DISCLAIMER

Uranium Disposition Services, LLC
Burns and Roe Enterprises, Inc.
Energy*Solutions*, LLC
AREVA NP Inc

U. S. Department of Energy
Portsmouth Paducah Project Office
Portsmouth Site
Paducah Site

EXECUTIVE SUMMARY

This plan, contract deliverable D-7, describes the management of wastes generated during operation of the conversion plants and during cylinder surveillance and maintenance activities at the DOE Paducah and Portsmouth sites.

DOE O 435.1, *Radioactive Waste Management*, applies to all new and existing Department of Energy (DOE) radioactive waste management facilities, operations, and activities and so applies to the DUF_6 Conversion Project. DOE M 435.1, *Radioactive Waste Management Manual*, sets forth the requirements, establishes responsibilities, and catalogs those procedural requirements and existing practices for managing DOE radioactive waste in a manner that is protective of worker and public health and safety and the environment. DOE M 435.1 was used extensively in the development of this plan.

This plan describes the process by which waste will be managed from the point of generation to disposal. Overall, the project will generate the types and quantities of wastes per year of conversion operations and cylinder management shown in Table 1.

Table 1: DUF_6 Project Waste Streams

Waste Stream	Nominal Quantity per Year (combined)
Depleted uranium oxides	424,000 cubic feet
Empty Cylinders	17,500 cubic feet
Calcium fluoride (CaF_2)	500 cubic feet
Other Low-Level Radioactive Waste (LLRW)	19,000 cubic feet
Hazardous Waste	<280 cubic feet
Sanitary Wastewater	<22,000 m^3
Commercial Landfill Waste	<1000 MT

BACKGROUND

This plan describes each waste stream anticipated during the operations phase of this project. Included in the plan are quantities of waste and management methods. UDS will perform all activities related to waste management, including waste generation, transportation, characterization, treatment, minimization, certification, handling, packaging, storage, and disposal. The scope of this plan includes hazardous, radioactive, mixed (both hazardous and radioactive), and non-hazardous sanitary/industrial wastes.

For management of radioactive or the radiological component of mixed waste, this plan conforms to the Contractor Requirements Document of DOE O 435.1. UDS will be the generator for the management of hazardous, sanitary/industrial, or hazardous component of mixed wastes associated with the project. UDS will systematically plan, document, execute, and evaluate the management of DOE radioactive waste and/or the radiological components of mixed waste in accordance with DOE O 435.1 and shall protect the public, the environment, and workers by maintaining exposures to radiation and radiological contamination as low as is reasonably achievable (ALARA). UDS shall ensure that all hazardous and sanitary/industrial wastes and hazardous components of mixed wastes are managed in compliance with the Resource Conservation and Recovery Act (RCRA), Toxic Substance Control Act (TSCA), Comprehensive Environmental Response, Compensation, and Recovery Act (CERCLA) and with applicable regulations and permits. Appendix A details the waste management requirements for the project.

This plan will be approved internally by UDS and then submitted to the DOE contracting officer for review and approval. This plan shall be maintained and revised whenever changes are made that affect the management of wastes. All changes to the plan shall be subject to DOE approval by the contracting officer or designee.

TABLE OF CONTENTS

ACRONYMS

ALARA	As Low As is Reasonably Achievable
BOL	Bill of Lading
CaF_2	Calcium Fluoride
$Ca(OH)_2$	Calcium Hydroxide
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CID	Cylinder Information Database
DAW	Dry Active Waste
DIW	De-ionized Water
DOE	Department of Energy
DOE M	Department of Energy Manual
DOE O	Department of Energy Order
DOT	Department of Transportation
DQO	Data Quality Objectives
DSA	Documented Safety Analysis
DUF_6	Depleted Uranium Hexafluoride
EPA	Environmental Protection Agency
ES	EnergySolutions, Inc.
ES&H	Environmental, Safety & Health
ETTP	East Tennessee Technology Park
g/cc	grams per cubic centimeter
HEPA	High-Efficiency Particulate Air
HF	Hydrofluoric Acid
IP	Industrial Package
ISMS	Integrated Safety Management System
KF	Potassium Fluoride
KOH	Potassium Hydroxide
LEU	Low Enriched Uranium
HQ	Headquarters
LLRW	Low-Level Radioactive Waste
LSA	Low Specific Activity
mrem/yr	milirem per year
NDA	Nondestructive Assay
n.o.s.	not otherwise specified
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
OEPA	Ohio Environmental Protection Agency
O&M	Operations and Maintenance
PCB	Polychlorinated Biphenyl
pCi/ml	picocuries per mililiter
PPE	Personal Protective Equipment
ppb	parts per billion
ppm	parts per million
PQAP	Project Quality Assurance Program
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RWMB	Radioactive Waste Management Basis
TBD	To Be Determined
TSCA	Toxic Substance and Control Act
TCLP	Toxic Characteristic Leachability Procedure
TSDF	Treatment, Storage, and Disposal Facility
TRU	Transuranic
UDS	Uranium Disposition Services, LLC
UF_6	Uranium Hexafluoride
USEC	United States Enrichment Corporation
WAC	Waste Acceptance Criteria
WAG	Waste Acceptance Guidelines
WCO	Waste Certification Official
WMP	Waste Management Plan
WCPP	Waste Certification Program Plan

1 INTRODUCTION

Uranium Disposition Services, LLC (UDS), was selected by the Department of Energy (DOE) to disposition the depleted uranium hexafluoride (DUF_6) that is stored at the DOE Paducah and Portsmouth sites. The DUF_6 was generated because of uranium enrichment employed to make uranium suitable for use as fuel for nuclear reactors or in national security applications. Approximately 700,000 metric tons of DUF_6 are stored in approximately 58,000 steel cylinders.

UDS has designed, and constructed conversion facilities at Paducah and Portsmouth to convert the DUF_6 to uranium oxide and hydrofluoric acid. UDS is responsible for demonstrating plant and staff readiness to continue into the startup phase of commissioning the facilities for full operations. This Waste Management Plan (WMP) describes how UDS will manage the waste streams generated from these activities.

1.1 Objectives, Purpose, and Scope

This plan describes each waste stream anticipated during the operations phase of this project. Included in the plan are quantities of waste and management methods. UDS will perform all activities related to waste management, including waste generation, transportation, characterization, treatment, minimization, certification, handling, packaging, storage, and disposal. The scope of this plan includes hazardous, radioactive, mixed (both hazardous and radioactive), and non-hazardous sanitary/industrial wastes.

For management of radioactive or the radiological component of mixed waste, this plan conforms to the Contractor Requirements Document of DOE O 435.1. UDS will be the generator for the management of hazardous, sanitary/industrial, or hazardous component of mixed wastes associated with the project. UDS will systematically plan, document, execute, and evaluate the management of DOE radioactive waste and/or the radiological components of mixed waste in accordance with DOE O 435.1 and shall protect the public, the environment, and workers by maintaining exposures to radiation and radiological contamination as low as is reasonably achievable (ALARA). UDS shall ensure that all hazardous and sanitary/industrial wastes and hazardous components of mixed wastes are managed in compliance with the Resource Conservation and Recovery Act (RCRA), Toxic Substance Control Act (TSCA), Comprehensive Environmental Response, Compensation, and Recovery Act (CERCLA) and with applicable regulations and permits. Appendix A details the waste management requirements for the project.

This plan will be approved internally by UDS and then submitted to the DOE contracting officer for review and approval. This plan shall be maintained and revised whenever changes are made that affect the management of wastes. All changes to the plan shall be subject to DOE approval by the contracting officer or designee.

1.2 Plan Outline

This plan details the process that will be used to ensure safe and compliant execution of waste management work. The plan includes:

- Identification of Requirements – Summary of requirements pertaining to waste management.
- Identification of Waste Streams – Annual Waste Forecast, Types, Description, Quantity, etc.
- Waste Disposition – Disposition Flow Path, Management Approach, Disposal Method, Disposal Site Requirements, etc.
- Pollution Prevention/Waste Minimization – Programmatic Methods, Training, etc.
- Waste Characterization – Characterization Process Description, Certification Method, etc.
- Handling, Packaging, Storage, and Transportation – Requirements for each waste form.
- ALARA, Environmental Safety and Health (ES&H), and Quality – Basic descriptions of each program and how they pertain to the WMP.
- Training – A summary of training requirements for personnel involved with the execution of this plan.
- Uncertainties and Contingencies – A reference for the uncertainties that could affect the plan and contingencies to alleviate the problems.

