and leaking PCB Small Capacitors through VTD.

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

PCB Articles Category	Definition	Acceptable
PCB Transformers	Any transformer that contains ≥ 500 ppm PCBs.	Yes*[1]
PCB Capacitors (Intact and non-leaking)	Any capacitor that contains ≥ 500 ppm PCBs. Capacitor is a device for accumulating and holding a charge of electricity and consisting of conducting surfaces separated by a dielectric. Assume PCBs ≥ 500 ppm in a capacitor of unknown concentration made prior to July 2, 1979. Assume PCBs < 50 ppm in a capacitor made after July 2, 1979.	--
PCB Small Capacitors	A capacitor which contains less than 3 lbs of dielectric fluid. A capacitor whose total volume is less than 100 cubic inches may be considered to contain less than 3 lbs of dielectric fluid. Includes fluorescent light ballasts containing intact and non-leaking PCB small capacitors and PCB potting material (< 50 ppm).	Yes*
PCB Large High or Low Voltage Capacitors	A large high voltage capacitor contains 3 lbs or more of dielectric fluid and which operates at or above 2,000 volts. A large low voltage capacitor contains 3 lbs or more of dielectric fluid and which operates below 2,000 volts.	Yes*
PCB Hydraulic Machines	Includes die casting machines	Yes*[2]
PCB-Contaminated Electrical Equipment	Any electrical equipment (such as transformers, capacitors, and circuit breakers, including those in railroad locomotives and self-propelled cars) which contain ≥ 50 ppm and < 500 ppm PCBs in the dielectric fluid. In the case of dry electrical equipment, the electrical equipment is PCB-Contaminated if it has PCBs > 10 ug/100 cm^2 and < 100 ug/100 cm^2 as measured by a standard swipe test (40 CFR 761.123).	Yes
Other PCB Articles		--
PCB Article (≥ 500 ppm PCBs)		Yes*
PCB-Contaminated Article	Any article which contains ≥ 50 ppm and < 500 ppm PCBs in the dielectric fluid. In the case of dry electrical equipment, the electrical equipment is PCB-Contaminated if it has PCBs > 10 ug/100 cm^2 and < 100 ug/100 cm^2 as measured by a standard swipe test per 40 CFR 761.123.	Yes

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

3.1.6.4 PCB Containers

A PCB Container is any package, can, bottle, bag, barrel, drum, tank, or other device that contains PCBs or PCB Articles and whose surfaces have been in direct contact with PCBs. PCB Containers must be emptied to the extent practical and not contain any free standing liquid. All PCB Containers received for disposal require a Uniform Hazardous Waste Manifest and removed from service dates. Waste containing PCBs in a liquid or solid phase is acceptable for VTD treatment (refer to Section 3.1.3.3).

PCB Container Category	Definition	Acceptable
≥ 500 ppm PCBs	The PCB concentration of material which was contained in the PCB Containers was ≥ 500 ppm	Yes*
< 500 ppm PCBs	The concentration of material which was contained in the PCB containers was < 500 ppm	Yes

* Requires disposal in Energy*Solutions*' Mixed Waste disposal embankment.

3.1.7 UCNI and Export Controlled Waste

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

3.1.8 Chelating Agents

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

3.1.9 Asbestos and Beryllium

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

Asbestos waste that requires wetting to prevent dispersion must be inspected to minimize free liquids. However, unless the waste is to be solidified at the Treatment Facility, the free liquid may not exceed one percent of the waste volume. Absorbent material must be added to containers when free liquids are present. Waste streams containing greater than one percent free liquid by waste volume may be shipped to Energy*Solutions*' Treatment Facility for solidification prior to disposal. Contact Energy*Solutions* prior to shipping waste streams that contain free liquids.

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

3.1.10 Lab Packs

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

3.2 ACCEPTABLE FORMS OF RADIOACTIVE WASTE

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

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

3.2.1 Soil or Soil-Like Wastes

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

Soil/Soil-Like Properties

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

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

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

3.2.2 Debris

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

3.2.2.1 Standard Size Debris

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

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

3.2.2.2 Oversize Debris and Large Components

Waste material is considered oversize debris if the debris has at one dimension greater than 12 feet or does not have one dimension less than 10 inches. Since oversize debris cannot be compacted directly into the soil

lifts, this material is placed in different areas of the disposal embankment where void spaces are minimized to the maximum extent practicable both in and around the debris.

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

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

Energy*Solutions* may also elect to dispose of dispersible waste forms (e.g., filtercake, dusty material, etc.) or waste with elevated dose rates by not emptying the waste from the container. Although ion-exchange media (resin) meets the standard size debris criteria, resins are not emptied from the container but grouted to minimize void spaces. Consequently, resin waste streams must be shipped under a resin specific waste profile unless approved in writing by Energy*Solutions*. Void spaces in and around the containers are minimized to the maximum extent practicable.

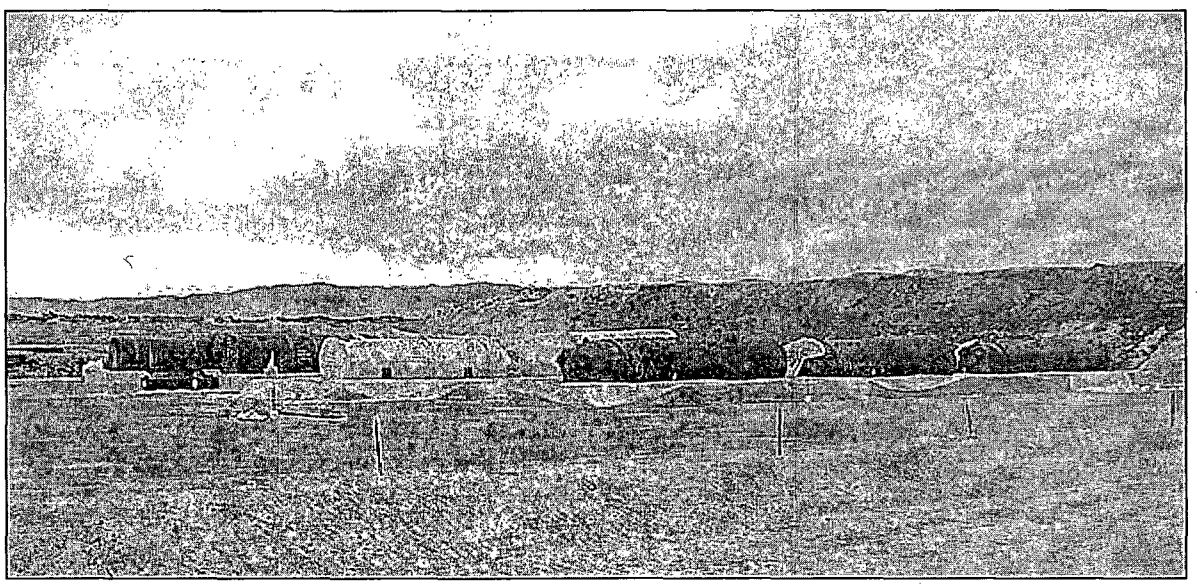


Figure 3-2. Large Component Disposal

3.2.3 Gaseous Waste

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

3.2.4 Waste Containing Free Liquids

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

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

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

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

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

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

Although uncommon, in some cases it is possible for precipitation to enter the package resulting in free liquids. Detailed inspections should be completed before waste is placed in transit to ensure the package meets strong-tight criteria and that water cannot enter. Energy*Solutions* does not maintain a list of approved

absorbents or manufacturers. If absorbents are added to the waste, the specific absorbent must be identified in the Radioactive Waste Profile Record (Section B.5).

3.3 PROHIBITED RADIOACTIVE AND MIXED WASTE

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

- Sealed sources defined in UAC R313-12 as "radioactive material that is permanently bonded or fixed in a capsule or matrix designed to prevent release and dispersal of the radioactive material under the most severe conditions which are likely to be encountered in normal use and handling" (e.g., instrument calibration check sources, smoke detectors, nuclear density gauges, etc.).
- Radioactive waste which is classified as Class B, Class C, or Greater Than Class C waste.
- Solid waste containing unauthorized free liquids.
- Waste material that is readily capable of detonation, of explosive decomposition, reactive at normal pressure and temperature, or reactive with water or air.
- Waste materials that contain or are capable of generating quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste.
- Waste materials that are pyrophoric. Pyrophoric materials contained in wastes must be treated, prepared, and packaged to be nonflammable.
- Waste materials containing untreated biological, pathogenic, or infectious material including contaminated laboratory research animals. Generators desiring to ship this type of waste must document in the Radioactive Waste Profile Record the process used to treat the potential non-radiological hazard. Sharps including needles, scalpels, knives, syringes, pipettes, and similar items having a point or sharp edge or that are likely to break during transportation must not be packaged in bulk containers unless written approval is given by Energy*Solutions*. When these items are used in the medical industry or related research, they must be treated to remove the biohazard. Documentation of such treatment must be included in the Waste Profile.

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

- Hazardous waste that is not also a radioactive waste
- Wastes that react violently or form explosive reactions with air or water
- Pyrophoric wastes and materials
- DOT Forbidden, Class 1.1, Class 1.2 and Class 1.3 explosives
- Shock sensitive wastes and materials
- Compressed gas cylinders, unless they meet the definition of empty containers
- Utah waste codes F999 and P999

SECTION 4

WASTE ACCEPTANCE PROCESS

4.1 WASTE PROFILING PROCESS

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

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

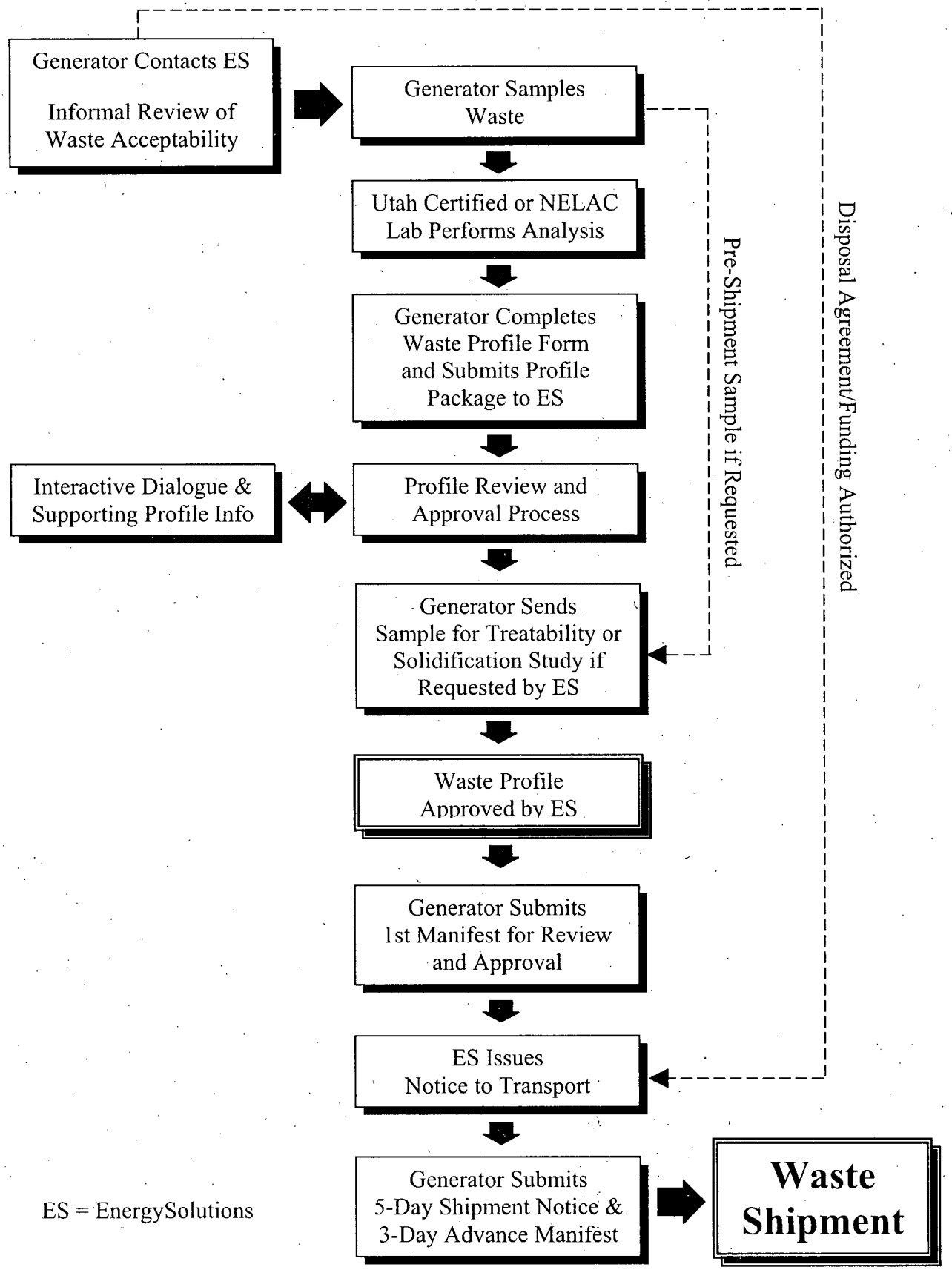
- Initial discussions
- Waste characterization
- Waste Profile Record completion and submittal
- Treatability and/or solidification study sample submitted, if requested
- Profile review and approval
- Notice to Transport

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

4.2 WASTE CHARACTERIZATION

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

Figure 4-1. Waste Acceptance Process



4.3 RADIOACTIVE WASTE PROFILE RECORD

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

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

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

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

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

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

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

4.3.1 Generator and Waste Stream Information

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

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

4.3.2 Waste Physical Properties and Packaging

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

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

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

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

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

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

4.3.3 Radiological Information

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

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

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

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

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

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

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

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

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

4.3.4 Chemical Composition and Hazardous Waste Evaluation

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

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

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

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

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

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

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

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

Analysis	EPA SW-846 Method
pH (liquids only)	Method 9045
TCLP Metals	Method 6010/7470
TCLP Herbicides	Method 8151
TCLP Pesticides	Method 8081
TCLP Semi-volatiles	Method 8270
TCLP Volatiles	Method 8260

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

40 CFR 261.24 Table 1

TABLE 1—MAXIMUM CONCENTRATION OF CONTAMINANTS FOR THE TOXICITY CHARACTERISTIC

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

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

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

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

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

4.3.5 Special Nuclear Material Exemption Certification Form

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

4.3.6 PCB Waste Certification Form

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

4.4 TREATABILITY AND SOLIDIFICATION STUDY SAMPLES

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

Preshipment samples should represent the waste material destined for shipment to Energy*Solutions*. Representative sampling techniques appropriate to radiological and hazardous wastes should be employed in obtaining these samples. Treatability study samples should represent the "worst case" for a waste stream destined for treatment at Energy*Solutions*. The samples should contain the highest anticipated levels of chemical contaminants in the waste steam to ensure that Energy*Solutions* can develop a treatment formula that is adequate for the entire waste stream. Energy*Solutions* may be required to perform additional treatability studies if the waste shipments contain chemical constituents of concern at concentrations that are higher than the treatability study sample.

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

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

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

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

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

4.5 WASTE PROFILE REVIEW AND APPROVAL

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

In order to assist each generator and accomplish the profile review and approval process as quickly as possible, Energy*Solutions* has developed a two-phase review process. During the first phase, an Energy*Solutions* Technical Services Representative will review and assess the Waste Profile, accompanying documentation, and analytical data for acceptability. If necessary, Energy*Solutions* will provide comments that delineate additional information needed for approval. This process typically takes

one to two weeks. Once the additional information or revisions have been received by Energy*Solutions* and found to be satisfactory, phase 2 of the process begins.

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

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

4.6 NOTICE TO TRANSPORT

Energy*Solutions* will issue a Notice to Transport to the generator that authorizes subsequent waste shipments. The Notice to Transport is completed and issued once the Waste Profile is completed and approved by Energy*Solutions*. A Notice to Transport is also issued in the following situations:

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

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

SECTION 5

SHIPMENT SCHEDULING AND MANIFESTING

5.1 GENERATOR SITE ACCESS PERMIT

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

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

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

5.2 SHIPPING CHECKLIST

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

5.3 5 WORKING-DAY ADVANCED SHIPMENT NOTIFICATION

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

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

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

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

- ☐ Manifested information is consistent with the approved Waste Profile.
  Verify that all manifested radionuclides are listed in the approved Waste Profile and that manifested concentrations do not exceed the approved ranges.
- ☐ Verified consignee information on manifests (see below).

  Consignee: Energy*Solutions*, LLC
  Clive Disposal Site
  Interstate 80, Exit 49
  Clive, UT 84029

  Contact: Shipping and Receiving
  Phone: (435) 884-0155
- ☐ Verified Shipment ID/Manifest Number (XXXX-YY-ZZZZ)
  XXXX is the generator number, YY is the waste stream number, and ZZZZ is the shipment number (starting with 0001 for the first shipment/conveyance and incrementing by one for each additional shipment/conveyance). If a Hazardous Waste Manifest is submitted, include the Shipment ID Number in Block 15.
- ☐ Verified valid Utah Site Access Permit number in Block 5 on Form 540. Generators must apply for the permit with the Utah Division of Radiation Control (DRC). The Shipper Name and Facility must be consistent with the Utah Site Access Permit number.
- ☐ Verified that Block 9 of Form 540 specifies Energy*Solutions*' "Treatment Facility" or "Bulk Waste Facility". Enter "Bulk Waste Facility" for LLRW, 11e.(2) Byproduct Material, and Mixed Waste shipped for direct disposal or enter "Treatment Facility" for waste streams requiring treatment by Energy*Solutions* prior to disposal.
- ☐ Submitted manifests to Energy*Solutions* **at least three working days** prior to the shipment arrival date. If possible, please export the manifests and send electronically via email to manifest@energysolutions.com. Otherwise, fax manifests to "Shipping and Receiving – Manifest" at (801) 413-5643. If applicable, include the LDR Notification/Certification forms, Hazardous Waste Manifest, and SNM Exemption Certification form.