1.3 Requirements

The requirements that drive the contents of the WMP are detailed in Appendix A and summarized below.

- DOE Regulations and Directives

  DOE O 435.1 identifies the contractor requirement to implement DOE M 435.1 which describes the requirements and establishes specific responsibilities for establishing a radioactive waste management program.

  DOE M 435.1 requires the following for all DOE radioactive waste management facilities, operations, and activities:

  - Analysis of Operations Information
  - Classified Waste
  - Conduct of Operations
  - Criticality Safety
  - Emergency Management Program
  - Environmental and Occurrence Reporting

- Environmental Monitoring
- Hazard Analysis Documentation and Safety Basis
- Life-Cycle Asset Management
- Mixed Waste
- Waste Characterization
- Packaging and Transportation
- Quality Assurance Program
- Radiation Protection
- Records Management
- Release of Waste Containing Residual Radioactive Material
- Safeguards and Security
- Safety Management System
- Site Evaluation and Facility Design
- Training and Qualification
- Waste Minimization
- Worker Protection

- Environmental Protection Agency (EPA) Requirements
- U.S. Department of Transportation (DOT) Requirements
- Commonwealth of Kentucky Requirements
- State of Ohio Requirements

1.4 Management Organization and Responsibilities

The UDS management team is responsible for developing, documenting, implementing, and maintaining the WMP and procedures that implement a systematic approach for planning, executing, and evaluating the management of waste in a manner that supports the DOE waste management programs and ensures that the requirements of DOE O 435.1, *Radioactive Waste Management*, and its manual are met. Table 1-1 outlines the responsibilities for the team members involved in waste management.

Table 1-1: Management Responsibilities

Position	Responsibility
Plant Manager	• Responsible for overall waste management • Ensure project adherence to plans and procedures • Assigns and designates the position of Waste Certification Official
Project Environmental, Safety, and Health (ES&H)/ Security	• Ensure project adherence to the integrated safety management system (ISMS) and ALARA program
Project Quality Assurance	• Ensure project adherence to the Project Quality Assurance Program (PQAP) • Assess adherence to plans and procedures
Waste Disposition Manager	Overall management of wastes generated by project to include: • Develop and maintain WMP • Develop and maintain waste management procedures • Establish waste transport and disposal contracts • Direct implementation of WMP and procedures
Waste Certification Official	• Certifies waste in accordance with NTS' WAC, Energy*Solutions* Waste Acceptance Guidelines (WAG), and UDS certification procedures • Assigns and designates the positions of Alternate Waste Certification Officials and Waste Package Certifiers • Ensures that required audits, surveillances, assessments and evaluations are conducted by qualified personnel in accordance with the annual self-assessment schedule
Waste Management and Transportation Specialists and Clerks (at the operating sites)	Performance of waste management procedures, including: • Meeting proper storage requirements • Management of samples • Characterization of wastes • Profiling of waste • Documentation for shipping and disposal
Sample Management Clerk (at the operating sites)	Performance of waste management procedures, including: • Oversight of all sample and data management activities • Contracting and interfacing with laboratories • Management and archival of data

Position	Responsibility
All Employees	• Implementation of pollution prevention/waste minimization program • Adherence to waste management procedures

The project organization is described in the DUF6-UDS-PLN-001, *Project Management Plan*.

2 WASTE STREAMS

This section describes each waste stream and an estimated annual generation quantity. The estimated quantities of waste streams generated during operations at Paducah and Portsmouth are summarized in Table 2-1. Except for the UF_6 cylinders, uranium oxide, and CaF_2, the volumes of the other wastes generated are a conservative estimate. During design, construction, and operations, UDS will seek to minimize the generation of waste as described in Section 5.0.

Table 2-1: Waste Stream Quantities

Waste Stream	Category	Generating Site*	
		Paducah	Portsmouth
UF_6 Cylinders	Low-level radioactive waste (LLRW)	10,500 cubic feet	7,000 cubic feet
Uranium Oxides	LLRW	265,000 cubic feet	159,000 cubic feet
CaF_2 (Normal Operating Conditions)	Non-Radioactive Non-Hazardous	280 cubic feet	220 cubic feet
Dry Active Waste (DAW)	LLRW	10,500 cubic feet	8,500 cubic feet
HF Clean-Up Debris	Non-Radioactive Hazardous	<140 cubic feet	<140 cubic feet
Fluids from maintenance activities (oil, hydraulic fluids)	Non-Radioactive Non-Hazardous	1,250 gallons	940 gallons
Paint Fines	Non-Radioactive Potential PCBs	7.4 cubic feet	7.4 cubic feet
Sanitary Wastewater	Non-Hazardous	4,000-8,000 gallons/day	4,000-8,000 gallons/day
Misc. Wastewater	Non-Radioactive Non-Hazardous	8,000 gallons/day	8,000 gallons/day
Miscellaneous Garbage	Non-Hazardous	5 m^3/yr	3.75 m^3/yr
Unplanned, non-specific mixed waste that may occur during some maintenance of operating activities	Mixed	<10 cubic feet	<10 cubic feet

Annual quantities unless otherwise specified

2.1 Cylinders

UDS will manage the majority of the DOE cylinder inventory at Paducah and Portsmouth and will disposition those that contain DUF_6, DUF_6 heels, or empty as waste. Note that "empty"

means the cylinder has been washed and does not contain UF_6 residues or heels. Cylinders containing low enriched uranium (LEU) or normal material, full, partially full, or heel quantities will be subject only to cylinder surveillance and maintenance pending disposition instructions from DOE. All cylinders will be stored and maintained in accordance with DUF6-UDS-PLN-011, *Cylinder Surveillance and Maintenance Plan*. The empty cylinders and those that contain depleted heels will follow two general flow paths. Cylinders that are 30-inch or 48-inch in diameter will be evaluated for reuse as containers for the uranium oxide. Cylinders that are not serviceable for this use or are not of the proper size will be sent for volume reduction and disposal. The current inventory of cylinders including those that are now empty is expected to be sufficient for oxide disposal.

The conversion process is detailed in the DUF6-UDS-PLN-004, *Conversion Operations O&M Plan*. In an autoclave, the cylinder will be emptied of UF_6 and then removed from the autoclave. The high vacuum drawn at the end of vaporization is expected to result in small heel volumes less than a few Kg for the majority of cylinders.

The emptied cylinders and heel cylinders are transferred to the heel stabilization area where the stabilizing chemical, potassium hydroxide (KOH), will be injected into the cylinder through the cylinder valve. The cylinder will then be rotated to coat the interior of the cylinder with the KOH. The chemical stabilization is necessary to ensure that the cylinder heels do not contain reactive or corrosive material that would exceed the disposal criteria. Approximately 10 gallons of potassium hydroxide will be added to each cylinder for stabilization. An absorbent determination will be prepared to assess the need for absorbent and if necessary, detail the amount and type of absorbent to use. Action steps for the optional addition of absorbent will be included in applicable procedures.

The vaporization process separates UF_6 vapor from the nonvolatile decay products that will end up in the cylinder heel. After stabilization, the cylinders will be moved to the cylinder aging area to allow the Th-234 (a daughter of U-238) to decay to acceptable ALARA levels. Th-234 is produced by the alpha decay of U-238 and is in equilibrium with the U-238, but has a short half-life. When the DUF_6 is removed in the conversion process, Th-234, which is not volatile at processing temperatures, will be concentrated in the cylinder heel. The Th-234 has a half-life of 24.1 days and its daughter nuclide, Pa-234m, is a gamma emitter with a half-life of only 1.17 minutes. Therefore, a relatively brief storage period will result in a significant decrease in the external dose from the cylinder. Accordingly, the empty cylinders will be aged to allow the Th-234/Pa-234m in the heel to decay to ALARA levels. The duration of aging is based on the actual activity levels in the cylinder and will be determined by ALARA studies. The duration is expected to be less than 60 days.

The 30-inch diameter and 48-inch diameter cylinders will be returned to the conversion building hot shop by forklift. The cylinders will be inspected for acceptability as DOT compliant packaging for transporting in accordance with 49 CFR Part 173.411, as applicable. Inspections may be completed prior to the transfer on a case-by-case basis. Based on engineering evaluation, cylinders found to have minor damage will be repaired as necessary to meet DOT requirements. After inspection and repairs, if needed, the cylinders will be moved to the cylinder

preparation system. The automated system welds a flange on to the cylinder end. Then a 6-inch diameter hole is cut in the valve end. The cut-out section will remain in the cylinder for disposal. If the automated system is shut down, UDS will weld the flange manually. In this case the 6-inch hole is cut out first followed by welding on the flange.

Cylinders with heels containing TRU and Tc-99 may be selected for sampling by manual or mechanical methods. The cylinders will be subjected to statistical sampling and analysis to determine the levels of Tc-99 and TRU isotopes actually present. The sampling requirements will be detailed in the waste stream specific sampling and analysis plan as governed by DUF6-UDS-PLN-047 *Sampling and Analysis Plan*, UDS-U-WMP-1009, *Sampling Request and Plan Development*, and modified in operations as necessary. Small cylinders or cylinders not acceptable for use as oxide shipment packages and contain heels with TRU and Tc-99 will be sampled, as necessary, and sent either directly to disposal or to a waste processor for volume reduction and then on to disposal.

2.1.1 Contaminants

Most of the cylinders are expected to contain heels consisting of depleted uranium and uranium daughters as the only radiological constituents and are expected to be Class A low-level radioactive waste (LLRW), as shown in 10 CFR 61 per DOE O 435.1. However, a small population of cylinders is known to have TRU and Tc-99 contaminants. These contaminants exist as dispersed material in the UF_6 as shown in Table 2-2 or concentrated in pre-existing heels as shown in Table 2-3.

Table 2-2: Bounding Concentrations of Dispersed TRU and Tc-99 in UF_6*

Contaminant	ppb_u
Pu-238	0.00012
Pu-239	0.043
Np-237	5.2
Tc-99	15.9
Am-241	0.0013

**** Strategy for Characterizing Transuranics and Technetium Contamination In Depleted UF6 Cylinders*, ORNL/TM-2000/242.**

The dispersed material poses no issue for waste disposal even if all the material shown in Table 2-2 remains in the cylinder after vaporization. For example,

- A full 48G cylinder contains 26,840 lbs. of UF_6 or 18,147 lbs. of uranium.
- Converting the data in the table to Ci of TRU (Pu-238, Pu-239, Np-237, and Am-241) and Tc-99 in the cylinder yields 1.055×10^{-4} Ci TRU and 2.23×10^{-3} Ci Tc-99.
- For the TRU isotopes, the disposal criterion is mass-based. The limit at Energy*Solutions* is 10 nCi/g, and the limit at NTS is 100 nCi/g. Ignoring the weight of the heel, for conservatism, and considering only the tare weight of the cylinder (2,600 lbs.), the concentration of TRU would be 0.09 nCi/g or two orders of magnitude below the more

conservative Energy*Solutions* limit. Therefore, disposal at either facility would be acceptable.

- For Tc-99, the disposal concentration is volume-based. The limit is 0.3 Ci/cubic meter at Energy*Solutions* (Class A limit per 10 CFR 61) and 3 Ci/cubic meter at NTS. In this case, the full cylinder external volume is approximately 3.99 cubic meters; therefore, approximately 1.2 Ci of Tc-99 would be allowed in this volume at Energy*Solutions*. Therefore, the worst concentration in this case is far below the more conservative limit. Again, disposal at either facility would be acceptable.

This relationship is similar for all cylinder types; therefore, the dispersed TRU and Tc-99 concentrations will have no effect on the planned waste disposal as shown above. Characterization and verification sampling will be conducted per sampling and analysis plans to further identify or verify characteristics of the material.

The cylinders with the isotopic concentration shown in Table 2-3 below are the result of uranium recycling programs that filled the cylinders with feed material for the diffusion plants that had TRU and Tc-99 entrained in the material. The cylinders were filled and emptied several times, and the heels were never removed. They were finally filled with DUF_6 and placed in storage as tails cylinders. These cylinders are not identified in the cylinder information database (CID), and, although the existing data indicates the number of cylinders with this material is small, it is not currently known which cylinders are affected.

Table 2-3: Bounding TRU and Tc-99 Concentration in Heel Cylinders*

Isotope	Concentration in Heel (ppb_u)	Concentration in cylinder (pCi/g_u)
Pu-238	5	9.52E + 02
Pu-239	1600	1.12E + 03
Np-237	54000	4.31E + 02
Tc-99	5700000	4.51E + 05
AM-241	0.57	2.20E + 01

**** Strategy for Characterizing Transuranics and Technetium Contamination In Depleted UF6 Cylinders*, ORNL/TM-2000/242.**

In this worst-case heel, the TRU concentration (ppb_U) is related to that of uranium and totals approximately 224 nCi/g_U. However, because the heel contains material other than uranium and because it is not going to be separated from the cylinder, the total mass of the waste, including the cylinder mass, is considered for disposal. Assuming the example 48G cylinder discussed previously, a heel containing over 119 lbs. of uranium would be necessary before the TRU concentration would exceed the Energy*Solutions* disposal criteria per cylinder. Although a heel containing 119 lbs. of uranium is possible, it is very unlikely and very large heels of this size are easily detected in the large cylinders. The Tc-99 concentration is more problematic because the disposal criteria is volume- and not mass-based. In this case, a heel consisting of 27 lbs. of uranium with the maximum Tc-99 concentration would exceed the Energy*Solutions* limits in a 48G cylinder. Such heels are possible and might be more difficult to discern from the cylinder weight variations, but, since the heel will include more than uranium, the actual heel

mass will be greater and more easily detected. However, these cylinders would be acceptable at NTS since the limits are an order of magnitude higher, and a heel with 270 lbs. of uranium exceeding the NTS limits is very unlikely.

Several historical studies have been or are being undertaken to determine which cylinders have these high concentrations of TRU and Tc-99 in the heels.

UDS is evaluating the available data and previous studies to determine if it is possible to identify which cylinders are suspected of having the recycled reactor heels. It is expected that the cylinders in the suspect category will be 30-inch and 48-inch diameter, but this shall be verified.

Because of the available data quality, it is likely that the radiological characterization status of this subpopulation of cylinders will be unable to be determined from the records. However, that sub-population will be sampled on a statistical basis or as required by the disposal facility. The data will be used to determine the disposal options for this sub-population. It is not anticipated that the results will affect the ability to dispose of these cylinders.

Another issue of potential cylinder contaminants is that of external polychlorinated biphenyls (PCB) paint. It is known that some cylinders are painted with PCB paint, but the total number of PCB painted cylinders is unknown. They will be handled as discussed in Section 2.8.

The contaminants for the cylinders are summarized as follows:

- The bounding concentrations of TRU and Tc-99 dispersed in the DUF6 are not expected to exceed NTS and EnergySolutions established WAC.
- The TRU and Tc-99 in the pre-existing heels of 30-inch and 48-inch diameter cylinders are unlikely to be an issue unless the heel mass or volumetric concentration exceeds a predetermined value (which varies by cylinder type).
    - In questionable cases, the cylinders will be subjected to a statistical sampling and analysis program to characterize them for disposal.
    - The CID, diffusion plant history, and available records will be reviewed to determine which cylinders might contain pre-existing heels from reactor recycle material that were present before the DUF_6 was loaded. These heels are not expected to be present in a large number of cylinders (UDS expects a subpopulation of approximately 5% or less of the cylinders to be in this category).
- A population of cylinders were painted with PCB paint. These populations will be identified and disposed as PCB bulk waste.

2.1.2 Characteristics

Table 2-4 defines the packaging/disposal cylinder characteristics.

Table 2-4: Packaging/Disposal Cylinder Characteristics

Characteristic	Description
Form	Bare or painted carbon or stainless-steel cylinder: Primarily 48-inch diameter, ~12-14-ft long, except for the adapted converter parts. Contains heels of various weights.
Particle Size	NA – The heel residue should collect in the bottom with some adhering to the walls.
Density	1.5 to 2 g/cc after conversion.
^{235}U:^{238}U content	Depleted (<0.711%)
Solubility in water	Soluble heels
Waste classification (DOE O 435.1)	Low level (non-mixed), KOH added to heel to remove potential for reactivity in heels.
Disposal classification (10 CFR 61)	Class A
Proper Shipping Name	Waste, Radioactive material, Low Specific Activity (LSA-I) or (LSA-II), non-fissile
Packaging required	Industrial Package

2.2 Oxide

The uranium oxide is generated as a powder with uniform physical and chemical properties. The powder will be compacted into briquettes prior to loading into the hopper. It is not considered waste until it is loaded into the cylinders for disposition.