Shipment Paperwork and Inspection

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

Figure 5-1. Shipping Checklist

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

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

5.4 SHIPPING PAPERWORK

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

Additional shipping paperwork may be required depending on the type of waste being shipped to Energy*Solutions*. Multiple waste streams on a single conveyance must include a unique set of shipping paperwork for each manifested shipment. The following paperwork may also need to accompany the shipping paperwork as applicable:

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

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

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

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

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

Form 540

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

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

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

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

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

Form 541

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

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

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

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

Form 542

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

5.4.2 Electronic Submittal of the Uniform LLRW Manifest

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

Electronic manifest submittal has numerous benefits for both the generator and Energy*Solutions* which include:

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

5.5 90-DAY SHIPPING FORECAST

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

SECTION 6

PACKAGING AND TRANSPORTATION

6.1 COMPLIANCE WITH TRANSPORTATION REGULATIONS

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

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

6.2 WASTE PACKAGING GUIDELINES

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

6.2.1 Bulk Packaging

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

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

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

6.2.2 Non-Bulk Packaging (Disposal Containers)

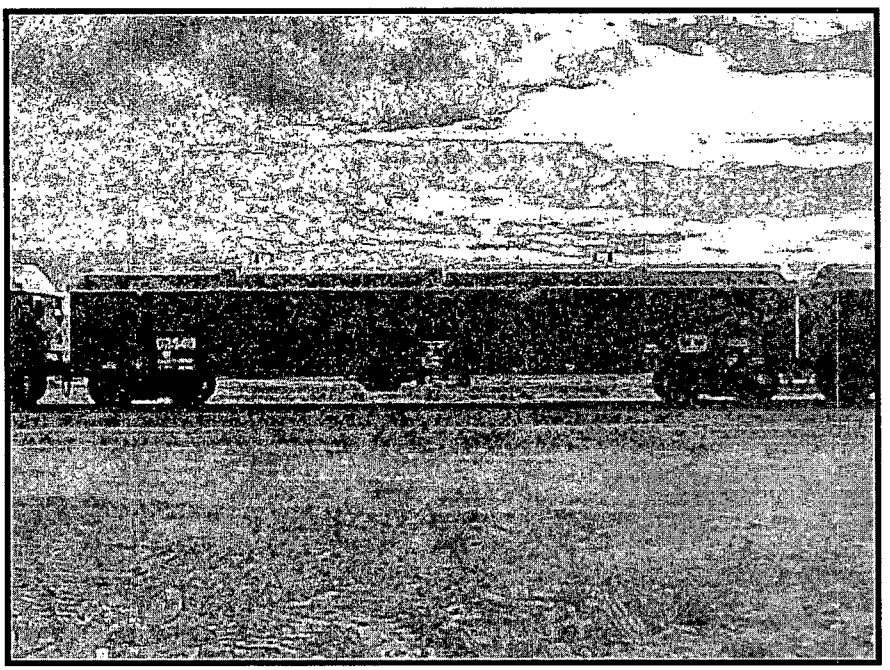
Energy*Solutions* receives non-bulk packages (disposal containers) including boxes, drums, super sacks, etc. The disposal container is generally disposed of with the waste contents and will not be returned to the generator. Energy*Solutions* recommends drums be palletized to reduce the amount of time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

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

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

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

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



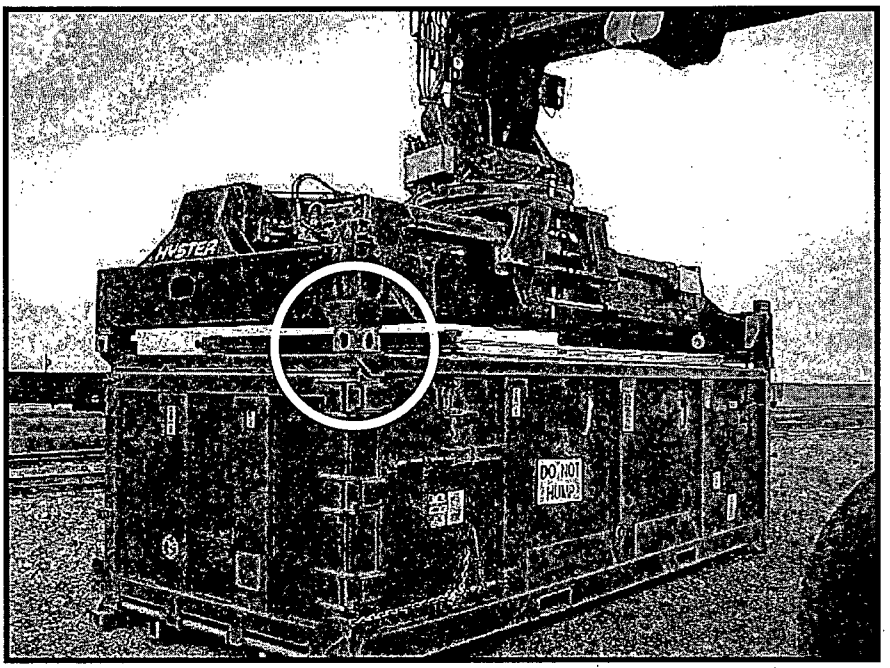


Figure 6-1. Bulk Shipping Containers

6.3 HIGHWAY TRANSPORTATION

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

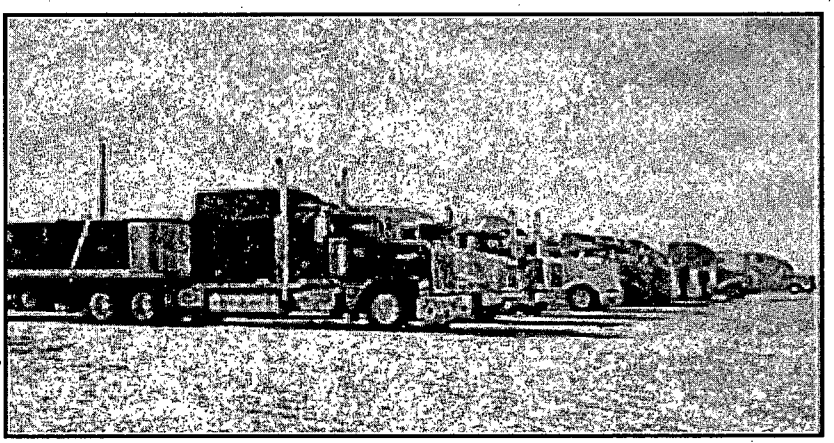


Figure 6-2. Truck Highway Shipments

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

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

6.4 RAIL TRANSPORTATION

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

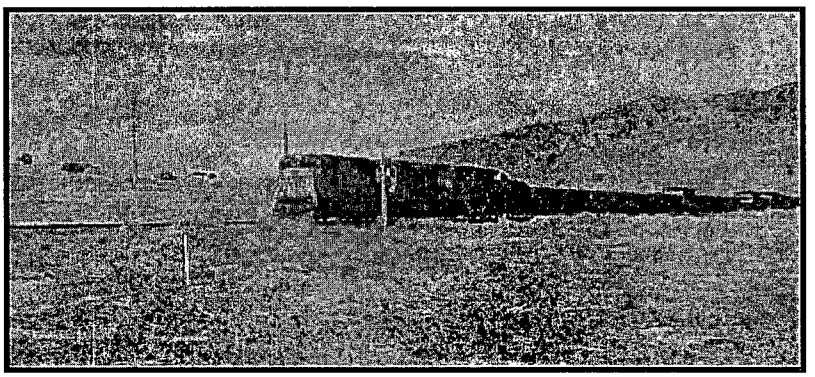


Figure 6-3. Rail Shipments

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

6.5 RELEASE OF SHIPPING CONVEYANCES

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

Energy*Solutions* Radiological Release Criteria

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

APPENDIX A

CONTACT INFORMATION

Energy*Solutions*

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

Energy*Solutions* Website: www.energysolutions.com

State of Utah

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

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APPENDIX B

Radioactive Waste Profile Record

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ENERGYSOLUTIONS

EC-0230
Revision 7

RADIOACTIVE WASTE PROFILE RECORD

A. GENERATOR AND WASTE STREAM INFORMATION

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

1. GENERATOR INFORMATION

Generator Name: _____ EPA ID #: _____

Generator Contact: _____ Title: _____

Mailing Address: _____

_____ Utah Site Access Permit #: _____

Phone: _____ Fax: _____ Email: _____

Contractor Name: _____ Location of Waste (City, State): _____

Name & Title of Person Completing Form: _____ Phone: _____ Email: _____

2. WASTE STREAM INFORMATION

Waste Stream ID: _____ Waste Stream Name: _____ State of Origin: _____

Revision: _____ Date: _____ Volume (ft^3): _____ Delivery Date: _____

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

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

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

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

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

Y ☐ If **YES**, a current copy of a LLRW Compact Export letter authorizing export must be submitted if applicable. This authorization is applicable for non-DOE LLRW (i.e., Mixed Waste, NORM/NARM, 11e.(2) material, and waste from DOE do not require a Compact Export Letter).

N ☐ If **NO**, check appropriate box: NORM/NARM ☐ 11e.(2) Byproduct Material ☐ Other: _____

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

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

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

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

ASBESTOS: Does the waste contain Asbestos Containing Material?

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

RADIOACTIVE WASTE PROFILE RECORD

B. WASTE PHYSICAL PROPERTIES & PACKAGE INFORMATION

1. GENERAL CHARACTERISTICS

Does the waste contain free liquids? Y ☐ N ☐ If **Yes**, what is the percent of free liquid by waste volume? _____ %

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

Does the waste contain absorbent? Y ☐ N ☐ Density range of the waste:_____-_____ g/cc ☐ lb/ft^3 ☐

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

Other constituents and percentage by volume? _____

2. MATERIAL SIZE

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

12" _____ % 4" _____ % 1" _____ % 1/4" _____ % 1/40" _____ % 1/200" _____ %

Does the waste stream contain oversize debris (i.e., no dimension < 10 inches and any dimension > 12 feet)? Y ☐ N ☐
If Yes, include a detailed description (i.e., weight, size, drawings, etc.) of the oversize debris in the narrative of Section B.5.

3. MOISTURE CONTENT

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

Optimum Moisture Content: _____% at Maximum Dry Density (lb/ft^3): _____

Average Moisture Content: _____% Moisture Content Range: _____% - _____%

4. WASTE SHIPPING & PACKAGING

Transportation Mode: ☐ Highway ☐ Rail

Shipping & Container Packages: (Check all that apply) ☐ Drums* (≤ 85 gallons) ☐ Boxes (≤ 100 ft^3) ☐ Soft-Sided Bags (≤ 10 yd^3)

☐ Intermodal ☐ Sealand ☐ Gondola** ☐ Box Car

Other:

*Palletized drums are preferred by the disposal site. Please specify in the "Other" field if drums will not be palletized.
**Dimensions of gondola railcars must be between 48 to 65 feet in length and 8.5 to 12.5 feet in height as measured from the top of the rail to the top of the railcar unless approved by EnergySolutions.

5. NARRATIVE DESCRIPTION AND HISTORY OF WASTE

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

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

RADIOACTIVE WASTE PROFILE RECORD

Waste Stream ID: Revision: Date of Revision:

C. RADIOLOGICAL INFORMATION

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

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

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

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

Isotope	Manifested Upper Concentration (pCi/g)	Weighted Avg. per Container (pCi/g)	Isotope	Manifested Upper Concentration (pCi/g)	Weighted Avg. per Container (pCi/g)

RADIOACTIVE WASTE PROFILE RECORD

HAZARDOUS WASTE CERTIFICATION ATTACHMENT

This form is required only if the checkbox for Hazardous Waste on page one has been checked YES. Otherwise, complete the Low-Level Radioactive Waste Certification Attachment instead of this attachment. EnergySolutions may waive the chemical laboratory analyses if the material is not amenable to chemical sampling and analysis (e.g., debris items including metal pieces, concrete, plastic, etc.). Justification for waiving the chemical analyses must be provided in Section B.5.

D. MINIMUM REQUIRED CHEMICAL ANALYSIS

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

1. GENERAL CHEMICAL PARAMETERS

SW-846 Analytical Methods

pH (Liquid only):_____ **Method 9045** Please provide the range of the pH analyses performed.

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

Analyze the waste for volatile or semi-volatile constituents (Methods 8260 & 8270), and attach the data.

Any distinguishing color or odor? Y ☐ N ☐ If Yes, color: _____; odor: _____

2. HAZARDOUS WASTE CODES AND TREATMENT STANDARDS (40 CFR 268)

List all hazardous waste codes and treatment standards. Include hazardous waste codes that have been removed through treatment and indicate "Former" in the second column. Worst-case concentrations only need to be provided for concentration based treatment standards. If additional space is needed, provide an Attachment D.2 to this profile record formatted as below. Include a description of hazardous waste determinations and any variances, exclusions, etc. in the narrative requested in Section B.5.

EPA HW Codes	Description, Constituent of Concern, or Subcategory	Treatment Standard (mg/kg unless noted as mg/L TCLP or Technology Code)	Worst-Case Concentration (mg/kg unless noted as mg/L TCLP)

3. UNDERLYING HAZARDOUS CONSTITUENTS (40 CFR 268.48)

List all underlying hazardous constituents (UHCs) and treatment standards. Include UHCs that have been removed through treatment. Worst-case concentrations only need to be provided for concentration based treatment standards. If additional space is needed, provide an Attachment D.3 to this profile record formatted as below.

Underlying Hazardous Constituents	**Treatment Standard** (mg/kg unless noted as mg/L TCLP or Technology Code)	**Worst-Case Concentration** (mg/kg unless noted as mg/L TCLP)

D. 4. OTHER CHEMICAL CONSTITUENTS

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

Other Chemical Constituents	**Worst Case Concentration** (mg/kg unless noted as mg/L TCLP)	**Other Hazardous Constituents**	**Worst-Case Concentration** (mg/kg unless noted as mg/L TCLP)

5. LABORATORY CERTIFICATION INFORMATION

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

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

_____

6. CERTIFICATION

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

Generator's Signature: _____ Title: _____ Date: _____

RADIOACTIVE WASTE PROFILE RECORD

LOW-LEVEL RADIOACTIVE WASTE CERTIFICATION ATTACHMENT

This form is required only if the checkbox for Hazardous Waste on page one has been checked No. Otherwise, complete the Hazardous Waste Certification Attachment instead of this attachment. EnergySolutions may waive the chemical laboratory analyses if the material is not amenable to chemical sampling and analysis (e.g., debris items including metal pieces, concrete, plastic, etc.). Justification for waiving the chemical analyses must be provided in Section B.5.

D. MINIMUM REQUIRED CHEMICAL ANALYSIS

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

1. GENERAL CHEMICAL PARAMETERS

SW-846 Analytical Methods

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

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

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

Arsenic_____	Chromium_____	Selenium_____
Barium_____	Lead_____	Silver_____
Cadmium_____	*Mercury_____	

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

Endrin_____	Toxaphene_____	Chlordane_____
Lindane_____	*2,4-D_____	Heptachlor_____
Methoxychlor_____	*2,4,5-TP Silvex_____	

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

o-Cresol_____	Hexachlorobenzene_____	Pentrachlorophenol_____
m-Cresol_____	Hexachlorobutadiene_____	Pyridine_____
p-Cresol_____	Hexachloroethane_____	2,4,5-Trichlorophenol_____
Total Cresol_____	Nitrobenzene_____	2,4,6-Trichlorophenol_____
2,4-Dinitrotoluene_____		

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

Benzene_____	1,4-Dichlorobenzene_____	Methyl ethyl keytone_____
Carbon Tetrachloride_____	1,2-Dichloroethane_____	Tetrachloroethylene_____
Chlorobenzene_____	1,1-Dichloroethylene_____	Trichloroethylene_____
Chloroform_____	Vinyl Chloride_____	

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

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

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

RADIOACTIVE WASTE PROFILE RECORD

D. 3. Former EPA HW Codes or Underlying Hazardous Constituents	Treatment Standard (mg/kg unless noted as mg/L TCLP or Technology Code)	Worst Case Concentration (mg/kg unless noted as mg/L TCLP)

4. OTHER CHEMICAL CONSTITUENTS

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

Other Chemical Constituents	Worst-Case Concentration (mg/kg unless noted as mg/L TCLP)	Other Hazardous Constituents	Worst-Case Concentration (mg/kg unless noted as mg/L TCLP)

5. LABORATORY CERTIFICATION

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

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

_____

6. CERTIFICATION

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

Generator's Signature: _____ Title: _____ Date: _____

ATTACHMENT B.5
PHYSICAL PROPERTIES

Generator Name:_____ Waste Stream ID:_____
Revision #:_____ Revision Date:_____

OVERWRITE THIS SECTION TO COMPLETE YOUR NARRATIVE
Items to include in this attachment as applicable:

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

For waste streams with SNM, please include the information requested in items 3a through 3d of the SNM Exemption Certification (form EC-0230-SNM) including:

- How the waste was generated
- Physical forms in the waste
- Uranium chemical composition (if applicable)
- How the waste was characterized
- The range of SNM concentrations
- Analytical results with error values
- Spatial distribution uniformity of SNM
- Determination of manifested concentrations

For waste streams containing PCBs regulated for disposal, please provide a description of the PCB waste categories listed on the PCB Waste Certification form (EC-98279)

For profiles containing large components (e.g., single items > 20,000 lbs), please provide the following information:

- Drawings illustrating dimension, weight, access ports to void spaces and lifting points
- Photographs of the object
- Radiological characterization and surveys including dose rates and surface contamination levels
- Packaging, rigging, loading and transportation plans

APPENDIX C

Special Nuclear Material Exemption Certification

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ENERGYSOLUTIONS

EC-0230-SNM
Revision 3

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 each box:

☐ 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:

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

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

APPENDIX D
PCB Waste Certification

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ENERGYSOLUTIONS

EC-98279
Revision 3

PCB WASTE CERTIFICATION

Waste Stream ID:_____ ☐ PCB/Radioactive Waste ☐ *PCB/Mixed Waste

The waste stream contains the following PCB categories (please check all that apply):

- ☐ *Drained PCB Transformers (contained ≥ 500 ppm PCB concentration)**
- ☐ *Other Drained PCB Articles (≥ 500 ppm PCB concentration)
- ☐ *Intact, non-leaking PCB Small Capacitors (including intact, non-leaking light ballasts with PCB concentrations < 50 ppm in the potting material)
- ☐ *Drained PCB Hydraulic Machines (≥ 50 ppm PCB concentration)
  - ☐ *PCB concentrations ≥ 1,000 ppm**
- ☐ Drained PCB-Contaminated Articles, including Electrical Equipment (≥ 50 ppm; < 500 ppm)
- ☐ Drained PCB Containers (previously contained PCBs at concentrations < 500 ppm)
- ☐ *Drained PCB Containers (previously contained PCBs at concentrations ≥ 500 ppm)
- ☐ PCB Bulk Remediation Waste, as defined in 40 CFR 761.3:
  - ☐ Non-liquid cleaning materials and personal protective equipment waste at any concentration, as described in 40 CFR 761.61(a)(5)(v)(A)
  - ☐ PCB concentrations < 50 ppm or PCB surface contamination < 100 µg/100 cm2
  - ☐ *PCB concentrations ≥ 50 ppm or PCB surface contamination ≥ 100 µg/100 cm2
- ☐ PCB Bulk Product Waste, as defined in 40 CFR 761.3
  - ☐ 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). PCB Bulk Product waste in this category is presumed or known to leach < 10 µg/L PCBs (40 CFR 761.62(b)(1)(i)).
  - ☐ *Leaches ≥ 10 µg/L PCBs
- ☐ PCB Waste from Research & Development
- ☐ Other: _____

* Any waste in groups marked with an asterisk must be disposed at EnergySolutions' Mixed Waste disposal embankment and requires the use of a Uniform Hazardous Waste Manifest.