2.2.1 Radioactive Contaminants

Some contaminants dispersed in the UF_6 are expected to be non-volatile and as such will remain in the cylinder heel versus entering the conversion process. Table 2-5 assumes the maximum carryover potential as 100%. As shown in the table, even if all the contaminants in the worst case carried over to the oxide, the resulting oxide is still an order of magnitude below waste disposal criteria limits at both Energy*Solutions* and NTS.

Table 2-5: Maximum Isotope Carryover to Oxide

Isotope	Concentration (ppb_u) in DUF_6	Concentration (ppb_u) in Uranium Oxide	Concentration nCi/g Oxide
Pu-238	0.00012	0.00012	1.7E-3
Pu-239	0.043	0.043	2.3E-3
Np-237	5.2	5.2	3.1E-3
Tc-99	15.9	15.9	2.3E-1
Am-241	0.0013	0.0013	3.7E-3

2.2.2 Characteristics

The characteristics of uranium oxide once loaded into the cylinders are listed in Table 2-6.

Table 2-6: Uranium Oxide Characteristics

Characteristic	Description
Color	Olive green to black
Form	Powder or compacted briquettes
Particle Size	100-200 microns following conversion. Will be roll compacted prior to disposal, although some small particulate will remain
Density	2 - 2.7 g/cc after conversion
^{235}U:^{238}U content	<0.71%
Impurities	Impurities are nominal in the feed (sub ppb) and reduced by over one order of magnitude by processing
Solubility in water	Insoluble
Waste classification (DOE O 435-1)	Low Level Radioactive Waste (non-mixed)
Disposal classification (10 CFR 61)	Class A
Proper Shipping Name	Waste, Radioactive material, Low Specific Activity (LSA-I) or (LSA-II), non-fissile
Packaging required	IP-1 or IP-2 per 49 CFR 173.402 and 173.411

2.3 Oxide-Filled Cylinders

The oxide loading area has two oxide hoppers with a cylinder fill station located below it. Cylinders will be horizontally loaded onto a hydraulic lift table and tilted to a vertical position. After the blind flange is removed, the oxide-loading flange will be connected to the cylinder flange.

While continuously monitoring the cylinder maximum fill height, the oxide will be roll-compacted to a target density of 2.4 to 2.7 g/cc and metered into the cylinder through a rotary valve. The cylinder will be vibrated to provide additional densification of the oxide in the cylinder. After the cylinder has been filled, the blind flange will be replaced, and the cylinder will be returned to the horizontal position. A final cylinder weight will be taken and entered into the waste management database. WM&T will inspect the cylinder prior to loading into a railcar or onto any conveyance. This inspection is performed to verify DOT regulations and disposal facility requirements are implemented as well as to determine if the packaging had sustained any damage that would compromise the integrity of the packaging. An overhead crane will transfer the cylinder to rail cars for shipment to the disposal site. During startup or other potential delay in shipments, the oxide-filled cylinder may be temporarily stored either within the conversion facility or the cylinder storage yards.

Key properties of the oxide-filled cylinders include:

- Waste Classification – LLRW per DOE O 435.1
- Disposal Classification – Class A per 10 CFR 61
- DOT Shipping Classification – Low Specific Activity (LSA-I or LSA-II) waste with an IP-1 or IP-2 package (49 CFR 173.403 and 173.411) or an excepted package per 49 CFR 173.427 if shipped exclusive use

2.4 Calcium Fluoride

During normal production, there is some calcium fluoride (CaF_2) that is generated. Scrubber solution in the spent KOH tank will be transferred to the CaF_2 reaction tank and contacted with calcium hydroxide ($Ca(OH)_2$). $Ca(OH)_2$ will react with potassium fluoride in the scrubber solution to form KOH and CaF_2. KOH will remain in solution, and CaF_2 (calcium fluoride) will precipitate out of solution as a solid. When this solution is filtered through the CaF_2 filter press, CaF_2 solids will be removed and packaged. Absorbent will be added to the solids to eliminate free liquid. The solid CaF_2 will be disposed in a municipal solid waste landfill or other sanitary landfill. Filtrate from the CaF_2 filter press will be transferred to the regenerated KOH tank. Process water and 45% KOH solution will be added as required to maintain a 20% KOH concentration in the scrubber solution.

2.4.1 Contaminants

Although the calcium fluoride being produced as part of the KOH regeneration process was not directly accessed in the ALARA analysis of hydrofluoric acid, the basis for release is the same since the source term is the same. Therefore, based on DUF6-G-Q-STU-001, *ALARA Analysis - Supporting Approval of Authorized Limits for Unrestricted Release of Hydrogen Fluoride and Calcium Fluoride During DUF6 Conversion Operations*, the calcium fluoride produced will be characterized for by the analysis of the hydrofluoric acid and be released as non-radioactive if results are below the approved release limits. The study concludes the following:

“A uranium release limit of 3 pCi/ml for aqueous HF correlates to a uranium concentration of 1.5 pCi/g in CaF2. Based on a worst plausible use scenario as shown in Table 4-4, worker internal radiation exposure from inhalation of CaF2 particulates (with uranium in ppm concentrations), using the 2.5 mg/m3 OSHA PEL for CaF2 (as fluorine), is approximately 0.132 mrem/yr. The expected worker dose from external exposure to CaF2 is on the order of 0.01 mrem/yr. The worst plausible use scenario total dose to workers from exposure to the uranium in CaF2 is between two and three orders of magnitude lower than the DOE dose constraint of 25 mrem/yr to the maximally exposed individual.“

2.4.2 Characteristics

Table 2-7 summarizes the characteristics of the CaF_2 regardless of the source in the process.

Table 2-7: CaF_2 Characteristics

Characteristic	Description
Color	White
Form	Powder
Particle Size	Variable depending on processing
Density	3.18 g/cc
Radioactivity content	<1.5 pCi/g
Impurities	<1%
Solubility in water	Insoluble
Waste classification (DOE O 435.1)	Non-hazardous
Disposal classification (10 CFR 61)	N/A
Proper Shipping Name	N/A
Packaging required	Dumpster or other municipal trash recepticle

2.5 Dry Active Waste (DAW)

Dry active waste is a broad category of waste that includes dry materials of varying physical forms that exhibit similar characterization and would be dispositioned in a similar manner. Some examples of DAW include personal protective equipment (PPE), paper, plastic, High Efficiency Particulate Air (HEPA) filters, mechanical parts from processing equipment, floor sweepings, yard waste, etc.

PPE and other consumables are generated daily through many operational and maintenance activities. Most of these activities occur in the conversion building, though the cylinder surveillance and maintenance activities in the yards will also generate some. Much of this PPE consists of lab coats, booties, caps, and safety glasses, which can be reused many times prior to disposal. Activities that demand more protection may require additional PPE and respirators. The respirators should be laundered and reused while their filters are disposed as LLRW.

HEPA filters are generated sporadically as they are soiled through the continuous process of building ventilation or through local point source ventilation or containment/enclosure ventilation. HEPA vacuum cleaners are also used through the facility for housekeeping activities, and these filters require disposal.

Mechanical parts from processing equipment are typically generated through maintenance activities. The sintered metal filters are an example of mechanical parts from processing equipment. These parts will be characterized for disposal after removal.

Floor sweepings are generated through housekeeping activities that include floor decontamination. In many instances, the dust generated by HEPA vacuum activities would be collected in drums and considered floor sweepings.

Cylinder Yard waste includes concrete and wooden cylinder chocks. There is a potential that the yard is contaminated by PCB paint. If so, it will be classified as bulk product waste per 40 CFR 761.3.

These examples of DAW are not all-inclusive. Other types of DAW may be generated and will be documented through the waste certification process described in Section 4.0.

All DAW will be sorted and segregated using drums or boxes throughout the processing areas. DAW generated at the Paducah facilities will be evaluated during the sorting and segregating process and again during the waste characterization process to determine if the material is a candidate for disposal in the onsite Subtitle D landfill. Pollution prevention practices and evaluations will be employed to reduce the amount of DAW generated.