** Each drained PCB Transformer with PCB concentrations ≥ 500 ppm and each drained PCB Hydraulic Machine with PCB concentrations ≥ 1,000 ppm must be accompanied by a certification that the flush requirements of 40 CFR 761.60(b)(1)(i)(B) have been met. Flush Certifications must include, at a minimum:

- A unique identification number for each PCB Item that was flushed;
- The date that the flush was performed;
- A statement that the flush was performed in accordance with regulation; and
- A certified signature and date signed.

Provide a description of the PCB waste (including information to support the groups identified above) in the Attachment B.5 narrative of the Waste Profile Record (EC-0230).

GENERATOR CERTIFICATION

I certify that the waste described on this form and accompanying documents were or shall be obtained using state and EPA-approved sampling methods, as applicable. I certify that the PCB/radioactive waste or PCB/mixed waste described on this form has not been diluted from a higher concentration in order to avoid any provision of specifying a PCB concentration in accordance with 40 CFR 761. I certify that the waste does not contain any free-standing liquids. I certify that the information provided on this form is complete, true and correct and is accurately supported and documented by any laboratory testing as required by EnergySolutions. I certify that the results of any said testing have been submitted to EnergySolutions.

Authorized Signature _____ Title _____ Date _____

APPENDIX E
Waste Management Flow Charts

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Chart 1 – Waste Process Initiation

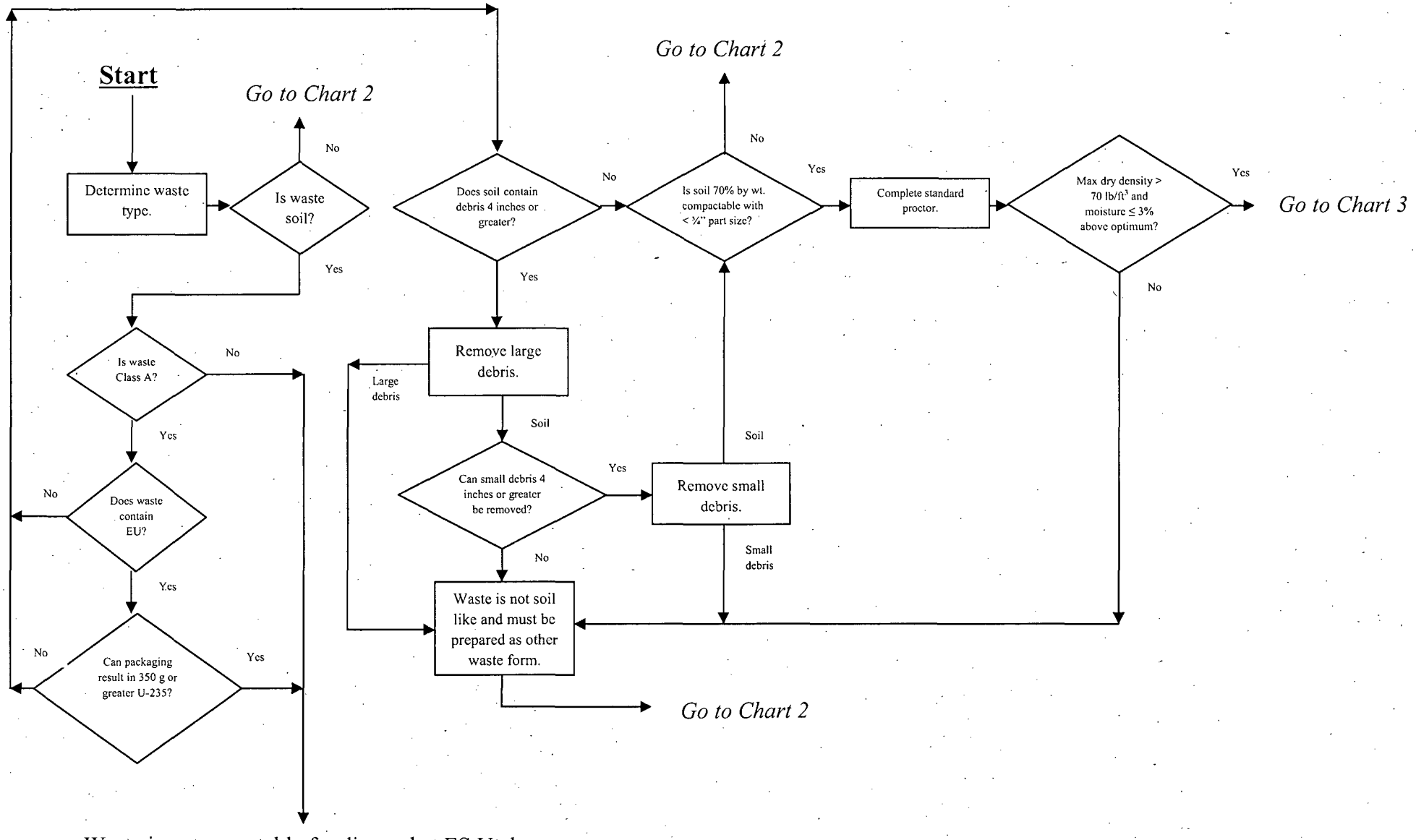


Chart 2 – Non-Soil Debris Waste Processing

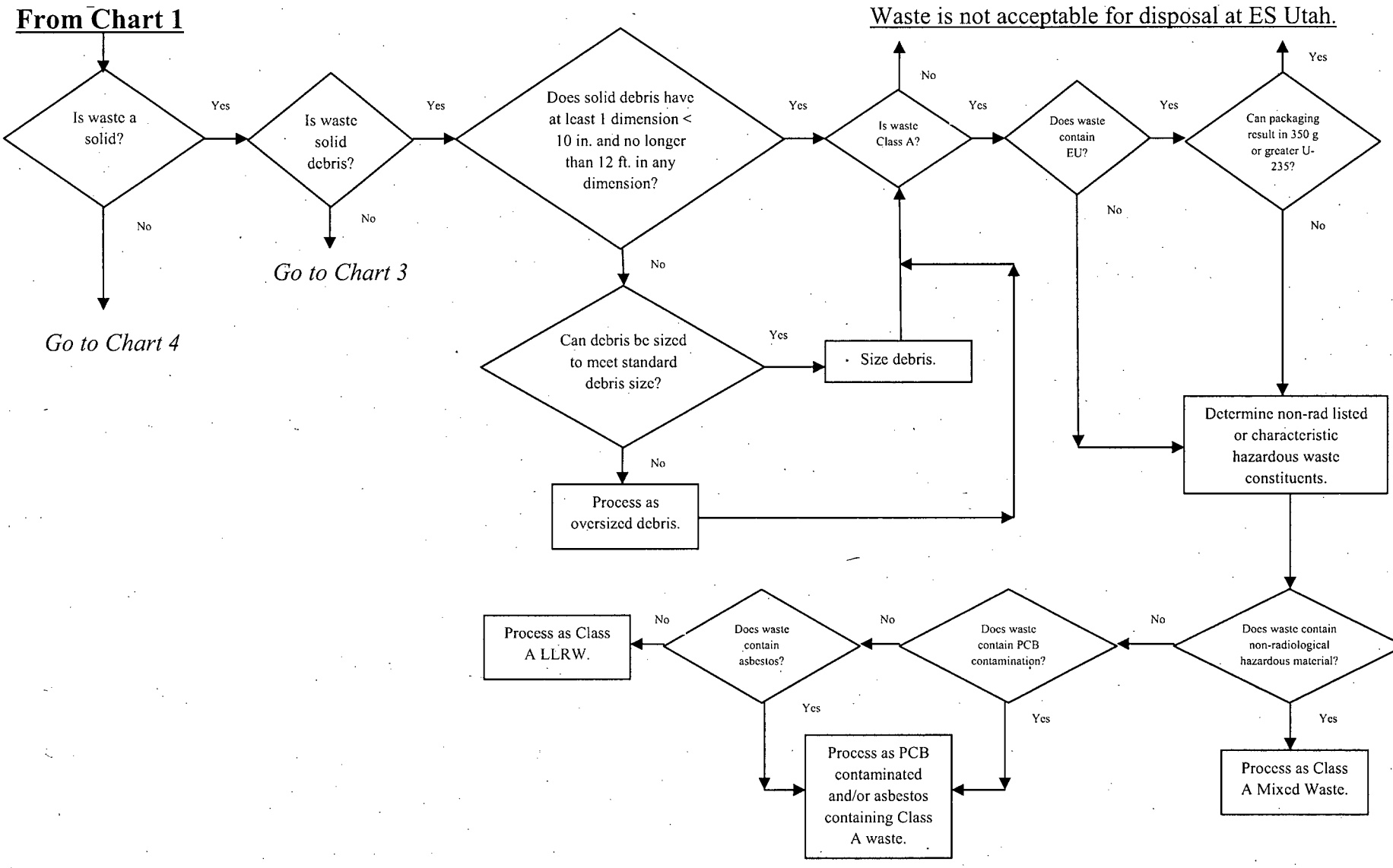


Chart 3 – Soil and Other Solid Waste Processing

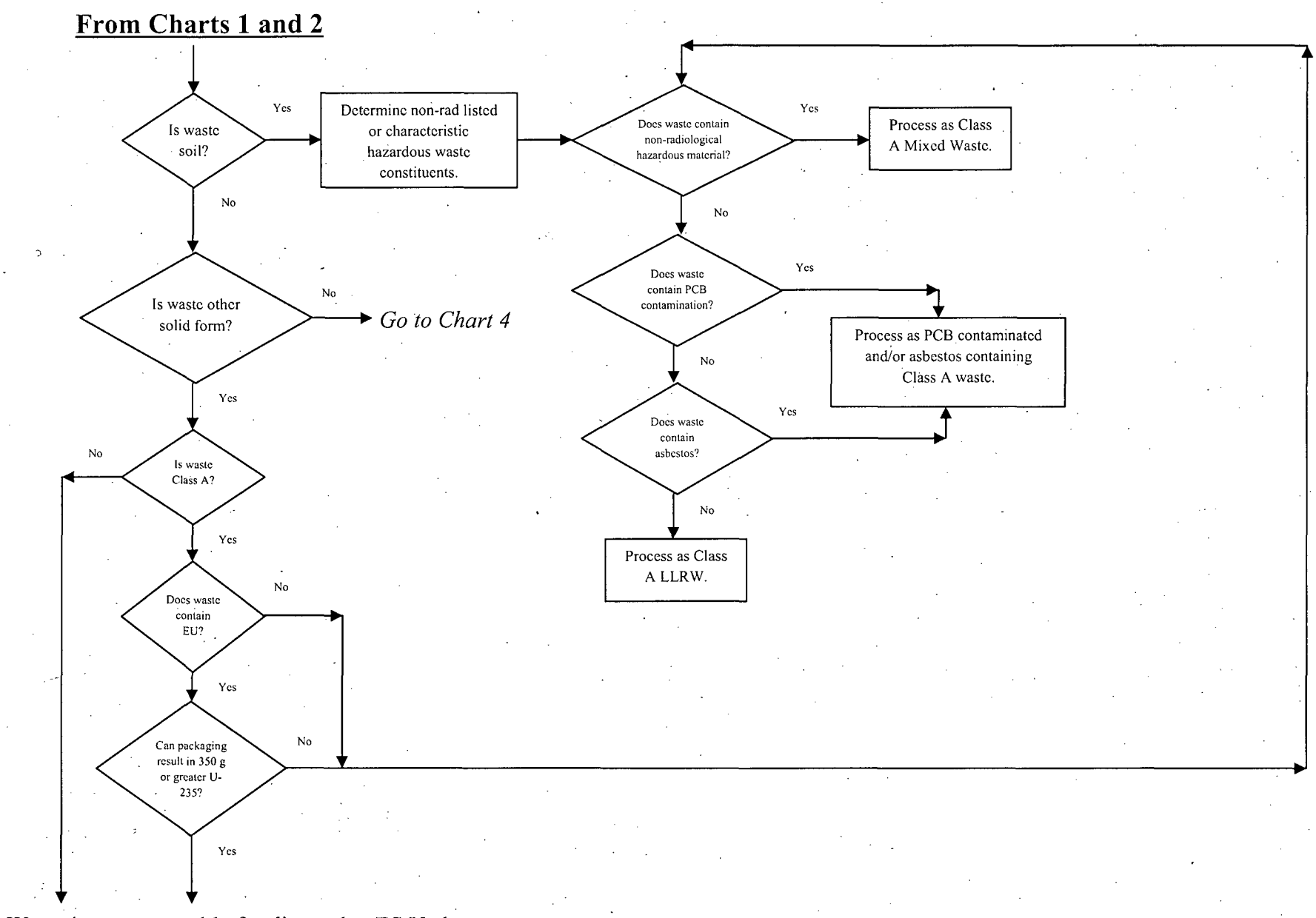
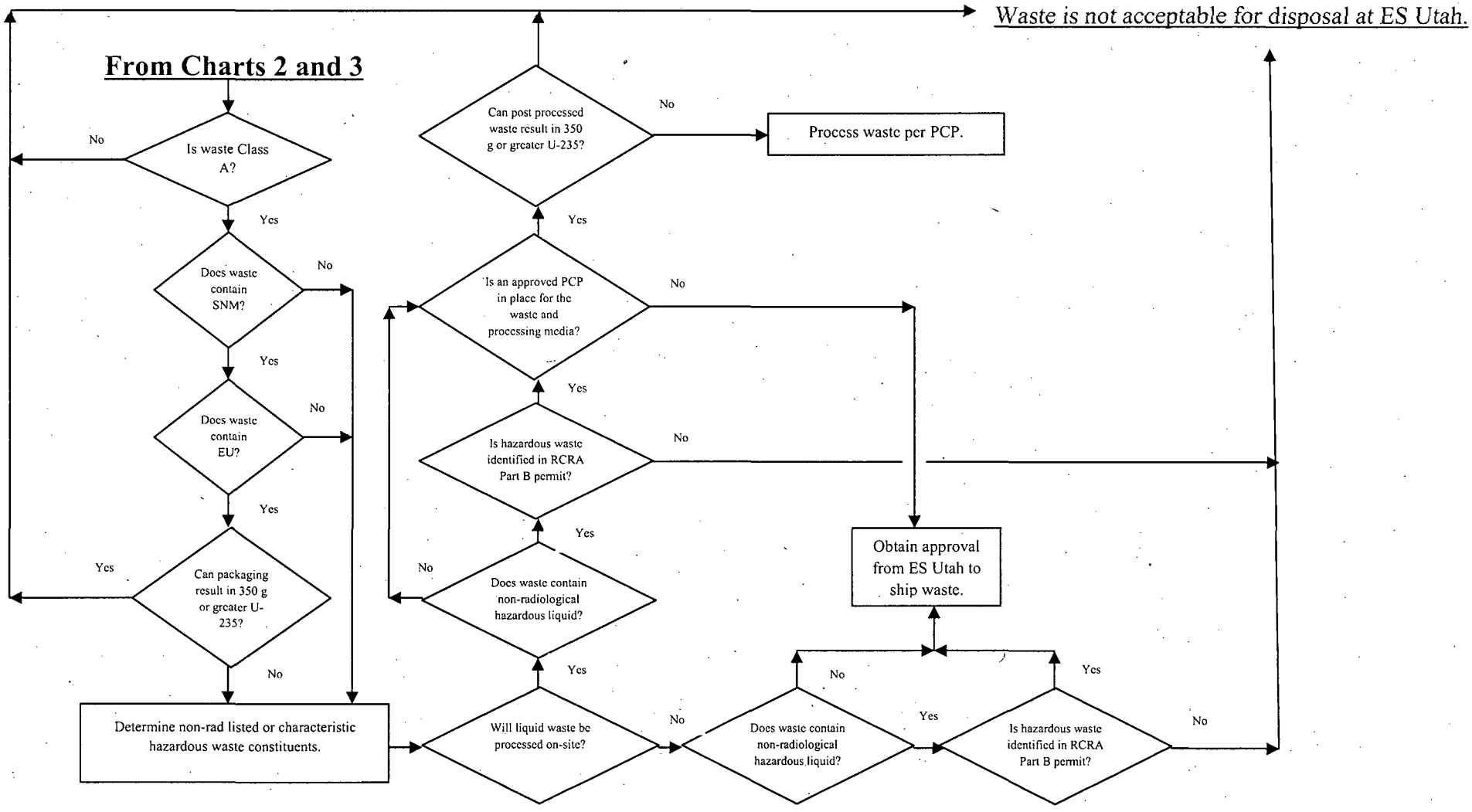


Chart 4 – Liquid Waste Processing



APPENDIX F

Material Control and Accountability Plan

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TABLE OF FIGURES

LIST OF ATTACHMENTS

ACRONYMS

BA	Adjusted Ending Book Inventory
CFR	Code of Federal Regulations
DOE	Department of Energy
FM	fissile material
FUSRAP	Formerly Utilized Sites Remedial Action Program
HPGe	high-purity germanium
IMC	intermodal container
ISOCS®	In Situ Object Counting System
KMP	Key Measurement Point
LEU	Low Enriched Uranium
MBA	Material Balance Area
MUF	Material Unaccounted For
NMMSS	Nuclear Materials Management and Safeguards System
NMSS	Nuclear Materials Management and Safeguards
NMTR	Nuclear Material Transaction Report
NRC	Nuclear Regulatory Commission
PE	Ending Physical Inventory
Pu	plutonium
QAC	Quality Assurance Coordinator
RIS	Reporting Identification Symbol
RSO	Radiation Safety Officer
SLDA	Shallow Land Disposal Area
SNM	Special Nuclear Material
SRD	Shipper/Receiver Difference
Th	thorium
ThC	thorium monocarbide
ThO_2	thorium dioxide
U	uranium
UC	uranium monocarbide
UC_2	uranium dicarbide
UO_2	uranium dioxide
USACE	United States Army Corps of Engineers

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1.0 INTRODUCTION

This document provides a program for the control and accounting of special nuclear material (SNM) exhumed from the affected trenches during the course of the Shallow Land Disposal Area (SLDA) Formerly Utilized Sites Remedial Action Program (FUSRAP) Site Remediation project. Wastes placed within the SLDA trenches consisted of process wastes; laboratory wastes, old or broken equipment; building materials; protective clothing; general maintenance materials and trash. Some of the wastes were placed in cardboard and metal drums, some were bagged, and some, particularly pieces of equipment and building materials, were placed in trenches with no special packaging or containers.

The wastes placed in the disposal trenches are in several chemical forms including but not limited to uranium dioxide (UO_2), ammonium diuranate, uranium metal, uranium monocarbide (UC) and uranium dicarbide (UC_2). Source material as thorium may exist as dioxide (ThO_2) and thorium monocarbide (ThC) as contamination.

The uranium-contaminated materials placed in the trenches are present at various enrichments, ranging from depleted at 0.2 percent uranium-235 (U-235) to high enriched uranium greater than 45 percent U-235.

1.1 Purpose

The purpose of this program document is to provide requirements for the material control, accountability, and reporting of SNM exhumed from the SLDA trenches.

1.2 Scope

This document sets the requirements for and defines the program for identifying, measuring, tracking and labeling SNM in the forms of enriched uranium, plutonium and thorium. The requirements in this Plan do not apply to materials with uranium enrichments of 0.7 percent or less.

1.3 Program Overview

To accomplish these general objectives, the following protocols are addressed herein:

(a) An organization has been established such that responsibility for the Nuclear Material Accountability is independent of excavation responsibilities.

(b) Uranium handling and measurement are performed according to approved procedures.

(c) Training is conducted to ensure that personnel are qualified with respect to Nuclear Material Accountability responsibilities.

(d) Discrete items of material are uniquely identified.

(e) Records are maintained that enable tracing material through the shipping process.

(f) A "near-real-time" inventory listing is maintained of items on hand. This listing is periodically audited to assure that items have been properly accounted.

(g) Accounting records are maintained of shipments and controlled discards. From these a facility book inventory (Ledger) is maintained.

(h) A Measurement Control Program has been implemented to assure (1) the accuracy of

uranium measurements, (2) eliminate significant measurement biases and (3) the facility book inventory is periodically verified by a physical inventory.

2.0 DEFINITIONS

2.1 Accounting Records

A set of data showing the quantity of each category of special nuclear material, its distribution within the project and any changes affecting it. Accounting records contain in respect of each MBA:

a) All inventory changes, so as to permit a determination of the book inventory at any time;

b) All measurement results that are used for determination of the physical inventory; and

c) All adjustments and corrections that have been made in respect of reconciliation of inventories, between book inventory and physical inventory.

2.2 Batch

A portion of nuclear material handled as a unit for accounting purposes at a key measurement point and for which the composition and quantity are defined by a single set of specifications or measurements. The nuclear material may be in bulk form or contained in a number of separate items.

2.3 Batch Data

The total weight of each element of nuclear material and, in the case of plutonium and uranium, the isotopic composition when appropriate. The units of account shall be as follows:

a. Grams of contained plutonium;
b. Grams of total uranium and grams of contained U-235 plus uranium-233 (U-233) for uranium enriched in these isotopes; and
c. Kilograms of contained thorium, natural uranium or depleted uranium.
d. For reporting purposes, the weights of individual items in the batch shall be added together before rounding to the nearest unit.

2.4 Book Inventory

The algebraic sum for a given point in time of the most recent physical inventory of a Material Balance Area (MBA) and all inventory changes that have occurred since that physical inventory was taken.

2.5 Category (Material Type) Change

A change in one of the three material types of uranium: depleted uranium, natural uranium, and enriched uranium. Uranium can change material type as a result of blending. For example, natural uranium can become depleted uranium as a result of the blending of depleted uranium with natural uranium. This change results in the reduction of one material type of uranium and a corresponding increase in another.

2.6 Data Element

Information in a report, it consists of a unique three or four digit numeric label, a value, and delimiters. A set of data elements logically connected to each other comprises a

report entry (record), a set of records (pertaining to the same Material Balance Area) is a considered a report.

2.7 Discrepancy

An inconsistency found in the facility operator's records, or between facility records and State reports or between these records and inspector observations or indications resulting from containment and surveillance measures. Discrepancies that cannot be resolved (i.e. ascribed to innocent causes or otherwise satisfactorily explained) may lead to the determination that declared nuclear material is unaccountably missing. A discrepancy involving 1 kilogram or more of special nuclear material of moderate strategic significance (Category II) is classified as a possible anomaly.

2.8 Effective Kilogram

A special unit used in safeguarding nuclear material. The quantity in effective kilograms is obtained by taking:

a) For plutonium (Pu) and U-233 their weight in kilograms

b) For uranium with an enrichment of 0.01 (1%) and above, its weight in kilograms multiplied by the square of its enrichment;

c) For uranium with an enrichment below 0.01 (1%) and above 0.005 (0.5%), its weight in kilograms multiplied by 0.0001; and

d) For depleted uranium with an enrichment of 0.005 (0.5%) or below, and for thorium, its weight in kilograms multiplied by 0.00005.

Example Effective Kilograms

@ 93% U-235 one effective kilogram = 1.16 kg U (1.31 kg UO_2)

@ 5% U-235 one effective kilogram = 400 kg U (454 kg UO_2)

@ 3% U-235 one effective kilogram = 1,111 kg U (1,261 kg UO_2)

@ 1% U-235 one effective kilogram = 10,000 kg U (11,350 kg UO_2)

2.9 Adjusted Ending Book Inventory (BA)

The algebraic sum of the beginning physical inventory and of the inventory changes over the period, adjusted to take account of the shipper-receiver differences. The beginning physical inventory is equal to the ending physical inventory of the previous reconciliation statement relating to the same category of nuclear material. BA is the balance in the General Ledger as of the effective date of the physical inventory verification.

2.10 Ending Physical Inventory (PE)

The sum of all measured and derived batch/item quantities of nuclear material on hand at the date of the physical inventory taking, i.e. the total of the list of inventory items.

2.11 Fertile Material

Nuclear material that can be converted into a special fissionable material through capture of one neutron per nucleus. There are two naturally occurring fertile materials: uranium-238 (U-238) and thorium-232 (Th-232).

2.12 Fissile Isotopes

Pu, U-235 and U-233, but not U-235 present in natural or depleted uranium.

2.13 Formula Quantity

Strategic special nuclear material in any combination in a quantity of 5,000 grams or more computed by the formula, grams = (grams contained U-235) + 2.5 (grams U-233 + grams plutonium). This class of material is sometimes referred to as a Category I quantity of material.

2.14 Gross Weight

The total weight of a batch of nuclear material.

2.15 Identity Data

Those data needed to uniquely characterize an item, batch or stratum. Examples are a material balance area, nuclear material category, batch identification, material description, and type and date of an inventory change.

2.16 Inventory Change

An increase or decrease of nuclear material, in terms of batches, in a material balance area.

(i) Increases
   a) receipts from other material balance areas, receipts from a non-safeguarded (non-peaceful) activity or receipts at the starting point of safeguards;

(ii) Decreases
   a) Domestic shipment: shipments to other material balance areas or shipments for a non-safeguarded (non-peaceful) activity;
   b) Measured discard: nuclear material which has been measured, or estimated on the basis of measurements, and disposed of in such a way that it is not suitable for further nuclear use;
   c) Retained waste: nuclear material generated from processing or from an operational accident, which is deemed to be unrecoverable for the time being but which is stored;
   d) Other loss: for example, accidental loss (that is irretrievable and inadvertent loss of nuclear material as the result of an operational accident) or theft.
   e) Inventory changes are reported to the Nuclear Materials Management and Safeguards System (NMMSS) in the Nuclear Material Transaction Report.

2.17 Key Measurement Point (KMP)

A location where nuclear material appears in such a form that it may be measured to determine material flow or inventory. Key measurement points include, but are not limited to, the inputs and outputs (including measured discards) and storages in material balance areas. Flow key measurement points are places in the material balance area where the flow of nuclear material is determined.

2.18 Low Enriched Uranium (LEU)

Enriched uranium containing less than 20% of the isotope U-235.

2.19 Material Balance Area (MBA)

An area of a facility such that:

(i) The quantity of nuclear material in each transfer into and out of the area can be determined; and

(ii) The physical inventory of nuclear material in each Material Balance Area can be determined when necessary, in accordance with specified procedures.

2.20 Material Unaccounted For (MUF)

The difference between book inventory and physical inventory.

2.21 Net Weight

The weight of the contents of a container. Gross weight minus the tare weight equals the net weight.

2.22 Physical Inventory

The sum of all the measured or derived estimates of batch quantities of nuclear material on hand at a given time within a material balance area obtained in accordance with specified procedures.

2.23 Rebatching

Accounting for changes in the inventory of an individual batch of nuclear material.

2.24 Reporting Identification Symbol (RIS)

A unique combination of letters and numbers that is assigned to shippers and receivers of nuclear material. The RIS for SLDA is VBL and the RIS for Energy Solutions is VDM

2.25 Shipper/Receiver Difference (SRD)

The difference between the quantities of nuclear material in a batch as stated by the shipping material balance area and as measured at the receiving Material Balance Area.

2.26 Source Material

Uranium containing the mixture of isotopes occurring in nature; uranium depleted in the isotope 235; thorium; any of the foregoing in the form of metal, alloy, chemical compound, or concentrate.

2.27 Special Nuclear Material

(A) Pu, U-233, uranium enriched in the isotope U-233 or in the isotope U-235, pursuant to the provisions of section 51 of the Atomic Energy Act of 1954, as amended, determines to be special nuclear material, but does not include source material.

(B) SNM of Low Strategic Significance, i.e., Category III, means:

(i) Less than an amount of special nuclear material of moderate strategic significance, but more than 15 grams of U-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope) or 15 grams of U-233 or 15 grams of Pu or the combination of 15 grams when computed by the equation, grams = grams contained U-235 + grams Pu + grams U-233; or

(ii) Less than 10,000 grams but more than 1,000 grams of U-235 (contained in uranium enriched to 10 percent or more, but less than 20 percent in the U-235 isotope); or

(iii) 10,000 grams or more of U-235 contained in uranium enriched above natural, but less than 10 percent in the U-235 isotope.

(C) SNM of Moderate Strategic Significance, i.e., Category II, means:

(i) Less than a formula quantity[1] of strategic special nuclear material but more than 1,000 grams of U-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope) or more than 500 grams of U-233 or Pu or in a combined quantity of more than 1,000 grams when computed by the equation, grams = (grams contained U-235) + 2 (grams U-233 + grams Pu); or

(ii) 10,000 grams or more or U-235 (contained in uranium enriched to 10 percent or more but less than 20 percent in the U-235 isotope).

(D) Strategic SNM, i.e., Category I, means U-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope), U-233, or Pu.

2.28 Supporting Document

A record containing identity data, source data and batch data for each accounting transaction, such as shipping documents, weight (volume) records, laboratory records, charge/discharge records and power production records.

2.29 Source Document

A supporting document that is the source of the information on a related report or record.

2.30 Tare Weight

The weight of a container and/or packing materials without the weight of the material it contains.

2.31 Weight Data

The numeric label and the element or isotope weight of an item or batch of nuclear material.

[1] Formula quantity means strategic special nuclear material in any combination in a quantity of 5000 grams or more computed by the formula, grams = (grams contained U–235) + 2.5 (grams U–233+grams plutonium).

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3.0 MATERIAL ACCOUNTING ORGANIZATIONAL STRUCTURE

The following Nuclear Material Accounting organization will oversee all SNM operations at the SLDA Site. Lines of reporting are shown in Figure 1.

3.1 Nuclear Material Accountability Officer

The Quality Assurance Coordinator (QAC) has been delegated responsibility for the nuclear material accountability for the SLDA project. This position must be filled by an individual who is outside of the operations chain of command. The Nuclear Material Accountability Officer reports directly to the Corporate Radiation Safety Officer (RSO).

3.2 SNM Accountants

SNM Accountants have the responsibility of making entries into the Inventory Ledgers (Figure 3) and performing transfers between established MBAs. The SNM Accountant also is responsible for establishing new MBAs, as well as maintaining boundaries and signage associated with existing MBAs.

3.3 Corporate RSO

The Corporate RSO will serve in an oversight capacity above all Nuclear Material Accountability procedures at the Site. The RSO shall be copied on all SNM Inventory reports (Figure 4) and Nuclear Regulatory Commission (NRC) Form 741 submissions to the NRC NMSS office. The RSO also is responsible for performing independent audits of the SNM Accountability Program (See Section 5.2) and shall prepare audit reports to the Project Manager for distribution to the United States Army Corps of Engineers (USACE).

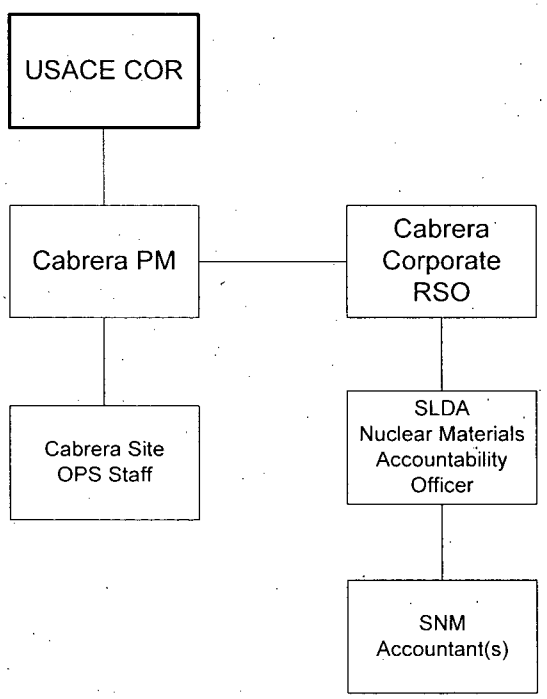

Figure 1 SLDA SNM Accountability Organization

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4.0 PROCESS DESCRIPTION AND ACCOUNTING

Source material and SNM may be exhumed from one or several burial trenches at a time using standard excavation techniques. Prior to exhuming the waste, preliminary analysis of source and special nuclear material quantities is made by reviewing historic records, characterization data and field analysis.

The steps below describe the major steps used to measure and track SNM at SLDA.

4.1 Material Identification and Classification

The identification of SNM will first be performed during 'lift' characterization surveys described in the FSP. Health Physics technicians will perform *in situ* radiological surveys prior to each soil (or debris) lift and process the collected data to ascertain the presence and concentrations of contaminants in the trenches. The results of the in situ characterization surveys will be used to determine the concentration, enrichment, and mass of the SNM during each excavation lift. The calculated enrichment and mass of U-235, as well as the mass of the total fissile material (FM), will determine the classification of the SNM as outlined by the flowchart in Error! Reference source not found..

This classification (I, II, III, or N/A) will serve as the basis for the requirements that are applied to the excavated materials, such as limits allowed within each MBA, total mass of exhumed SNM allowed in the process life-cycle, and the level of controls required.

4.2 Material Balance Areas

4.2.1 General Information

MBAs will be established at certain key handling and storage locations throughout the Site. All SNM identified at the Site MUST be contained within a MBA at all times until it is packaged and shipped for disposal.