2.5.1 Characteristics

Table 2-8 summarizes the characteristics of PPE and consumables.

Table 2-8: DAW Characteristics*

Characteristic	Description
Form	Various; solid, flexible forms of various sizes and shapes; solid frames around paper filter media; various sizes from small cylindrical shapes to 2-ft x 2-ft x 12-inch blocks; various sizes and shapes of various incombustible materials of construction; powder mix of various sizes from fines to aggregate chips.
Density	1.1 to 8g/cc
Radioactive content	TBD based on area of generations; may have uranium contamination
Solubility in water	Insoluble
Waste classification (DOE O 435.1)	Low Level (non-mixed)
Disposal classification (10 CFR 61)	Class A
Proper Shipping Name	Waste, Radioactive material, Low Specific Activity (LSA-I) or (LSA-II), non-fissile
Packaging required	IP-1

*** Floor sweepings may contain PCB paint chips or rust that contains PCBs; See Section 2.8 for additional information.**

2.6 HF Clean-Up

There may be small HF spills that will be contained and cleaned. These activities generate $Ca(OH)_2$, CaF_2, and debris that require management. Table 2-9 summarizes the characteristics of HF clean-up waste.

Table 2-9: HF Clean-Up Characteristics

Characteristic	Description
Form	Various sizes and shapes of various debris, $Ca(OH)_2$ and CaF_2
Density	1 to 4 g/cc
Radioactive content	None
Solubility in water	Insoluble
Waste classification (DOE O 435.1)	Hazardous (U134) – assumes HF spilled was considered product.
Disposal classification (40 CFR 261)	NA
Proper Shipping Name	Hazardous Waste Solid, n.o.s. Hazardous Waste Liquid, n.o.s.
Packaging required	IP-1 or IP-2

2.7 Fluids from Maintenance Activities (Oil, Hydraulic Fluids)

Fluids from maintenance activities include oil and hydraulic fluids from material handling equipment. Table 2-10 summarizes the characteristics of fluids from maintenance activities.

Table 2-10: Fluids from Maintenance Activities Characteristics

Characteristic	Description
Form	Various sizes and shapes of various incombustible materials of construction
Density	0.8 to 1.2 g/cc
Radioactive content	TBD; none expected
Solubility in water	Insoluble
Waste classification (DOE O 435.1)	NA
Disposal classification (40 CFR 261)	Waste Oil / Used Oil (if recycled)
Proper Shipping Name	NA
Packaging required	Industrial package (i.e., Drums or Boxes)

2.8 PCB Painted Cylinders, Paint Fines, and Related Wastes

In 1999, a number of older cylinders were found to have PCB paint at all three storage sites. Sample data indicates that some of these cylinders contain PCBs in excess of 50 ppm and would be classified as bulk product waste as defined in 40 CFR 761.3. Almost all of the PCB-painted cylinders are type 48T (approximately 4,200 cylinders in the total DOE inventory). However, the model 30A cylinders and some model 48X and 48OM cylinders manufactured before 1970 have also been found with PCB paint in excess of 50 ppm at the ETTP. Although other cylinders have been found to have some PCBs in the paint, the levels are below 50 ppm and pose no concern for storage, processing, or disposal.

As the PCB-painted cylinders with levels >50 ppm are handled, paint chips and fines could be generated and contaminate the cylinder storage and processing areas and equipment. Therefore, UDS will review the available data before processing and will process the cylinders

with PCB paint in excess of 50 ppm in batches. Note that UDS is continuing to review the historic sampling data to determine if it is sufficient for waste classification; therefore, additional characterization may be necessary. Following the batch processing, the autoclaves and associated equipment and areas will be cleaned of any visible paint residue. These wastes and the cylinder yard waste from the PCB storage areas will be assumed to be PCB-contaminated. The cylinders and waste will be disposed of as PCB bulk product waste as defined by 40 CFR 761.3.

Table 2-11 summarizes the characteristics of PCB materials with contamination >50 ppm.

Table 2-11: PCB Waste Characterization

Characteristic	Description
Form	Various sizes and shapes of various incombustible materials of construction
Density	0.9 to 1.3 g/cc or higher, depending on material
Radioactive content	Depends on waste characteristics
Solubility in water	Insoluble
Waste Classification (DOE O 435.1)	Depends on waste characteristics
Disposal classification (40 CFR 761)	PCB Bulk Product Waste if PCBs are the only hazard; if other hazardous constituents exist, waste will be classified in accordance with the primary hazard; see Section 4.
Proper Shipping Name	Depends on other waste characteristics
Packaging Required	Depends on hazard: • Radioactive: Industrial package (i.e., Drums or Boxes), IP-I or II, or as required by 49 CFR 173 • Mixed Waste: As determined by primary hazard; see Section 4 • Hazardous (even if PCB is the only hazard): as required by 40 CFR 761.65 and 49 CFR 172.101

These materials are not regulated as PCB Bulk Product Waste for disposal if the PCB concentration is <50 ppm.

2.9 Sanitary Wastewater

Sanitary wastewater will be generated daily through normal operations. Sanitary wastewater will be direct-piped to the USEC sanitary wastewater treatment facility.

2.10 Miscellaneous Wastewater

Miscellaneous wastewater, which could consist of Process (DIW) Treatment System, Wastewater, and Cooling Tower Blowdown, will be managed in accordance with all state permits. Any solids generated during dewatering activities will be characterized and managed according to the UDS Waste Certification Program.

2.11 Miscellaneous Garbage

These wastes are defined as office trash and other small-quantity wastes that can be treated as municipal or commercial waste. It is generated daily under normal operations. It is estimated that less than five cubic meters a year will be generated at each site and will be collected in dumpsters for disposition at a local landfill. Table 2-12 summarizes the characteristics of miscellaneous garbage.

Table 2-12: Miscellaneous Garbage Characteristics

Characteristic	Description
Form	Various sizes and shapes of various materials of construction ranging from paper to metal components
Density	1 to 8 g/cc
Radioactive content	None
Solubility in water	Insoluble
Waste classification (DOE O 435.1)	NA
Disposal classification (10 CFR 61)	NA; Industrial Waste
Proper Shipping Name	Sanitary Waste
Packaging required	Roll-off container or waste receptacle

3 WASTE DISPOSITION

This section provides an overview of the disposition of each waste stream.

3.1 Overview and Disposal Site Criteria

Waste will be dispositioned in accordance with Table 3-1 and the waste acceptance criteria/guidelines of the designated disposal site. Each waste stream will be profiled in accordance with UDS-U-WMP-1008, *Profile Development* to verify and document that each waste stream is appropriately characterized for the selected TSDF and meets the selected TSDF waste acceptance criteria.

NTS can accept any LLRW allowed by its performance assessment. At present, the uranium oxide-filled cylinders are considered acceptable at the NTS, but an evaluation of the NTS performance assessment may be necessary. The NTS waste acceptance criteria can be found in NOE/NV-325, *Nevada Test Site Waste Acceptance Criteria*.

Energy*Solutions* is licensed by the State of Utah with waste disposal requirements and state law based on 10 CFR 61.55. The Energy*Solutions* acceptance criteria can be found in *Bulk Waste Disposal and Treatment Facilities Waste Acceptance Criteria*; the most current version is available on the Energy*Solutions* website. Mixed waste (waste containing both hazardous constituents as defined in 40 CFR 261 and radioactive contamination) will be shipped to an off-

site TSDF to remove the hazard and then disposed as radioactive waste in the mixed waste cell at the Energy*Solutions* Clive, Utah facility.

Neither site NTS or Energy*Solutions* will grant formal waste acceptance until the process for obtaining disposal authority has been completed as described in this plan. Energy*Solutions* has provided a letter accepting the uranium content of the waste and that letter has been provided to HEI.

Hazardous waste without radioactive contamination will be packaged and transported in accordance with UDS-U-WMP-2001, *Waste Shipping*, to a properly permitted TSDF.

Non-hazardous/non-radioactive waste will be packaged and transported in accordance with UDS-U-WMP-2001, *Waste Shipping*, to a properly permitted TSDF or sanitary waste disposal facility (e.g., landfill or sewage treatment plant).