4.2.2 MBA Establishment and Management

All initially exhumed and characterized SNM shall be added to a MBA inventory and documented using the General Ledger shown in Figure 3. The Criticality Safety Plan for the SLDA site limits the mass of SNM within each MBA to 350 grams with a minimum spacing of 12 feet. These conditions must be followed during management of current MBA's and when establishing new ones. The Accountability Officer must review and approve the proposed MBA prior to loading of any material.

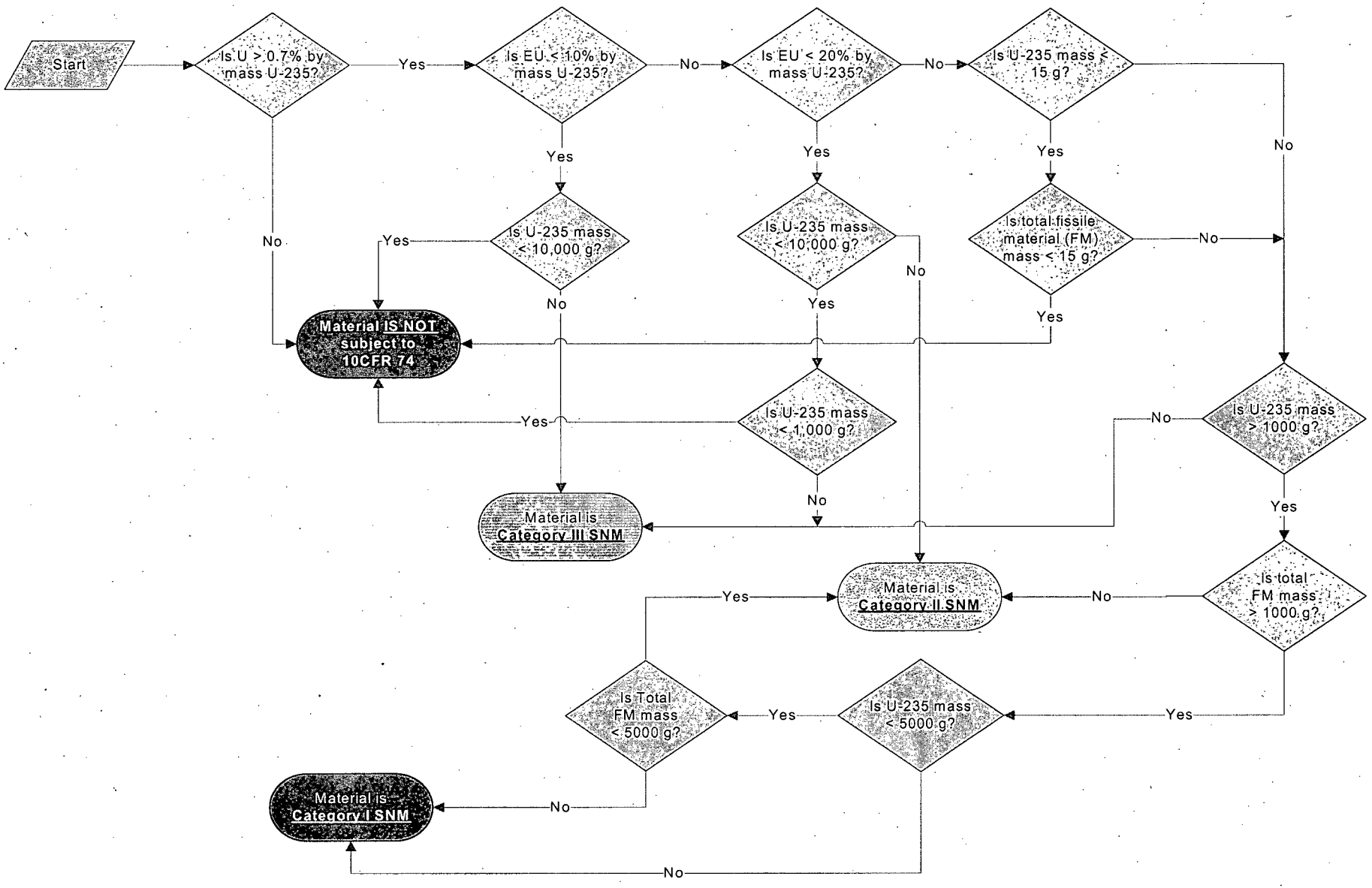


Figure 2 Decision Tree for Determining SNM Classification

SNM of Low Strategic Significance (Category III)

The number of Category III MBAs will be managed based on what is discovered during excavation activities and the resulting enrichment and mass of SNM measured. Materials may be added to an individual Category III MBA until the inventories reach the following mass limits:

- Individiual MBA Mass Limit = 350 g SNM;
- Collective MBA Mass Limits (for Category III SNM)
  - Unlimited amount for uranium enrichment between 0.7% - 10%;
  - Less than 10,000 g of uranium with an enrichment range between 10% - 20%; or
  - Less than 1,000 g of uranium with enrichment >20%.

If the total above ground inventory of low strategic significance SNM (Category III) reaches 80% of the maximum mass allowed (8,000 g of 10 to 20% enriched or 800 g of >20% enriched), the SNM Accountant shall inform the construction superintendent to pause excavation activities. At this time, focus will be diverted to waste package loading in order to reduce inventories back to a manageable level without risk of triggering a potential Category II condition for enrichments < 20%.

SNM of Moderate Strategic Significance (Category II)

SNM of Moderate Strategic Significance (Category II) is defined in Section *2.27 (C)* as greater than 10,000 g of U-235 enriched between 10-20% or greater than 1,000 g of U-235 enriched higher than 20%. A total mass up to 5,000 g of Category II SNM is allowed before the SNM is considered a Formula Quantity, or Category I. All SNM operations at the site will be managed to stay within Category II SNM limits. **Category I SNM conditions are not expected at SLDA**.

A single, dedicated Category II SNM storage area will be established that meets all requirements in 10 CFR 73.67 (d). This area will be kept under lock and key with access granted only to key project personnel.

The Category II SNM storage area may contain multiple MBAs, provided the total inventory does not exceed 5,000 g. Individual MBA SNM mass limits will not be required, however, a minimum distance of 12 feet will be implemented as is the case for the Category III MBAs.

4.2.3 MBA Inventory and Tracking

Material placed in MBA inventory shall be assigned a consecutively numbered inventory number (unique line on Inventory Ledger, See Figure 3), and documented with the following information:

(a) Inventory Tag Number
(b) Batch (trench) Identification
(c) Type (Soil, Debris, Container, etc.)
(d) Material Description
(e) Volume (in cubic yards)
(f) Average Concentration (in pCi/g)
(g) Enrichment
(h) U-235 mass
(i) Total FM Mass (if additional to U-235)
(j) Method of Measurement

4.2.4 Measurement Systems

Volume

Volume measurements may be performed by either using containers with volume increments or by calculation based on container dimensions. The measurements will be performed to ensure that the overall volume measurement uncertainty is ± 10% of the actual volume.

Weight

Net and gross weights of material will be determined by using calibrated scales. The scales shall be routinely verified by weighing a check weight to ensure that the measurements are within ± 10% of the check weight. Scales shall be calibrated a minimum of once per year.

Element and Isotope Measurements

Element and isotopic measurements may be performed by a number of methods including gamma spectroscopy, alpha spectroscopy, or mass spectroscopy. Measurement systems will be selected based on the material type with the goal of maintaining the measurement uncertainty < 20% of the measured value.

In situ gamma spectroscopy using a high-purity germanium (HPGe) detector system may be used to calculate uranium concentrations and approximate enrichment. The HPGe system will be calibrated using the In Situ Object Counting System (ISOCS®) software, which uses Monte Carlo mathematical modeling to simulate calibration geometries. *In situ* gamma spectroscopy is discussed in more detail in the Field Sampling Plan.

Site ID	Material Balance Area ID (MBA###)	MATERIAL BALANCE AREA (MBA) GENERAL INVENTORY LEDGER													Page of	
SLDA		Transfers		Type (soil, debris, containers, etc.)	Material Description	Enrichment	Element	Increases		Decreases		Balance		Corrections		
Line No.	Date	Batch No. (Trench)	MBA (To)	MBA (From)					Total Volume	SNM Mass	Total Volume	SNM Mass	Total Volume	SNM Mass	Previous Date	Line No.	Initials

Figure 3 MBA Inventory Ledger Form

4.2.5 Physical Material Tagging

Waste material in an MBA (or the MBA itself if all materials are consistent and homogeneous) shall be either labeled or otherwise marked so that the contents can be identified. Each label should include material identification, location, enrichment, material type, and mass. Material in process (soil stockpiles) does not require labeling providing that the material can be traced to its source lot. This can be performed using signs on portable stanchions placed in front of each stockpile.

Individual items are labeled with a six place alphanumeric sequence starting with the trench number, the sequential batch followed by a two digit sub-batch sequence.

T## XXX YY

Where:

T## = trench number

XXX = sequential number correlated to a sample or lot of samples used to determine the quantity of SNM or source material

YY = any subsample of the larger batch

4.3 Transfer of SNM Between MBAs

Movement of SNM MUST be tracked via subtraction and addition on individual Inventory Ledger forms. Each transaction shall be logged on a unique line of each MBA's active ledger (Figure 3), with the subtracted amount from the first MBA's inventory equaling the added amount to the second MBA's inventory. The SNM accountant assigned to the area will enter the data in each ledger and track the total inventories against the Category III limits provided in Section 4.2.2.

Transfers between Category II and Category III MBAs are allowed only for SNM less than 20% enrichment. All SNM identified as having enrichment > 20% must remain in the dedicated Category II MBA until the material has been approved for transfer and shipment.

4.4 SNM Packaging and Shipping

The final set of MBAs will reside within the Waste Processing Building of the Site Operations Plan. The various waste streams will be packaged for disposal in accordance with the guidance and requirements described in the Waste Management, Transportation and Disposal Plan.

Materials slated for waste packaging in an intermodal container (IMC) will be chosen from the appropriate MBAs, with the total mass of material (soil, debris, etc.) predetermined prior to loading such that no single container will exceed 350 g of SNM. The following steps outline the IMC loading process:

(a) Package the material according to the Waste Management, Transportation and Disposal Plan and weigh the filled IMC to obtain the Net Weight of the IMC contents.

(b) Calculate the mass of SNM based on the MBA inventory used to fill the container.

(c) Loaded materials will be subtracted from the MBA Inventory Ledger as described in Section 4.2.3. The contents of the IMC will be recorded using a Department of Energy (DOE)/NRC Form 741, "Nuclear Material Transaction Report," (NMTR) according to the instructions provided in Attachment 1. The DOE/NRC Form 741 is the means for entering transaction data into the NMMSS. DOE/NRC Form 741 must be completed in accordance with the instructions provided in Attachment 1 and must be submitted in computer-readable format. Instructions for creating the computer-readable submittal are found in NMMSS Report D-24, "Personal Computer Data Input for NRC Licensees."

(d) The NMTR must accompany the radioactive waste manifest forms (Form 501) that are provided to the consignee for transport to the off-site disposal facility. Copies of the NMTR must also be submitted to the NRC NMSS office for SNM license accountability purposes.

(e) Notify the Receiver of the shipment of SNM in accordance with the requirements in Title 10 of the Code of Federal Regulations (CFR) 73.67(c) *In-transit Requirements for Special Nuclear Material of Moderate Strategic Significance* or 73.67(g) *In-transit Requirements for Special Nuclear Material of Low Strategic Significance.*

4.5 Inventory Reconciliation and Changes

Inventory reconciliation between the MBA Inventory Ledgers and the Form 741 NMTRs must be performed at regularly scheduled intervals throughout the project to ensure that all SNM is accounted for. The first reconciliation shall be performed after the first full day of IMC packaging and shipment, with a report of the findings provided to the QAC, Project Manager, and Corporate RSO. Afterwards, reconciliation activities are to be performed at least weekly, or at the discretion of the PM or Corporate RSO.

If the results of any reconciliation report indicate that a change to a reported inventory is required, the changes must be reported to the NMSS via a 741 NMTR Form.

SNM Accountability Form

Inventory Date: _____ Page _____ of _____

MBA No.	Isotope (use new line for each fissile isotope)	SNM Mass Present (grams) Uranium Enrichment Range ? 0.7%	0.7 - 10%	10 - 20%	>20%	MBA Total Mass (g)	Notes	Initials
		? 0.7%	0.7 - 10%	10 - 20%	>20%			
Category III Enrichment Totals								
(Category III Limits)		unlimited	unlimited	<10 kg	<1 kg			
Category II Enrichment Totals		N/A	N/A					
(Category II Limits)		unlimited	unlimited	unlimited	<5 kg			

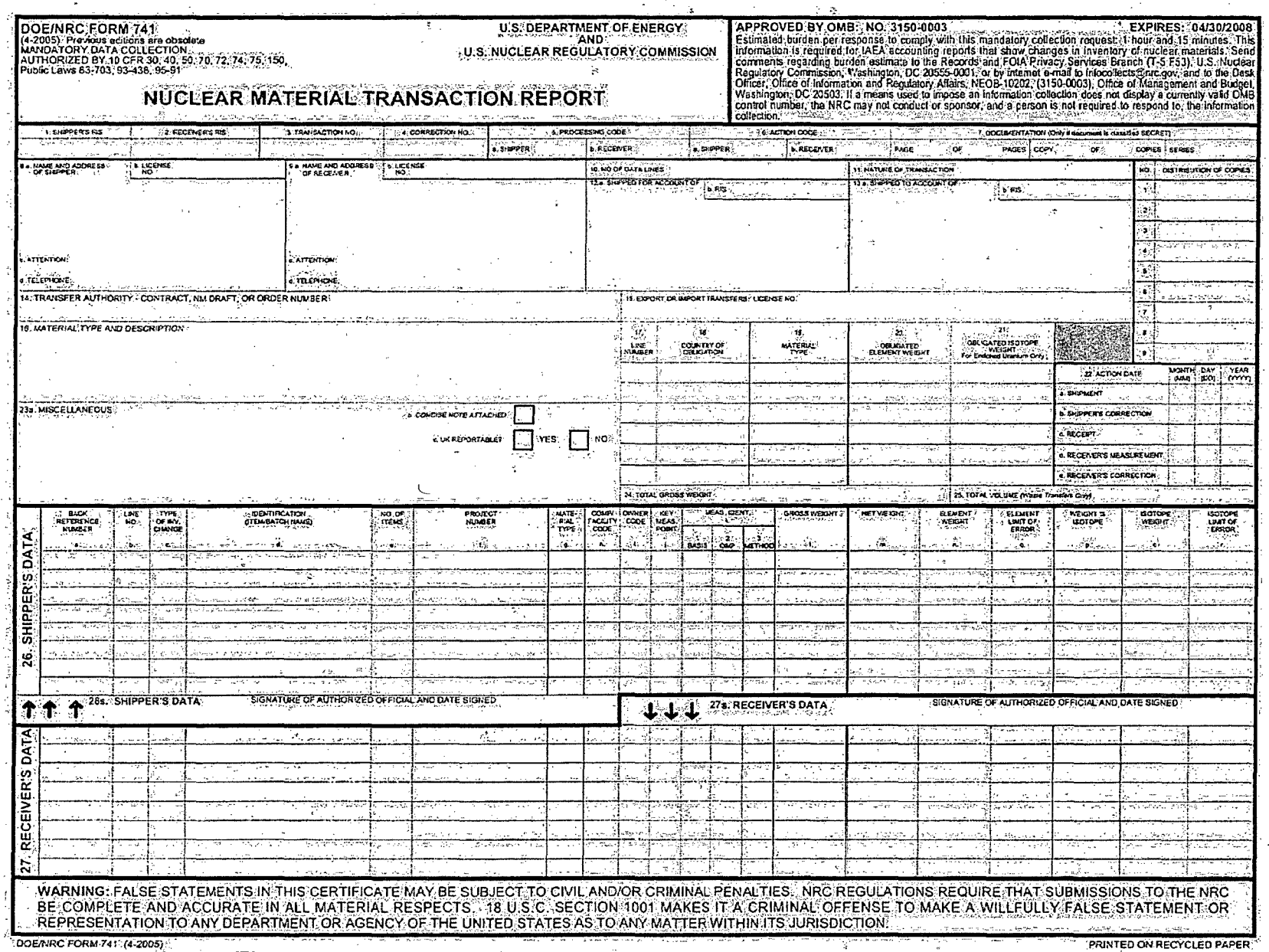
Signatures: _____ Date: _____

SLDA SNM Accountability Officer

_____ Date: _____

Cabrera Corporate Radiation Safety Officer

Figure 4 SLDA Master SNM Accountability Form



DOE/NRC FORM 741
(4-2005) Previous editions are obsolete
MANDATORY DATA COLLECTION
AUTHORIZED BY 10 CFR 30, 40, 50, 70, 72, 74, 75, 150,
Public Laws 83-703, 93-438, 95-91

U.S. DEPARTMENT OF ENERGY
AND
U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0003 EXPIRES: 04/30/2008

Estimated burden per response to comply with this mandatory collection request: 1 hour and 15 minutes. This information is required for IAEA accounting reports that show changes in inventory of nuclear materials. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0003), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

NUCLEAR MATERIAL TRANSACTION REPORT

1. SHIPPER'S R/S | 2. RECEIVER'S R/S | 3. TRANSACTION NO. | 4. CORRECTION NO. | 5. PROCESSING CODE: a. SHIPPER b. RECEIVER | 6. ACTION CODE: a. SHIPPER b. RECEIVER | 7. DOCUMENTATION (Only if document is classified SECRET): PAGE OF PAGES COPY OF COPIES SERIES

8.a. NAME AND ADDRESS OF SHIPPER | b. LICENSE NO. | c. ATTENTION | d. TELEPHONE

9.a. NAME AND ADDRESS OF RECEIVER | b. LICENSE NO. | c. ATTENTION | d. TELEPHONE

10. NO OF DATA LINES

11. NATURE OF TRANSACTION

12.a. SHIPPED FOR ACCOUNT OF | b. R/S

13.a. SHIPPED TO ACCOUNT OF | b. R/S

NO. | DISTRIBUTION OF COPIES

14. TRANSFER AUTHORITY - CONTRACT, NM DRAFT, OR ORDER NUMBER

15. EXPORT OR IMPORT TRANSFERS - LICENSE NO.

16. MATERIAL TYPE AND DESCRIPTION

17. LINE NUMBER | 18. COUNTRY OF OBLIGATION | 19. MATERIAL TYPE | 20. OBLIGATED ELEMENT WEIGHT | 21. OBLIGATED ISOTOPE WEIGHT (For Enriched Uranium Only)

22. ACTION DATE: MONTH (MM) DAY (DD) YEAR (YYYY)
a. SHIPMENT
b. SHIPPER'S CORRECTION
c. RECEIPT
d. RECEIVER'S MEASUREMENT
e. RECEIVER'S CORRECTION

23.a. MISCELLANEOUS
b. CONCISE NOTE ATTACHED
c. UK REPORTABLE? YES NO

24. TOTAL GROSS WEIGHT

25. TOTAL VOLUME (Waste Transfers Only)

26. SHIPPER'S DATA

a. BACK REFERENCE NUMBER	b. LINE NO.	c. TYPE OF ADJ. CHANGE	d. IDENTIFICATION (ITEM/BATCH NAME)	e. NO. OF ITEMS	f. PRODUCT NUMBER	g. MATERIAL TYPE	h. CONV. FACILITY CODE	i. DINNER CODE	j. KEY MEAS. POINT	k. MEAS. IDENT. 1. BASIS 2. GAP 3. METHOD	l. GROSS WEIGHT	m. NET WEIGHT	n. ELEMENT WEIGHT	o. ELEMENT LIMIT OF ERROR	p. WEIGHT % ISOTOPE	q. ISOTOPE WEIGHT	r. ISOTOPE LIMIT OF ERROR

26s. SHIPPER'S DATA — SIGNATURE OF AUTHORIZED OFFICIAL AND DATE SIGNED

27s. RECEIVER'S DATA — SIGNATURE OF AUTHORIZED OFFICIAL AND DATE SIGNED

27. RECEIVER'S DATA

a. BACK REFERENCE NUMBER	b. LINE NO.	c. TYPE OF ADJ. CHANGE	d. IDENTIFICATION (ITEM/BATCH NAME)	e. NO. OF ITEMS	f. PRODUCT NUMBER	g. MATERIAL TYPE	h. CONV. FACILITY CODE	i. DINNER CODE	j. KEY MEAS. POINT	k. MEAS. IDENT. 1. BASIS 2. GAP 3. METHOD	l. GROSS WEIGHT	m. NET WEIGHT	n. ELEMENT WEIGHT	o. ELEMENT LIMIT OF ERROR	p. WEIGHT % ISOTOPE	q. ISOTOPE WEIGHT	r. ISOTOPE LIMIT OF ERROR

WARNING: FALSE STATEMENTS IN THIS CERTIFICATE MAY BE SUBJECT TO CIVIL AND/OR CRIMINAL PENALTIES. NRC REGULATIONS REQUIRE THAT SUBMISSIONS TO THE NRC BE COMPLETE AND ACCURATE IN ALL MATERIAL RESPECTS. 18 U.S.C. SECTION 1001 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

DOE/NRC FORM 741 (4-2005) PRINTED ON RECYCLED PAPER

Figure 5 Nuclear Material Transaction Report DOE/NRC form 741

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5.0 QUALITY ASSURANCE / QUALITY CONTROL

5.1 Equipment Calibration and Quality Control

Equipment and systems used for nuclear material control and accounting shall be calibrated and maintained according to the Waste Management, Transportation and Disposal Plan and in accordance with the criteria and requirements in the Quality Assurance Project Plan.

5.2 SNM Accountability Audits

Periodic internal audits will be performed by the Accountability Officer, and/or persons so designated, to verify that SNM accountability activities comply with established procedures and other aspects of this Plan and to evaluate the overall effectiveness of the SNM Accountability and Control Program.

Independent audits will be performed by the Corporate RSO, or his qualified designee, on a task-oriented basis according to schedule milestones (establishment of initial MBAs and inventories, Waste packaging and completion of 741 Forms, etc.), in accordance with written guidelines or checklists.

Audit results will be reported to the PM in writing for review prior to forwarding to the USACE COR. Actions to resolve identified deficiencies will be tracked and appropriately documented. The audit information will become part of the project record for the site.

5.3 SNM and Source Material Records

All Accountability Records of the total SNM removed from the trenches, processed and disposed off-site shall be maintained for the duration of the SLDA project. These include:

(a) Completed DOE/NRC Form 741 Nuclear Material Transaction Reports
(b) MBA General Inventory Ledgers
(c) SNM Master Inventory Accountability Forms
(d) Audit reports and Corrective Action Forms

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6.0 REFERENCES

CABRERA, 2009a, *Criticality Safety Plan*, Appendix to the *Radiation Protection Plan, SLDA FUSRAP Site*, Cabrera Services, Inc., May 2009.

CABRERA, 2009b, *Sampling and Analysis Plan, SLDA FUSRAP Site*, Cabrera Services, Inc., May 2009.

NRC, U.S. Nuclear Regulatory Commission; Department of Energy, Title 10, Code of Federal Regulations, Part 73 – Physical Protection of Plants and Materials.

NRC, U.S. Nuclear Regulatory Commission; Department of Energy, Title 10, Code of Federal Regulations, Part 74 – Material Control and Accounting of Special Nuclear Material.

NRC, U.S. Nuclear Regulatory Commission, NUREG/BR–0006 Revision 7, Instructions for Completing Nuclear Material Transaction Reports, January 1, 2009

NRC, U.S. Nuclear Regulatory Commission, NMMSS Report D-24, Personal Computer Data Input for NRC Licensees

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ATTACHMENT 1
DOE/NRC Form 741 Instructions

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1.1 DOE/NRC Form 741 Instructions

This appendix is an abbreviated version of NUREG/BR-0006 and provides instructions specific to the SLDA project. If required, additional information regarding nuclear material transaction may be obtained from the full text of NUREG/BR-0006.

1.2 Transaction Data

The DOE/NRC Form 741, "Nuclear Material Transaction Report," is the means for entering transaction data into the NMMSS. DOE/NRC Form 741 must be completed in accordance with the instructions in NUREG/BR-0006.

DOE/NRC Form 741 is used to report physical transfers of nuclear materials between facilities. The report is also used to convey information on transactions such as inventory corrections that otherwise increase or decrease obligation balances or nuclear material categories within a facility. The NMMSS relies heavily on the quality of the data reported by the facilities involved in nuclear activities. The data submitted to the NMMSS are subject to evaluation according to the restrictions placed on nuclear activity by the policies of various governing agencies of the United States. After being verified as acceptable within the restrictions of the system, the data are entered into the NMMSS database.

Both the shipper and the receiver are required to submit DOE/NRC Form 741. The receiver should confirm that the quantity received is consistent with the shipper's report. When significant shipper-receiver differences (SRDs) are identified, they must be resolved and their root causes corrected. The regulatory intent is to require material control and accounting (MC&A) systems to promptly detect and resolve all significant SRDs. Comparisons of shippers' and receivers' reports are necessary both to confirm the acceptability of shippers' and receivers' values for establishing the book accounting amounts for received material and to detect unacceptable shippers' or receivers' values. Comparisons typically involve item verification, seal integrity, gross weights, nondestructive assay (NDA) measurements (if appropriate), and destructive measurements (if appropriate).

1.3 Reporting/Distribution Requirements

Reports are required whenever nuclear material in the types and amounts stated in the preceding section moves between locations or operations that have been assigned different reporting identification symbols (RISs) and whenever SNM and source material inventories change. The nuclear material change data (including burnup, production, measured discards, and decay) should be documented and reported to NMMSS before or at the same time as the physical inventory taking, unless another arrangement is authorized by the NRC.

The shipper initiates a DOE/NRC Form 741. If the licensee is involved in a transfer of material with a party that is not required to prepare a DOE/NRC Form 741, the licensee must prepare and submit both the shipper's and the receiver's section of the Form 741..

Reports of physical shipments between RISs must show the actual movement of material. In addition, any information on the material must also be reported. In particular, the obligation of material by a foreign entity must follow the physical movement of material between RISs.

1.4 Automated Methods for Submitting Data to the NMMSS

Since the SLDA is not a licensed site the electronic submission requirements are not required.

2 GENERAL INSTRUCTIONS

2.1 Instructions for Completing DOE/NRC Form 741

If the DOE/NRC Form 741 is reporting an onsite gain or loss, review the instructions for block 6, (ACTION CODE), and the special instructions for the M action code in Section 3 of this NUREG before completing the form.

The numbered instructions below correspond to the numbered blocks on the DOE/NRC Form 741. Each shipper of reportable quantities of SNM or source material (refer to blocks 26n and 26q) must send a DOE/NRC Form 741 to the NMMSS operator and a copy to the receiver's business address preferably on the same day the material is shipped and, in any case, no later than the close of business the next working day.

Burials are reported when shipped. The burial site operator must prepare and transmit DOE/NRC Form 741 to NMMSS to document receipt and disposal. The electronic formats for the DOE/NRC Form 741 are given in NMMSS Report D-24.

2.1.1 Reporting Shipper's Data

The DOE/NRC Form 741 should be completed in accordance with the following instructions.

1. SHIPPER'S RIS - Enter the shipper's RIS.

2. RECEIVER'S RIS - Enter the receiver's RIS.

3. TRANSACTION NUMBER - Enter a number for the same shipper-receiver combination. Numbers in the series should be consecutive (i.e., no skipped numbers).

4. CORRECTION NUMBER - This block is used to identify a transaction which is an adjustment to a previously issued DOE/NRC Form 741. Leave this block blank for an original submission of a DOE/NRC Form 741. Use the numbers 1-9, consecutively, for adjustments. For corrections requiring only changes to NMMSS data (and not to the other party's data), letters (A, B, etc.) should be used instead of numbers. See Section 4.

5. PROCESSING CODE - Enter processing code A, C, D, or Z.

A Initial entry of data.

C Replacement of data. With the concurrence of the other party to the transaction, an entire data set may be replaced at any time prior to the close of the processing period in which the initial entry was made.

D Deletion of data. Data may be deleted at any time prior to the close of the processing period in which the initial entry was made, with the concurrence of the other party to the transaction.

Z Receiver's acceptance of other party's correction. This processing code can only be used with action code D. Receivers reporting per 10 CFR Part 75 may not use the Z code.

6. ACTION CODE - This block is used to identify the type of transaction being reported on the DOE/NRC Form 741.

6a. SHIPPER - Enter one of the following action codes:

A The shipper is reporting a transaction that has taken place between the stated parties.

C The shipper is adjusting the initial DOE/NRC Form 741 for the shipment or a previous adjustment to the same initial report, or acknowledging an adjustment originated by the receiver, or accepting and agreeing with the receiver's adjustment to the DOE/NRC Form 741. See Section 4 of this NUREG.

M The shipper is reporting a one-party transaction or an adjustment to a one-party transaction (i.e., an onsite gain or loss of material due to burnup, production, measured discards, etc.). Such inventory changes are shown on DOE/NRC Form 742, "Material Balance Report." See Section 3 of this NUREG.

R The shipper is identifying a one-party transaction to delete an obligated amount of material from the facility's inventory. This code is applicable only to Former Soviet Union Weapons (WR) material after the fresh low-enriched uranium (LEU) is irradiated in a reactor core.

X The shipper is reporting an exchange of obligation that involves no physical movement of material.

6b. RECEIVER - Enter one of the following action codes:

B The receiver is reporting that a shipment has been received and that the weights reported by the shipper on the DOE/NRC Form 741 were accepted without further measurement by the receiver.

E The receiver is reporting that a shipment was received, that independent measurements were made, and that the values resulting from the independent measurements are being reported.

D The receiver is adjusting the initial DOE/NRC Form 741 for the receipt of the shipment or a previous adjustment to the same initial report, or acknowledging an adjustment originated by the shipper, or accepting and agreeing with the shipper's adjustment to the DOE/NRC Form 741. See Section 4 of this NUREG.

M The receiver is reporting a one-party transaction or an adjustment to a one-party transaction (i.e., an onsite gain or loss of material due to burnup, production, measured discards, etc.). Such inventory changes are shown DOE/NRC Form 742, "Material Balance Report." See Section 3 of this NUREG.

N The receiver is reporting physical receipt of a shipment but will delay the quantity determinations for the shipment of material for more than 10 days but no more than 60 days for source, and LEU, or no more than 45 days for highly enriched uranium.

(HEU). At the end of this time the receiver will prepare a DOE/NRC Form 741 with a B or E action code to report the receiver's quantity determinations).

Y The receiver is reporting an exchange of obligation that involves no physical movement of material.

7. DOCUMENTATION - Enter the number of pages if the submission is SECRET. This block is for paper copy submissions only.

8. SHIPPER - Leave blank.

9. RECEIVER - Leave blank.

10. NUMBER OF DATA LINES - After completing of block 26 (SHIPPER'S DATA), or block 27 (RECEIVER'S DATA), enter the total number of detail lines in block 26 or 27.

11. NATURE OF TRANSACTION - Leave blank.

12. SHIPPED FOR ACCOUNT OF - Leave blank.

13. SHIPPED TO ACCOUNT OF - Leave blank.

14. TRANSFER AUTHORITY - Leave blank.

15. EXPORT OR IMPORT TRANSFERS - For all export or import transfers, enter the NRC export or import license number, under which SNM or source material is being transferred. Where transfers are authorized by a general license, enter "Gen-Lic." In some cases the transfer may be exempt from licensing. If so, enter "Lic-Exempt." If several batches authorized by separate licenses are combined into one shipment, a separate DOE/NRC Form 741 must be filed for each license.

16. MATERIAL TYPE AND DESCRIPTION - Leave blank.

17. LINE NUMBER - Enter a two-digit sequential line number (01-99).

18. COUNTRY OF OBLIGATION - Enter the two-character country or entity designation from Table 1 for the line numbers entered in block 17. See Appendix F of this NUREG for further instructions.

19. MATERIAL TYPE - Enter the two-character material type to which the obligation is attached. Refer to Table 2 in Appendix F. (The field is expandable to three characters.)

The only material types to be reported are 10, 20, 50, 70, 81, and 88.

20. OBLIGATED ELEMENT WEIGHT - Enter the weight of the obligated amount of the element. The weight cannot be more than 11 numeric characters per D-24. See Appendix F for further instructions.

21. OBLIGATED ISOTOPE WEIGHT - For Enriched Uranium Only - Enter the weight of the obligated amount of the isotope. The weight cannot be more than 11 numeric characters.

22. ACTION DATE - * Follow the instructions below for blocks 22a through 22e.

22a. SHIPMENT (entry required by shipper) - Enter the date the nuclear material is shipped.

22b. SHIPPER'S CORRECTION (entry required by shipper) - If the document is an

acknowledgment of or a correction to a previously issued transaction report, enter the date the correction is recorded or the acknowledgment made, as appropriate.

22c. RECEIPT (entry required by receiver) - Enter the date the nuclear material is received.

22d. RECEIVER'S MEASUREMENT (entry required by receiver) - Enter the date the nuclear material is measured by the receiver. This entry is required only if receiver's action code is E.

22e. RECEIVER'S CORRECTION (entry required by receiver) - If the document is an acknowledgment or a correction to a previously issued transaction report, enter the date the correction is recorded or the acknowledgment made, as appropriate. In the case of imports or exports, licensees must complete a separate DOE/NRC Form 741 to document the foreign party action, including action dates in blocks 22a and 22c, as applicable.

23a. MISCELLANEOUS - Leave blank.

23b. CONCISE NOTE ATTACHED - Enter an X if a Concise Note is attached.

23c. UK REPORTABLE - Facilities reporting material transfers involving facilities in the United Kingdom (UK) must indicate in this block whether the shipment is reportable or non-reportable to the IAEA. Check YES for reportable or NO for non-reportable.

24. TOTAL GROSS WEIGHT - Enter the total gross weight of the shipment rounded to the nearest kilogram An approximate or estimated gross weight rounded to the nearest kilogram is acceptable. Make no entry for M action code transactions, receipts, and correction documents.

25. TOTAL VOLUME (Waste Transfers Only) - For transfers of nuclear material to or from nuclear waste sites (i.e., if the shipper or receiver RIS begins with the letter V), enter the volume of the material to be buried, stated in cubic feet rounded to the nearest cubic foot. An entry in block 25 is not required for transfers to nuclear laundry services.

26. SHIPPER'S DATA - Shipper's data are entered in block 26. Receiver's data are entered in block 27. Receivers should review the instructions for block 27 before completing the block.

Shipper and receiver measurement data are entered on DOE/NRC Form 741 for each batch of material. For licensees reporting pursuant to 10 CFR Part 75 requirements or if the transfer is an import or an export, a batch is a portion of nuclear material that is handled as a unit for accounting purposes at a key measurement point (KMP) and whose composition and quantity are defined by a single set of specifications or measurements. The batch may be in bulk form or contained in a number of separate items. If the shipment is an export or is being reported pursuant to 10 CFR Part 75, fuel assemblies or loose rods or fuel pins must be listed separately with the identifying label serving as a unique batch name. Fuel assemblies can be reported as "average" enrichment as long as the appropriate accounts (material types 10, 20, 81, etc.) are properly adjusted. Material being transferred may be listed on one line of DOE/NRC Form 741 if the material is all of the same material type, composition, ownership, and weight percent isotope (except as noted in the next paragraph). Material differing in any of these data elements must be listed on separate lines. Two or more lines may be necessary to describe a single batch (e.g., spent fuel assemblies, mixed oxide fuel). If a batch consists of several types of nuclear material, several consecutive lines should be used to describe the batch. The batch name should be repeated on all lines used to describe a single batch. In block 26e the number of items is also repeated on all lines with the same batch name. The above

general rules for grouping or batching material for reporting purposes are also applicable to licensees reporting imports or exports pursuant to 10 CFR Part 40 or 74.