Table 3-1: Summary of Product/Waste Disposition

Product / Waste	Disposition
Cylinders	• Disposal at NTS or Energy*Solutions*. • Qualify/repair 30-inch diameter, 48-inch diameter, and CV12 DUF_6 cylinders for reuse as oxide packaging. • Cylinders that do not qualify for reuse as oxide packaging will be sent to a nuclear waste processor for volume reduction and/or packaged for disposal. • Smaller cylinders processed and/or packaged for disposal. • Shall meet the acceptance guidelines of approved disposal site • Shipped in railcars for disposal at EnergySolutions or for transload to trucks for shipment to NTS
Uranium Oxide and other LLRW	• Disposal at NTS or Energy*Solutions*. • Reuse oxide if a viable option is found. • If disposed of as waste, it shall meet WAC of an approved disposal site • Ship oxide in cylinders and other waste in appropriate packaging (i.e., drums or boxes in covered railcars or truck).
Calcium Fluoride Powder (CaF_2)	• Commercially reuse, if possible. • If disposed of as waste, primary disposal at commercial landfill if authorized for release (see DUF6-UDS-PLN-004, *Conversion Product Management Plan* and DUF6-G-Q-STU-001, *ALARA Study Supporting Free Release Limits*). • Disposal at NTS or Energy*Solutions*. • Ship in drums or metal boxes.
Mixed Waste	• Disposal shall meet WAC of an approved TSDF. • Primary TSDF is Energy*Solutions*; secondary treatment and storage (not disposal) will be facilities permitted for such activities (e.g., Permafix, Waste Control Specialists) with disposal at Energy*Solutions* or NTS. • Ship in drums or metal boxes.
Hazardous Wastes	• Off-site transport to an authorized TSDF. • Ship in drums or metal boxes.
Non-Mixed, Non-Hazardous Waste	• Package and transport to TSDF. • If water treatment is required, treatment occurs at water treatment plant. • Garbage will be sent to a commercial landfill.

4 WASTE CERTIFICATION

4.1 General

Waste certification is the process by which a variety of information related to a waste is reviewed and a determination is made that the information is or is not sufficient to allow the waste to be sent for further processing (e.g., treatment) or disposal. This information may include, but is not limited to: characterization/analytical data, container requirements,

traceability documents, quality information such as audits of processes, shipping information, etc.

The waste certification program shall designate the officials who have the authority to certify and release waste for shipment and specify what documentation is required for waste generation, characterization, shipment, and certification. These officials must be approved as part of the waste generator approval process for NTS disposal as waste certification officials, alternate waste certification officials, and package certifiers. The program will provide requirements for auditability, retrievability, and storage of required documentation and will specify the records retention period. The waste certification program specifies the documentation to be produced to support the certification that waste meets the WAC of the receiving facility.

Each waste stream generated by UDS will flow through the standards established by the UDS waste certification program.

The programmatic elements of the UDS waste certification program are outlined in DUF6-UDS-PLN-055, *Waste Certification Program Plan* (WCPP). These elements include:

- Organization and Responsibilities
- Quality Assurance
- Training
- Document and Record Control
- Work Processes
- Procurement and Purchasing Controls

In addition to the programmatic elements of the certification program, certain elements requiring more detail are included in specific procedures and/or plans described in this section.

4.2 Waste Characterization

Waste characterization is defined in DOE M 435.1-1 as:

> "The identification of waste composition and properties, such as by review of acceptable knowledge (which includes process knowledge), or by nondestructive examination, nondestructive assay (NDA), or sampling and analysis, to comply with applicable storage, treatment, handling, transportation, and disposal requirements."

Waste characterization is a tool for gathering information that supports defensible decisions regarding safety, process, environmental, and compliance matters in the management of waste.

UDS-U-WMP-1001, *Waste Characterization* details the overall characterization process for UDS.

The characterization results will be reviewed on a continuing basis to determine if process improvements can be made to reduce handling or sampling frequency or reduce or eliminate waste production in accordance with the Data Quality Objectives (DQO) process.

Information used as part of the characterization process will be documented in a characterization package that is subject to the quality assurance and record management controls established in the WCPP.

4.3 Sampling and Analysis

In some instances, existing data is not sufficient to establish the physical, chemical, or radiological characteristics of the waste. If it is determined that sampling and analysis is required to complete characterization, DUF6-UDS-PLN-047, *Sampling and Analysis Plan* and UDS-U-WMP-1009, *Sampling Request and Plan Development* will be employed.

DUF6-UDS-PLN-047, *Sampling and Analysis Plan* outlines the use of the DQO process to establish quality data results. UDS-U-WMP-1009, *Sampling Request and Plan Development* outlines the application of the DQOs to specific waste streams, initiation of sample collection, and the requirements of the documentation of each step as part of the overall certification process.

4.4 Data Evaluation and Management

Waste data must be evaluated and managed in a manner that ensures that the data is legally defensible and can provide the basis for sound decision-making.

UDS will follow the steps outlined in UDS-U-WMP-1010, *Data Evaluation* for data verification, assessment, and validation. Data will be managed in accordance with UDS-U-WMP-1012, *Data Management*.

4.5 Waste Stream Profile

The waste stream profile is a description of the waste stream, generally identifying the source, physical and chemical description, and upper limits on radionuclides. Waste stream profiles will be combined into a single document for each disposal and/or treatment facility.

Profiles will be created and managed according to UDS-U-WMP-1008, *Profile Development*.

4.6 Waste Certification

Where the waste certification program plan (DUF6-UDS-PLN-055) sets forth the overall programmatic aspects of certification, UDS-U-WMP-1007, *Waste Certification* outlines the specific steps of performing certification.

It sets forth the roles and responsibilities of the Waste Certification Official (WCO) and documents the certification process for each waste stream and shipment.

4.7 Waste Shipments

Waste shipments will be performed through subcontracts or UDS procedure UDS-U-WMP-2001, *Waste Shipping*. Shipments will be made in compliance with DOE, DOT, EPA, NRC, and disposal facility requirements. Shipping documents may include but are not limited to the following types of documents:

- **EPA Uniform Hazardous Waste Manifest**. The EPA manifest is required by 40 CFR Part 262 for the transfer of a hazardous or mixed waste. The manifest will be generated in accordance with UDS-U-WMP-2001, *Waste Shipping*. The manifest along with attendant documents for each shipment (inspections, certifications, and supporting data) will become part of the project records.

- **Radiological Survey Results** (or documentation referencing a survey record). Survey results include the determination of the surface contamination of the waste container and the external dose rate. This data will be recorded and included with the manifest for each shipment in the project records.

- **Bill of Lading (BOL)** (also referred to as the manifest or DOT shipping papers). A document indicating the contents of a shipment, the BOL and supporting data as indicated above will be retained by shipment in the project records.

Prior to initiating oxide shipments, a transportation plan will be drafted per DOE O 460.2 and approved by DOE HQ.

5 POLLUTION PREVENTION / WASTE MINIMIZATION

Pollution prevention/waste minimization contributes to the protection of human health and the environment by reducing risks of potentially exposing people to pollutants and reducing environmental impacts from releases of pollutants. UDS is committed to pollution prevention/waste minimization as part of its environmental protection responsibilities. Prior to waste generation, the generating process will be evaluated for possible waste minimization or substitution for achieving pollution prevention. For more information, refer to DUF6-UDS-PLN-031, *Pollution Prevention and Waste Minimization Plan*.

6 HANDLING, PACKAGING, STORING, TRACKING, AND TRANSPORTING

6.1 Handling

Waste handling requirements are determined by the weight, dose, package orientation, and the handling requirements for those wastes will be detailed in work instructions or procedures.

Waste handling will be minimized as much as possible in keeping with ALARA principals.

6.2 Packaging

Waste will be packaged in a manner that provides containment and protection for the duration of the anticipated storage period and until disposal is achieved or until the waste has been removed from the container. Waste is packaged and stored in accordance with UDS-U-WMP-1002, *Waste Storage*; additional work instructions may be required and will be developed as needed to perform the required activities. Packaging decisions (selection, inspection, evaluation, or qualification) will be made only by personnel meeting the requirements of 49 CFR 172 Subpart H and deemed by the Project to have sufficient experience, training and demonstrated proficiency.

6.2.1 Radioactive Waste

Packaging is prescribed by the DOT for hazardous materials and substances meeting the threshold quantity requirements of 49 CFR 171, 172, and 173. The depleted uranium handled by the project has unlimited A2 values per 49 CFR 173.435; therefore, packaging for the oxide or any waste contaminated by the uranium has to meet only the Industrial Packaging –1 (IP-1) criteria as described in 49 CFR 172.403. The TRU and Tc-99 contents of some cylinder heels may qualify as LSA-II material, in which case an IP-II package would be the appropriate designation for those cylinders.