Batch names are optional for other transactions reported pursuant to 10 CFR Part 40 or 74.

26a. BACK REFERENCE NUMBER - Enter the appropriate back reference number adjustments to previously completed DOE/NRC Form 741 documents. Licensees must change the back reference numbers for action codes C and D and for action code M when reporting adjustments. Both the back reference change digit and the back reference line number must be reported.

The back reference change digit represents the change digit of the document being corrected for a nullifying entry and the change digit of the document now being completed for a correcting entry. For example, if the DOE/NRC Form 741 being corrected is the original, or if the line being entered represents an addition only, enter 0 (zero). The back reference line number represents the line number of the line being corrected for a nullifying entry and the line number of the corresponding nullifying line for a correction entry. If the line being entered represents an addition only or represents a net change, enter 000000 (zeros).

26b. LINE NUMBER - In providing detailed measurement data, enter a line number. Beginning with 01 for the first line of detailed shipper's data, and increase the line number by one for each additional line of detailed shipper's data entered on the form (up to 99). When two or more lines of measurement data refer to a single batch, repeat the unique batch name for each line of the batch data. For example, repeat the batch name when different material types of multi-enrichment fuel rods are entered on separate lines or when UF6 product material and UF6 heel material in a cylinder are reported on separate lines.

26c. TYPE OF INVENTORY CHANGE - All changes to inventory that meet the reporting criteria must be reported on DOE/NRC Form 741. There are 29 inventory change type (ICT) codes listed in Appendix B. Many of these 29 codes are used by NMMSS for internal reporting activities. And need not be entered by the licensee in this block. Other codes, such as the codes for de-exemption use, de-exemption quantity, exemption use, exemption quantity, and termination of non-nuclear use are seldom used. These codes are occasionally used for the facilities identified in the instructions for block 26h and are addressed as they occur through direct contact between the licensee and the NRC. There is a third group for which entry in this block is mandatory. Appendix B explains the ICT codes and indicates whether they are to be entered in block

26c. When the ICT code for a normal operational loss (LD), measured discard (TW), or (LA) accidental loss is used, additional information is required. There are four dispositions of measured discards for which are to be reported:

A when material is discarded into the atmosphere

G when material is discarded through ground effluents

L when material is discarded into a pond or lagoon

H when material is transferred to a holding area at the facility pending possible shipment offsite for disposal

When any of the above activities occurs, a DOE/NRC Form 741 should be prepared. The shipper should enter its RIS in the SHIPPER'S RIS block (block 1) and the same RIS in the RECEIVER'S RIS block (block 2), but append an A, G, L, or H, to the receiver's RIS as appropriate. For example, if a facility with RIS XYZ discards material to a lagoon, the transaction on the DOE/NRC Form 741 would be from XYZ to XYZL.

26d. IDENTIFICATION (ITEM/BATCH NAME) - Enter a name or number, or a combination of both, that identifies the reporting facility and the batch of material being shipped. If the licensee is reporting pursuant to 10 CFR Part 75, or if the transfer is an import or export,

the shipper or receiver enters a name which identifies a unique portion of nuclear material handled as a unit for accounting purposes. For fuel assemblies pins and rods, the batch name should be the identification numbers of the fuel assembly pin or rod. In the case of an import, the receiver must use the same batch name as the shipper provided the shipper's batch name conforms to the above specifications. If it does not, see the Concise Note instructions (Section 5).

26e. NUMBER OF ITEMS - Enter the number of similar items of which the line entry consists (e.g., cylinders, packs, drums, bird cages, bottles, tank vessels). When reporting fuel pins, rods, or plates, report the number of separate fuel pins, rods, or plates involved. When reporting fuel assemblies, report the number of complete assemblies represented on the line entry. In the case of transfer of bulk material, enter a 1. Leave blank if an M action code is used.

26f. PROJECT NUMBER - Leave blank.

26g. MATERIAL TYPE - Enter the appropriate SNM or source material type code from the list below. U.S. Code (Domestic Transfers) IAEA Code (Imports/Exports)

Description

10 D Depleted uranium

20 EG Enriched uranium

50 P Plutonium

70 EK U-233

81 N Normal uranium

83 Pu Pu238

88 T Thorium

89 To be obtained from IAEA

Uranium in cascade

26h. COMPOSITION/FACILITY CODE - Enter the appropriate code describing the physical form (unencapsulated, encapsulated, etc.) and the chemical form of the material. See Attachment 1.

26i. OWNER CODE - This code identifies the ownership of the material at the time it was in the shipper's possession. Enter the appropriate code from the list below.

G U.S. Government-owned J Not U.S. Government-owned

26j. KEY MEASUREMENT POINT (KMP) - This block is for reporting on a facility where nuclear material is in a form that may be measured to determine material flow or inventory. Codes for KMPs are identified in the FAs or TFAs developed for those facilities described in the instructions for block 26h. This data element only applies to licensees reporting pursuant to the requirements of 10 CFR Part 75. All other licensees should leave this block blank.

26k. MEASUREMENT IDENTIFICATION (see 26j) - This block applies only to licensees reporting pursuant to the requirements of 10 CFR Part 75 and to those facilities identified in the instructions for 26h. All other licensees should leave blank. This block indicates where and when the material was measured. It consists of three parts.

26k1. BASIS - Enter the pertinent one-character code from the following: N if the batch data are based on measurements made in an IAEA material balance area (MBA) other than the reporting MBA L if the batch data are based on measurements made in another IAEA MBA and have been previously reported by the reporting MBA in a DOE/NRC Form 741, "Nuclear Materials Transaction Report," or a DOE/NRC Form 742C, "Physical

Inventory Listing" M if the batch data are based on measurements made in the reporting IAEA MBA and the data were not previously reported T if the batch data are based on measurements in the reporting IAEA MBA and have been previously reported for that MBA on a DOE/NRC Form 741 or a DOE/NRC

Form 742C

26k2. OTHER MEASUREMENT POINT (OMP) - For batch data designated code M in block

26k1, enter the code of the KMP where measurements were made if it is different from the KMP indicated in 26j above. If the same, leave blank.

26k3. MEASUREMENT METHOD - If two or more measurement methods employed at the same KMP have a different measurement uncertainty, enter the code for the measurement method used, as identified in your FA.

26l. GROSS WEIGHT - Enter the gross weight of the line entry in kilograms of material shipped plus tare weight (packaging and shipping container).

26m. NET WEIGHT - Enter the weight of the material shipped, excluding tare weight, in grams for SNM and kilograms for source material.

26n. ELEMENT WEIGHT - Enter the weight of the contained SNM or source material rounded to the quantities reported below.

Material Reporting Units

Plutonium or uranium enriched in U-235 or U-233 nearest whole gram

Pu238 nearest 1/10 gram

Source material nearest kilogram

If the quantity to be entered is equal to or greater than 0.5 of the reporting unit, the quantity should be rounded up to the next whole reporting unit. If the quantity to be entered is less than 0.5 of the reporting unit, the quantity should be rounded down to the next whole reporting unit.

26o. ELEMENT LIMIT OF ERROR - Limits of error need only be reported by licensees who are authorized to possess at any time and location SNM in a quantity exceeding one effective kilogram and authorized to use SNM for activities other than those involved in the operation of a nuclear reactor licensed pursuant to 10 CFR Part 50; are involved in a waste disposal operation; or are authorized to possess sealed sources (under 10 CFR 70.58(e)). Complete when the total shipment contains more than 50 grams of U-235, U-233, or plutonium, or any combination of these. Enter the limit of error for each element entry using the same weight units as in block 26n, except where the line entry represents a sealed plutonium-beryllium source (composition code 481); samples each of which has been determined by other means to contain less than 10 grams U-235, U-233, or plutonium (composition code 771); and reactor-irradiated fuels (composition code 375) involved in research, development, and evaluation programs in facilities other than irradiated-fuel reprocessing plants. Limits of error are to be at the 95% confidence level, propagated by the uncertainties of the weight measurement, the chemical analysis, and the sampling method. Limits of error are not applicable to source material. Licensees making onsite transfers between two different RISs or within the same RIS are exempt from supplying limits of error data for the transfers. (Transfers between a license-exempt operation and a licensed operation at the same location are not considered onsite transfers, and limits of error are required.)

26p. WEIGHT % ISOTOPE - Enter the weight percent of the isotope U-235 if the uranium is enriched or depleted in U-235. If plutonium, enter the weight percent of the isotope Pu-240. If Pu-238, enter the weight percent of the isotope Pu-238. Report weight percent to at least two, but not more than four, decimal places, depending upon the accuracy of the measurement method employed (for example, XX.XXXX%). For U-233, enter the parts per million of U-232. This block does not apply to natural uranium and thorium. Use separate lines to report material of different enrichments. The Pu and U-235 content of irradiated fuel must be determined and reported upon removal of the spent fuel from the reactor core. Reactor operators may report the total non-fissile isotope instead of Pu-240 in this block for spent fuel if the computer codes the operator uses have this limitation.

26q. ISOTOPE WEIGHT - Enter the isotope weight. If enriched uranium or U-233, enter weight to the nearest gram of U-235 or U-233 as appropriate. If plutonium, enter the sum of Pu-239 nd Pu-241 to the nearest gram. If Pu-238, enter the weight of the isotope Pu-238 to the nearest 1/10 of a gram. For depleted uranium, enter the isotope weight to the nearest kilogram. Make no entry for other source material.

If the quantity to be entered is equal to or greater than 0.5 of the reporting unit, the quantity should be rounded up to the next whole reporting unit. If the quantity to be entered is less than 0.5 of the reporting unit, the quantity should be rounded down to the ext whole reporting unit.

26r. ISOTOPE LIMIT OF ERROR - Limits of error need only be reported by licensees who re authorized to possess at any one time and location SNM in a quantity exceeding 1 effective kilogram and authorized to use such SNM for activities other than those involved n the operation of a nuclear reactor licensed pursuant to 10 CFR Part 50; who are involved in a waste disposal operation; or who are authorized to possess sealed sources 10 CFR 70.58(e)). Complete this block when the total shipment contains more than 50 grams of U-235, U-233, r plutonium or any combination of U-235 and plutonium. Enter the limit of error for each isotope entry using the same weight units as in block 26n, except where the line entry represents a sealed plutonium-beryllium source (composition code 481); samples each f which has been determined by other means to contain less than 10 grams U-235, U-233, or plutonium (composition code 771); or reactor-irradiated fuels involved in research, development, and evaluation programs in facilities other than irradiated-fuel reprocessing plants. Limits of error are to be at the 95% confidence level, propagated by the uncertainties of the weight measurement, the chemical analysis, the isotopic analysis, and the sampling method. Limits of error are not applicable to source material.

26s. SIGNATURE OF AUTHORIZED OFFICIAL AND DATE SIGNED - If submitted on paper, the report must be signed by an authorized representative of the licensee. Otherwise, enter the date submitted. Each licensee must establish internal procedures to ensure that the information provided in the report is accurate and that the report has been prepared and issued only by the authorized licensee personnel. Proprietary information must be included when necessary to provide an adequate response. An application to withhold such information from public disclosure may be made and will be dispositioned in accordance with the provisions of 10 CFR 2.790. If any of this information is of particular sensitivity, a request may be made that such information not be transmitted to the IAEA. Such a request must refer to, and must conform with 10 CFR 75.12.

2.1.2 Reporting Receiver's Data

Each receiver of reportable quantities of special nuclear material or source material must acknowledge receipt of shipments in accordance with the following instructions:

• If the receiver plans to accept the shipper's measurement data without making independent measurements (B action code), the receiver must, within 10 days of receipt of the material, submit a DOE/NRC Form 741. There are two options for filling out the form:

(1) complete blocks 1 through 25 and put a zero (0) in block 10, or

(2) complete blocks 1 through 25, enter the shipper's values in block 26, and repeat the shipper's values in block 27.

Facilities reporting pursuant to 10 CFR Part 75 must use the second option. Dispatch the form in accordance with the instructions in Section 2.3.2.

• If the receiver makes independent measurements (E action code), the receiver must, within 10 days of receipt of the material:

(1) complete blocks 1 through 25, enter the shipper's values in block 26, and complete blocks 27a through 27s of the DOE/NRC Form 741.

(2) dispatch the form in accordance with the instructions in Section 2.3.2.

• If the receiver intends to make independent measurements within 60 days for source material or LEU, or 45 days for HEU (N action code), unless an exemption is authorized by NRC, the receiver shall, within 10 days of receipt of the material:

(1) complete blocks 1 through 25, enter the shipper's values in block 26, and complete blocks 27a through 27s of the DOE/NRC Form 741.

(2) dispatch the form in accordance with the instructions in Section 2.3.2; and

(3) after independent measurements are made, follow the instructions for reporting a B or E action code. If measurements are delayed, they must be completed and reported on DOE/NRC Form 741 within 60 days for source material and LEU and within 45 days for HEU after the receipt of each shipment, except in the case of receipts of scrap and irradiated material. In the case of a scrap processor receiving several shipments of scrap which are accumulated and processed together, the recovered quantity of material must be prorated to the specific transmittal documents and line entries to maintain the one-to-one correspondence between shipper's and receiver's data.

27. RECEIVER'S DATA - Fill in the receiver's data blocks as follows.

27a. BACK REFERENCE NUMBER - See the instructions for block 26a.

27b. LINE NUMBER - See 26b.

27c. TYPE OF INVENTORY CHANGE - See 26c.

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27d. IDENTIFICATION (ITEM/BATCH NAME) - See 26d.

27e. NO. OF ITEMS - See 26e.

27f. PROJECT NUMBER - See 26f.

27g. MATERIAL TYPE - See 26g.

27h. COMPOSITION/FACILITY CODE - See 26h.

27i. OWNER CODE - This code describes the material ownership at the time it comes into the receiver's possession. See 26i.

27j. KEY MEASUREMENT POINT - See 26j.

27k. MEASUREMENT IDENTIFICATION - See 26k.

27l. GROSS WEIGHT - See 26l.

27m. NET WEIGHT - See 26m.

27n. ELEMENT WEIGHT - See 26n.

27o. ELEMENT LIMIT OF ERROR - See 26o.

27p. WEIGHT % ISOTOPE - See 26p.

27q. ISOTOPE WEIGHT - See 26q.

27r. ISOTOPE LIMIT OF ERROR - See 26r.

27s. SIGNATURE OF AUTHORIZED OFFICIAL AND DATE SIGNED - See 26s.

2.2 Preparation of DOE/NRC Form 741 in Computer-Readable Format

NMMSS Report D-24 provides instructions for preparing DOE/NRC Form 741 in computer readable format as required for submittals.

2.3 Distribution of DOE/NRC Form 741

2.3.1 Shipper

Each shipper of reportable quantities of special nuclear material (SNM) or source material must dispatch a DOE/NRC Form 741, as described below, no later than the close of business the next working day after the shipment. In the case of spent fuel shipments, in accordance with 10 CFR 73.37, the date of shipment is "Safeguards Information" until 10 days after the shipment or the last shipment in a series of shipments is received. Therefore, the DOE/NRC Form 741 should be stamped "Safeguards Information" and handled according to 10 CFR 73.21. Burials are reported when shipped. A DOE/NRC Form 741must be prepared and transmitted to NMMSS by the burial site operator to document receipt and disposal. Distribute the completed DOE/NRC Form 741 as follows:

• Provide a copy in a mutually agreeable format, to the other party in the transaction.

• Submit one copy to NMMSS. (See Section 1.5 for documentation and distribution of classified and unclassified reports.)

• Retain one copy for your file.

2.3.2 Receiver

Distribute the completed DOE/NRC Form 741 as follows:

• Submit one copy in computer-readable format to NMMSS. (See Section 1.5 for documentation and distribution of classified and unclassified reports.)

• Return one copy, in a mutually agreeable format, to the shipper.

• Retain one copy for your file.

3 INSTRUCTIONS FOR ONSITE GAINS AND LOSSES (M ACTION CODE)

3.1 Instructions for Completing DOE/NRC Form 741

When action code M is used, the DOE/NRC Form 741 should be completed in accordance with the following instructions.

1. SHIPPER'S RIS - Enter your RIS.

2. RECEIVER'S RIS - Same as in block 1.

3. TRANSACTION NUMBER - See the instructions for block 3 in Section 2.1.1 or contact the NMMSS operator for other options.

4. CORRECTION NUMBER - See the instructions for block 4 in Section 2.1.1.

5. PROCESSING CODE - See the instructions for block 5 in Section 2.1.1.

6. ACTION CODE - Enter M in 6a or 6b or both.

7. DOCUMENTATION - Enter the number of pages if the submission is SECRET. This block is for paper copy submissions only.

8. NAME AND ADDRESS OF SHIPPER - Leave blank.

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9. NAME AND ADDRESS OF RECEIVER - Leave blank.