The designation of packaging is made by the packaging supplier or shipper and may be shown by test or evaluation as described in 49 CFR 173.411 and 427. For boxes, drums, or other packaging supplied by commercial source, the vendor will provide the packaging certification. For the UF_6 cylinders to be filled with uranium oxide, the certification will be provided by UDS based on an evaluation of the cylinder design and an inspection of each cylinder.

Only 48-inch and 30-inch diameter cylinders may be used for oxide, and the other cylinder types will be processed for disposal as LLRW. The cylinders designated for oxide will be determined to be acceptable by evaluation and inspection as follows:

- All 30-inch and 48-inch diameter cylinder designs will be evaluated for compliance with 49 CFR 173.411 and 427. Note that most cylinder designs (except the CV-12 cylinders) were certified as DOT specification 7A Type A cylinders by the DOE in accordance with 49 CFR 178.350. This testing and the certification are described in DOE/RL-96-57, *Test and Evaluation Document for DOT Specification 7A Type A Packaging*. Classification as a DOT 7A Type A container is fully compliant with the requirements of 49 CFR 173.411 and 427.
- After the cylinders have been emptied of UF_6, stabilized, and aged, those previously deemed acceptable for oxide in accordance with the criteria described above will be inspected to ensure that they still comply with the requirements. The inspection will consist of a visual inspection of the cylinder and the plugs for any defects that could lead to the cylinder leaking or failing during transport. Acceptable cylinders will be released to have the filling flange added. Unacceptable or questionable cylinders will be reviewed by plant management and engineering and dispositioned as identified in Section 2.1.
- The filling flange will be added to cylinders designated for use as oxide containers. After the filling flange is added, the welds will be inspected to be sure that they are visually free of defects that could result in leakage of oxide during transport. Unacceptable welds will be repaired. The cut-out section for the filling hole, valves and plugs removed from the cylinder may be placed in the cylinder for disposal. Cut-out sections, valves and plugs may only be placed in the cylinder from which they originated to avoid cross contamination and inaccurate characterization. However, properly characterized waste from similar cylinder populations may be placed in the cylinders. Absorbent material may be placed in the container to eliminate free liquids as identified in a corresponding absorbent determination.
- Following filling and final closure, the filling closure will be inspected to ensure that it is properly sealed and the cylinder checked for removable contamination and loaded onto the conveyance for transport. Unacceptable closures will be repaired and removable contamination will be reduced to or below the limits prescribed for exclusive use transport as described in 49 CFR 173.443.

6.2.2 Other Hazardous Waste

The project may generate other hazardous wastes in sufficient quantities to meet the DOT packaging requirements. Although unlikely, the project could generate mixed waste (radioactive waste mixed with waste meeting another DOT hazard classification) or a waste meeting the definition of another DOT classification or classifications other than radioactive (e.g., corrosive or oxidizer).

The packaging required for a mixed waste depends on the designation of the primary and subsidiary hazards. This designation is made in accordance with 49 CFR 173.2a. In most cases Class 7 (Radioactive) is the dominant hazard; therefore, packaging is determined accordingly. However, if radioactive material qualifies as a limited quantity per 49 CFR 173.421, another hazard may take precedence. This also applies to the mixing of hazards other than radioactive.

Once the primary hazard is assigned, the proper shipping name of the material is found in 49 CFR 172.101. The required packaging is shown in the same row as the proper shipping name.

Table 6-2 provides an outline of how the waste will be packaged for storage and disposal.

Table 6-2: Waste Packaging Requirements

Waste Description	Packaging Requirements
Oxide-Filled Cylinders	Cylinders will be classified as IP-1 or IP-2 containers depending on heel characteristics in accordance with 49 CFR 173.411 or 427.
CaF_2	Not regulated per DOT. Packaging may be drums, boxes, bags, trucks, etc. If regulated as DOT Radioactive, packaging may be IP-1 drums, boxes, bags, etc. or containers in compliance with 49 CFR 173.411 or 427
Low-Level Waste (LLRW)	IP-1 packages (drums or boxes) containers in accordance with 49 CFR 173.411 or 427.
Mixed LLRW	IP-1 packages (drums or boxes) containers in accordance with 49 CFR 173.411 or 427 if Class 7 is the primary hazard. Otherwise packaging will be prescribed by 49 CFR 172.101.
TSCA / TSCA-LLRW	IP-1 packages (drums or boxes) containers in accordance with 49 CFR 173.410
Hazardous Waste	Packaging will be prescribed by 49 CFR 172.101
Industrial Waste (Bulk)	Not regulated per DOT if not a hazardous material or substance. Packaging may be drums, boxes, bags, roll off containers, trucks, etc.

6.3 Storage

An essential element of proper storage of waste is the assurance that the waste is adequately contained in the packaging (as described in the above section), and the package is protected from conditions that could cause it to degrade. Degradation could lead to failure and result in the spread of contaminated materials, leading to worker, public, or environmental exposure. It could also result in non-acceptance by a receiving facility. UDS will designate appropriate waste storage areas to ensure that package integrity is maintained throughout the storage period. An inspection and corrective action program will evaluate storage conditions and eliminate conditions that could lead to package failure. These elements of the UDS waste certification program can be found in UDS-U-WMP-1002, *Waste Storage*.

Other elements related to proper control of the waste while in storage and in preparation for shipment are also documented through UDS-U-WMP-1002, *Waste Storage* as follows:

- **Waste Container Data and Integrity Maintenance Documentation.** Container data includes information about the container's dimensions and physical attributes and procurement information. Integrity documentation includes the records of ownership and "transfer" of waste containers and data.

- **Volume and Weight, Including the Waste and any Other Media.** Volume and weight information are necessary for proper control of storage and disposal facility capacities, as well as proper payload control for transportation and handling systems. Typical parameters will include:

- o Container volume, measured as the external volume of the waste container, representing the volume that will be occupied in a storage or disposal facility
- o Actual waste volume, including stabilization media
- o Container weight (i.e., the total weight of the container and all of its contents [waste, shielding, stabilization media] that would have to be handled)
- o Identification of the stabilization medium, if used
- o Waste container utilization factor, measured as the percentage of the packaging volume that is filled with waste, including stabilization media

6.4 Waste Tracking

A waste-tracking program is being developed (with emphasis on the RCRA “cradle to grave” tracking requirements) consisting of a system with the following requirements:

The system will track:

- Material generation and disposition by type, quantities, and locations (waste and product)
- Sample and analytical data
- Radiological, hazardous, and physical properties
- Release certifications

The system will generate:

- Movement orders (on-site)
- Transportation manifests (off-site)
- Inventory reports
- Certification and inspection checklists for material release
- Production reports

The system will have the following interfaces:

- CID
- Production control
- Nuclear Material Control and Accountability Systems
- Production reporting systems

The system will be a compilation of programs developed for or by UDS.

Prior to implementation of the long term tracking software, each container generated will be tracked in a spreadsheet or table and include as a minimum the following information:

- a unique container indicator,
- date waste collection began for each container,
- container location,
- container contents,
- maximum waste volume,
- regulatory classification, and
- date maximum container volume filled.

6.5 Transportation

The primary transport mode for the Project will be by rail. Rail shipments will be made to Energy*Solutions* directly. For disposal at NTS, the oxide filled cylinders will be transported by rail to a transloading facility where the material will be off-loaded to trucks. Truck transport is also the back-up mode should rail not be available for any reason or not be economical. Truck transportation will serve as a backup method regardless of the disposal facility.

6.5.1 Rail Transport

The cylinders will be braced in railcars using a custom saddle design to secure the cylinders during transport per UDS-U-FSP-2009, *Gondola Rail Loading*. Other payload containers, drums, and boxes will be transported as necessary and blocked and braced as necessary to meet Federal Railroad Administration and DOT requirements (see Table 6-3).

Railcars will be released from the facility individually (not in unit trains), and UDS will be the shipper of record.

The principal rail carriers will be Paducah and Louisville for the Paducah site and Norfolk and Southern at the Portsmouth site.