10. NUMBER OF DATA LINES - Enter the total number of detail line entries on the form.

11. NATURE OF TRANSACTION - Leave blank.

12. SHIPPED FOR ACCOUNT OF - Leave blank.

13. SHIPPED TO ACCOUNT OF - Leave blank.

14. TRANSFER AUTHORITY - Leave blank.

15. EXPORT OR IMPORT TRANSFERS - Leave blank.

16. MATERIAL TYPE AND DESCRIPTION - Leave blank.

17. LINE NUMBER - See the instructions in Section 2.1.1 for block 17.

18. COUNTRY OF OBLIGATION - See the instructions in Section 2.1.1 for block 18.

19. MATERIAL TYPE - See the instructions in Section 2.1.1 for block 19.

20. OBLIGATED ELEMENT WEIGHT - See the instructions in Section 2.1.1 for block 20.

21. OBLIGATED ISOTOPE WEIGHT - For Enriched Uranium Only - See the instructions in Section 2.1.1 for block 21.

22. ACTION DATE - Enter the date of the activity in at least one of blocks 22a through 22e. If more than one block is completed, all dates must be the same.

23. MISCELLANEOUS - Leave blank.

24. TOTAL GROSS WEIGHT - Leave blank.

25. TOTAL VOLUME - Leave blank.

26. SHIPPER'S DATA

26a. BACK REFERENCE NUMBER - See the instructions in Section 2.1.1for this block.

26b. LINE NO. - See the instructions in Section 2.1.1 for this block.

26c. TYPE OF INVENTORY CHANGE - See Section 2.1.1.

26d. IDENTIFICATION (ITEM/BATCH NAME) -See Section 2.1.1.

26e. NO. OF ITEMS - See Section 2.1.1.

26f. PROJECT NUMBER - Leave blank.

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26g. MATERIAL TYPE - See Section 2.1.1.

26h. COMPOSITION/FACILITY CODE - See Section 2.1.1.

26i. OWNER CODE - See Section 2.1.1.

26j. KEY MEASUREMENT POINT - See Section 2.1.1.

26k. MEASUREMENT IDENTIFICATION - See Section 2.1.1.

26l. GROSS WEIGHT - See Section 2.1.1.

26m.NET WEIGHT - See Section 2.1.1.

26n. ELEMENT WEIGHT - See Section 2.1.1.

26o. ELEMENT LIMIT OF ERROR - See Section 2.1.1.

26p. WEIGHT % ISOTOPE - Leave blank for ICT codes MF and EQ unless the material is enriched uranium. For ICT codes LN and TN, report the same weight % isotope as for the beginning of the inventory period. See the instructions in Section 2.1.1 for this block.

26q. ISOTOPE WEIGHT - See Section 2.1.1.

26r. ISOTOPE LIMIT OF ERROR - Leave blank.

26s. SIGNATURE OF AUTHORIZED OFFICIAL AND DATE SIGNED - See Section 2.1.1.

27. RECEIVER'S DATA - See the instructions in Section 2.1.2 for block 27.

3.2 Preparation of DOE/NRC Form 741 in Computer-Readable Format

NMMSS Report D-24 provides instructions for preparing DOE/NRC Form 741 in computer readable format as required for submittals.

3.3 Distribution of DOE/NRC Form 741

Distribute the completed DOE/NRC Form 741 as follows:

• Submit one copy in computer-readable format to NMMSS. (See Section 1.5 for documentation and distribution of classified and unclassified reports.)

• Retain one copy for your file.

4 INSTRUCTIONS FOR CORRECTING A DOE/NRC FORM 741 (C, D, AND M ACTION CODES or Z PROCESS CODE)

Adjustments are independent actions. Either the shipper or the receiver may initiate an adjustment to a DOE/NRC Form 741 reporting the original shipment or receipt of material or an adjustment to any previous adjustment to the original. The other party is required to acknowledge that an adjustment was made, but not required to make the same adjustment to its records.

4.1 Originator

The originator of the "corrected copy" must:

• Complete blocks 1 through 25, as appropriate, referring to the copy of DOE/NRC Form 741 being corrected.

• Insert in block 26a or 27a of the "did-read" line, as appropriate, a three-digit back reference code. If the line of data has not been previously corrected, a zero (0) should be used. If previously corrected, the first digit is the correction number (block 4) from the DOE/NRC Form

741 being corrected. (If the line of data has been corrected several times, the most recent correction number should be used.) The next two digits are the line number (block 26b or 27b) on the DOE/NRC Form 741 being corrected.

• Complete the did-read line, blocks 26b through j and n through r or 27b through j and n through r, as appropriate, by duplicating the entire line being corrected from the DOE/NRC Form 741 being corrected and indicating the opposite sign (positive or negative) from the original one used in reporting the number of items (block e), element weight (block n), element limit of error (block o), isotope weight (block q), and isotope limit of error (block r).

• Insert in block 26a or 27a of the "should-read" line, as appropriate, a three-digit back reference code that references the corresponding did-read line. The first digit is the correction number of the document being completed; the next two digits are the line number of the corresponding did-read line.

Repeat this procedure until all lines requiring adjustment have been "backed out" and resupplied with the correct information. The did-read and should-read for each line being adjusted should be paired (i.e., consecutive).

One or more changes can be made to each line. Only incorrect lines should be included in a correction report. If adding a line to the original document, the back reference should be (000) (block 26a or 27a) and pairing is not done.

If a line previously reported is split into two or more lines, one of the should-be lines should back reference the did-read line and all others should be considered new additions (000).

If a line is to be voided, only a did-read line should be used (no pairing). Examples of an initial report and subsequent correction reports are provided in Appendix C.

4.2 Receiver

Within 10 days, the facility receiving the corrected DOE/NRC Form 741 must either:

• submit a DOE/NRC Form 741 acknowledging the adjustment (which will close a transaction but will not affect the acknowledging party's values),

• submit a DOE/NRC Form 741accepting the adjustment. This closes a transaction and applies the other party's adjustment to the acknowledging party's values.

There is no requirement for both parties to make the same quantity adjustments. However, if both parties choose to adjust on the same corrected DOE/NRC Form 741, they must both report the same number of entries and the material types must agree line for line.

4.3 Use of the Z Process Code

If the receiving party agrees to all changes for an action code C document, the receiving party may utilize process code Z and action code D. Submit a DOE/NRC Form 741 to report data in blocks 1, 2, 3, 4, 20, 22. The Z code should be entered in block 5b and action code D in block 6b, and block 22 should be completed. The Z process code may not be used by a licensee reporting per 10 CFR Part 75.

4.4 Distribution of Corrections to DOE/NRC Form 741

The originator should:

• Submit one copy, in a mutually agreeable format, to the other party in the transaction.

• Submit one copy to NMMSS. (See Section 1.5 for documentation and distribution of classified and unclassified reports.)

• Retain one copy for your file.

Upon receipt of a correction, distribute the completed DOE/NRC Form 741 as follows:

• Submit one copy to NMMSS. (See Section 1.5 for documentation and distribution of classified and unclassified reports.)

• Return one copy to the originator.

• Retain one copy for your file.

5 INSTRUCTIONS FOR COMPLETING DOE/NRC FORM 740M, "CONCISE NOTE"

Not applicable to SLDA

APPENDIX G

Hazard Categorization Procedure

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Scope of Procedures for the Hazardous Compatibility Testing of Drummed Materials

1.0 Drum Waste Compatibility Testing

1.1 Air Reactivity

Visual observation is made when a sample is first opened for any type of reaction, (fuming, bubbling)

1.2 Phase Determination

Determination of phase by visual observation. Sample is solid, liquid or mixture of both. If a sample has a mixture, a percentage to equal 100% is given to each phase.

2.0 General Liquid Compatibility

2.1 Flame Ignitability

Determination is made using a Pensky-Martin closed cup tester or another compatible closed cup tester.

2.1.1 5 ml of sample is added to a testing cup of a closed cup tester.
2.1.2 Closed cup tester is heated
2.1.3 Flame is added to the closed cup sample at intervals of 5 ^{o}F.
2.1.4 Observation is made and temperature is recorded at which flash occurs.
2.1.5 If temperature reaches 200 ^{o}F, test is concluded and flashpoint of >200 ^{o}F is recorded.

2.2 Beilsteins Test

Test to determine whether halogens are present within a sample.

2.2.1 The tip of a copper wire is bent into a small coil.
2.2.2 The coil is held over flame to ensure that the wire will not melt and that any impurities are destroyed.
2.2.3 The wire is cooled
2.2.4 The coil is dipped into a small amount of waste, then held at the edge of a flame.
2.2.5 Flame color is observed, any green color is indicative of a halogen present in the sample. (Chlorine, Bromine, Fluorine, iodine).
2.2.6 The coil is held near the flame until all of the sample melts, is burned away, or evaporates.
2.2.7 Test result is recorded as either + (positive) or - (negative).

2.3 Water Reactivity and Solubility

Determination of whether a waste is soluble, insoluble or reactive with water.

2.3.1 Five milliliters of distilled water are added to a test tube.
2.3.2 Several drops of waste are placed into the test tube containing the water.
2.3.3 Any reactions are observed. These may be noted as gas generation, heat generation or combustion. These test result is recorded as either + (positive) or - (negative), along with the type of reaction.

2.3.4 Water soluble properties are observed. Organic solvents will form a distinctly separate layer from the water and will be recorded as - (negative).
2.3.5 An aqueous waste will form a single phase in the test tube and will be recorded as + (positive).

2.4 Hexane Solubility

Determination of whether a waste is soluble or insoluble in hexane.

2.4.1 Five milliliters of hexane are added to a test tube.
2.4.2 Several drops of waste are placed into the test tube containing the hexane.
2.4.3 Hexane solubility properties are observed. Organic solvents will from a single phase in hexane and will be recorded as + (positive). Wastes that are insoluble in hexane will be recorded as - (negative).

3.0 Inorganic and Organic liquid compatibility.

3.1 Oxidizers

The presence of oxidizers are tested using potassium iodide (KI) / starch paper.

3.1.1 A drop of waste is placed on KI / starch paper.
3.1.2 Color change on the paper is observed. A purple stain will indicate the presence of an oxidizer and will be recorded as + (positive).
3.1.3 If no purple stain appears after two minutes, no oxidizer is present and will be recorded as - (negative). Many wastes are dark and cause dark staining on the KI paper. In this case the edges of the KI paper must be studied closely for observation of staining.
3.1.4 Strong acids and bases may cause a brownish staining. When this happens, the KI paper must be moistened with a buffer solution of sodium acetate cryohydrate and acetic acid, the test is then repeated.

3.2 Peroxides

The presence of peroxides is tested using peroxide test paper.

3.2.1 Peroxide test paper is placed in a one milliliter solution of sample for five seconds.
3.2.2 If necessary, prior to testing, pH of a sample will be adjusted using to a range between 2-12 by slowly adding either drops of NaOH to raise the pH, or H2SO4 to lower the pH.
3.2.3 A blue stain will indicate the presence of a peroxide and will be recorded as + (positive). The darker the blue stain appears, the stronger the concentration of peroxides.
3.2.4 If no blue staining occurs after two minutes, no peroxides are present and the result will be recorded as - (negative).

4.0 Organic Liquid Compatibility

4.1 Volatile Vapor measurement

The presence of volatile vapors is tested for by using an organic vapor monitor or combustible gas meter.

4.1.1 Sample jar is secured beneath a fume hood.
4.1.2 The lid of the sample jar is opened and held over the jar.
4.1.3 The tip or wand of the gas meter is placed within the headspace of the jar.

4.1.4 A recording is made of the maximum concentration of volatile gases detected.

4.2 Oxidizers

The presence of oxidizers are tested for using the same method as described above in section **3.1**

4.3 Peroxides

The presence of peroxides is tested for using the same method as described in section **3.2**

4.4 pH

The pH of a sample is determined using pH test paper.

4.4.1 Two milliliters of distilled water are placed in a test tube.
4.4.2 Two milliliters of sample are placed in the test tube with the water and the solution is mixed.
4.4.3 A drop of this solution is placed onto a strip of pH test paper.
4.4.4 The color change of the pH test paper is compared to the pH key provided on the pH test paper packet, and a determination of pH is made.
4.4.5 The pH result is recorded.

4.5 Sulfide Testing

The presence of sulfide is tested for using lead acetate paper.

4.5.1 A strip of lead acetate paper is moistened with a sodium acetate cryohydrate buffer solution.
4.5.2 A drop of sample is placed on the lead acetate paper.
4.5.3 Observations are made and if a black stain appears on the paper, sulfide is present and a + (positive) notation is recorded.

4.6 Cyanide Testing

The presence of Cyanide is tested for using a cyanide Draeger ion detector tube.

4.6.1 Cyanide ion detector tube is broken and placed into the Draeger tube hand pump.
4.6.2 Pump is operated according to directions specified by Draeger and air is sampled from the headspace of the sample container.
4.6.3 Observations within the tube are made.
4.6.4 Color change within the tube will indicate the presence of Cyanide and the concentration will be recorded as it is shown on the graduated test tube.

5.0 Solids Characterization

5.1 Volatile Vapor measurement

The presence of volatile vapors is tested for by using an organic vapor monitor or combustible gas meter.

5.1.1 Sample jar is secured beneath a fume hood.
5.1.2 The lid of the sample jar is opened and held over the jar.
5.1.3 The tip or wand of the gas meter is placed within the headspace of the jar.
5.1.4 A recording is made of the maximum concentration of volatile gases detected.

5.2 Ignitibility

The ease of ignitibility of a solid is tested.

5.2.1 The tip of a copper wire is bent into a small coil.
5.2.2 The coil is held over flame to ensure that the wire will not melt and that any impurities are destroyed.
5.2.3 The wire is cooled.
5.2.4 A BB-sized portion of the sample is collected on the wire coil.
5.2.5 The wire coil is placed into the flame and observations are made.
5.2.6 Samples that do not ignite or burn only while in the flame, will be designated as having a - (negative) result.
5.2.7 Samples that do ignite and burn vigorously, will be designated as having a + (positive) result.

NOTE: This test may be supplemented by performing Method 1030, Ignitibility of Solids. A copy of this test method is included at the end of these procedures.

5.3 Beilsteins Test

Test to determine whether halogens are present within a sample.

5.3.1 The tip of a copper wire is bent into a small coil.
5.3.2 The coil is held over flame to ensure that the wire will not melt and that any impurities are destroyed.
5.3.3 The wire is cooled
5.3.4 A BB-sized portion of the sample is collected on the wire coil.
5.3.5 The wire coil is placed into the flame and observations are made.
5.3.6 Flame color is observed, any green color is indicative of a halogen present in the sample. (Chlorine, Bromine, Fluorine, iodine).
5.3.7 The coil is held near the flame until all of the sample melts, is burned away, or evaporates.
5.3.8 Test result is recorded as either + (positive) or - (negative).

5.4 Water Reactivity and Solubility

Determination of whether a waste is soluble, insoluble or reactive with water.

5.4.1 Five milliliters of distilled water are added to a test tube.
5.4.2 A BB-sized portion of waste is placed into the test tube containing the water.
5.4.3 Any reactions are observed. These may be noted as gas generation, heat generation or combustion. These test result is recorded as either + (positive) or - (negative), along with the type of reaction.
5.4.4 Sample is mixed thoroughly.
5.4.5 Observations of the samples solubility will be made and recorded as - (insoluble), partial, or (+soluble).

5.5 Hexane Solubility

Determination of whether a waste is soluble or insoluble in hexane.

5.5.1 Five milliliters of hexane are added to a test tube.
5.5.2 A BB-sized portion of waste is placed into the test tube containing the hexane.

5.5.3 Hexane solubility properties are observed and recorded as - (insoluble), partial, or + (soluble).

5.6 Oxidizers

The presence of oxidizers are tested using potassium iodide (KI) / starch paper.

5.6.1 Five milliliters of distilled water are added to a test tube.
5.6.2 A BB-sized portion of waste is placed into the test tube containing the water and the water is thoroughly mixed.
5.6.3 A drop of the mixture is placed on KI / starch paper.
5.6.4 Color change on the paper is observed. A purple stain will indicate the presence of an oxidizer and will be recorded as + (positive).
5.6.5 If no purple stain appears after two minutes, no oxidizer is present and will be recorded as - (negative). Many wastes are dark and cause dark staining on the KI paper. In this case the edges of the KI paper must be studied closely for observation of staining.
5.6.6 Strong acids and bases may cause a brownish staining. When this happens, the KI paper must be moistened with a buffer solution of sodium acetate cryohydrate and acetic acid, the test is then repeated.

5.7 Peroxides

The presence of peroxides is tested using peroxide test paper.

5.7.1 Five milliliters of distilled water are added to a test tube.
5.7.2 A BB-sized portion of waste is placed into the test tube containing the water and the water is thoroughly mixed.
5.7.3 If necessary, prior to testing, pH of a sample will be adjusted using to a range between 2-12 by slowly adding either drops of NaOH to raise the pH, or H2SO4 to lower the pH.
5.7.4 A blue stain will indicate the presence of a peroxide and will be recorded as + (positive). The darker the blue stain appears, the stronger the concentration of peroxides.
5.7.5 If no blue staining occurs after two minutes, no peroxides are present and the result will be recorded as - (negative).

5.8 Sulfide Testing

The presence of sulfide is tested for using lead acetate paper.

5.8.1 Five milliliters of distilled water are added to a test tube.
5.8.2 A BB-sized portion of waste is placed into the test tube containing the water and the water is thoroughly mixed.
5.8.3 A strip of lead acetate paper is moistened with a sodium acetate cryohydrate buffer solution.
5.8.4 A drop of sample is placed on the lead acetate paper.
5.8.5 Observations are made and if a black stain appears on the paper, sulfide is present and a + (positive) notation is recorded. If no black stain appears, a - (negative) notation is recorded.

5.9 Cyanide Testing

The presence of Cyanide is tested for using a cyanide Draeger ion detector tube.

5.9.1 Cyanide ion detector tube is broken and placed into the Draeger tube hand pump.
5.9.2 Pump is operated according to directions specified by Draeger and air is sampled from the headspace of the sample container.

5.9.3 Observations within the tube are made.
5.9.4 Color change within the tube will indicate the presence of Cyanide and the concentration will be recorded as it is shown on the graduated test tube.