Table 6-3: Rail Shipping Requirements

Regulated Parameter	Requirement
Loading, Unloading, Blocking, and Bracing	49 CFR 174.55-59, 715-750. American Association of Railroads Open Top Loading Rules Manual
Shipping Papers	49 CFR 172 Subpart C and 49 CFR 174.24. Note that for disposal at ES, NRC/DOT Forms 540 and 541 (Uniform Low-Level Radioactive Waste Manifest Shipping Paper) are required per 10 CFR 20. NRC Form 741 may also be required for the transfer of the source material (depleted uranium) per 10 CFR 30, 40, 50, 70, 72, 74, 75, and 150. These forms must be sent directly to Energy*Solutions* when the shipment departs.
Transportation	49 CFR 174.1-86

6.5.2 Truck Transport

For shipment of uranium oxide to NTS, a transload facility will be utilized. This facility will be responsible for receiving and offloading the cylinders from the railcars, inspecting the cylinders to ensure that no damage was incurred during transport and that all markings and labels are intact, and producing shipping paperwork and loading the cylinders onto truck trailers which are appropriately placarded for shipment to NTS.

When uranium oxide is shipped to EnergySolutions for disposal, truck transport is a back-up to rail; therefore, the specific number of shipments cannot be determined per year. These shipments will be made on flatbed trailers and have a payload weight not to exceed 40,000 lbs. Essentially, only one 48-inch and up to six 30-inch diameter cylinders filled with oxide may be transported at a time. Other waste materials will be packaged in drums and boxes and will be loaded up to the payload weight allowed.

Other truck shipments of waste materials will occur to support sample analysis and transport of secondary waste streams. Samples will be transported using a shipping service such as United Parcel Service.

Truck transport will utilize subcontracted companies that can demonstrate safety, compliance, and service with cost control through a competitive procurement. Each prospective bidder will be evaluated with respect to these parameters and a contract established for as-needed support. The truck transport company will be selected from the Motor Carrier Evaluation Program List provided and maintained by DOE.

UDS will be the shipper of record for truck shipments where shipping papers are required. The primary regulatory requirements are listed in Table 6-4.

Table 6-4: Truck Shipping Requirements

Regulated Parameter	Requirement
Loading, unloading, Blocking, and Bracing	49 CFR 177.834, 842, and 843
Shipping Papers	49 CFR 172 Subpart C and 49 CFR 177.817. Note that for disposal at ES, NRC/DOT Forms 540 and 541 (Uniform Low-Level Radioactive Waste Manifest Shipping Paper) are required per 10 CFR 20. NRC Form 741 may also be required for the transfer of the source material (depleted uranium) per 10 CFR 30, 40, 50, 70, 72, 74, 75, and 150.
Transportation	49 CFR 177.800-816. Federal Motor Carrier Safety Regulations. 49 CFR 40, 325-399, 571, and 658.

7 SAFETY

UDS has implemented DUF6-UDS-PLN-040, *Integrated Safety Management System Plan for Operations*, (Deliverable D-8), in compliance with 10 CFR 830, *Nuclear Safety Management*; 48 CFR 970.5204-2, *Integration of Environment, Safety, and Health into Work Planning and Execution*; and DOE P 450.4, *Safety Management System Policy*.

In addition, UDS has also developed the following two documents - DUF6-UDS-PLN-074, *Worker Safety and Health Program*, and DUF6-UDS-PLN-037, *Safety Management Program Descriptions for the UDS DUF_6 Conversion Project*. The DUF6-UDS-PLN-074, *Worker Safety and Health Program* was developed to comply with requirements identified in 10 CFR 851*Worker Safety and Health Program*. DUF6-UDS-PLN-037, *Safety Management Program Descriptions for the UDS DUF_6 Conversion Project* was developed to address descriptions of the twelve safety management programs identified in DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis*.

UDS will take necessary measures to emphasize safety in all waste management activities including but not limited to pollution prevention/waste minimization and radiation protection.

7.1 Radiation Protection

UDS activities, including design, construction, operation, decontamination, disposal, and closure activities, will be analyzed and conducted in manners such that radiation exposures of the public, the workforce, and the environment are kept ALARA. ALARA is the approach to radiation protection for managing and controlling exposures as far below the applicable limits as can be reasonably achieved. This approach advocates the use of administrative and design controls that are incorporated into the waste management plan.

The ALARA process is incorporated into all radioactive waste management activities. Line management involvement and accountability at the highest levels will be maintained. The

governing directives on implementing an ALARA process are in 10 CFR Part 835, *Occupational Radiation Protection*. UDS has implemented these directives through DUF6-UDS-PLN-007, *Radiation Protection Program*.

7.2 Environmental Safety and Health

DUF6-UDS-PLN-040, *Integrated Safety Management System Plan for Operations* applies to the cylinder yard surveillance and maintenance phase and the conversion facility operations phase of the project and refers to the requirements documents of 10 CFR 830 *Nuclear Safety Management*; and 48 CFR 970.5204-2, *Integration of Environment, Safety, and Health into Work Planning and Execution*. UDS embraces the eight guiding principles of ISMS that include:

- Line management's responsibility for safety
- Clear roles and responsibilities
- Competence commensurate with responsibility
- Balanced priorities
- Identification of safety standards and requirements
- Hazard controls tailored to the work being performed
- Operations authorization
- Worker Involvement

UDS also embraces the five core functions of ISMS that include:

- Defining the scope of work
- Analyzing the hazards
- Developing and implementing hazard controls
- Performing work within controls
- Providing feedback and continuous improvement

The UDS ISMS plan reflects the team's approach to demonstrating the integration of safety into all relevant aspects of design, work planning, performance, assessment, and continuous improvement. More specifically, related systems and processes will be implemented through our established ISMS program to ensure that:

- Safety issues, activities, and initiatives are effectively identified, coordinated, and integrated
- Work processes and management systems are used to accomplish work adequately and integrate safety
- Expectations and requirements are included in work directives agreements, and subcontracts are properly interpreted, integrated, and consistently applied
- Workers, managers, and subcontractors are fully aware of their roles, responsibilities, and authorities for safety and are held accountable through formal performance review mechanisms
- Safety risks and vulnerabilities are identified, communicated, and appropriately incorporated into the project budget and work planning process

- Workers are meaningfully involved in safety performance and work control planning processes to better ensure that job-specific hazards are identified and appropriate controls are implemented
- Lessons learned from previous activities are appropriately included in the planning process to continuously improve future work performance

Additionally, this ISMS plan explains the UDS quality assurance program's approach to implementing a strong safety posture within the requirements of the project and without compromise to safety objectives.

The five core safety management functions and eight guiding principles of ISMS are applied as a continuous safety management cycle across the organizational levels and during all phases of the Project: design, construction, and operations. The ISM process promotes the company's core values, the UDS "Safety First Culture," and "zero accident" commitment.

In addition to DUF6-UDS-PLN-040, DUF6-UDS-PLN-074, *Worker Safety and Health Program* also describes how UDS integrates safety and health requirements into all phases of its activities; conducts its operations in an environmentally clean manner; and provides necessary and sufficient protection for its workers, subcontractors, visitors, vendors, and the surrounding community while fulfilling its mission to the DOE in performance of contracted work on the DUF6Conversion Project. DUF6-UDS-PLN-074 also describes the integrated safety management system and the safety and health management systems employed to ensure that applicable standards and criteria are identified, communicated, and implemented, and that assessments of safety and health programs are conducted and identified deficiencies are corrected.

UDS has also developed Safety Management Program Descriptions for the UDS DUF_6 Conversion Project, DUF6-UDS-PLN-037, to address descriptions of the twelve safety management programs identified in DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis*. The purpose of the safety management program descriptions document is to present information that is common to the UDS managed facilities and support organizations. It is intended to complement the facility-specific Documented Safety Analysis (DSAs).

DUF6-UDS-PLN-001, *Project Management Plan* defines clear and unambiguous lines of authority and responsibility for ensuring that safety is established and maintained at all organizational levels and extended downward to subcontractor companies.

8 QUALITY

The design, construction, and operation of the DUF_6 conversion facilities are accomplished in a manner that minimizes potential hazard to the public, employees, and the environment. To ensure this, UDS commits to compliance with and implementation of the quality assurance criteria contained in 10 CFR 830, *Nuclear Safety Management* and DOE Order 414.1C, *Quality*

Assurance. The development of the DUF6-UDS-PLN-003, *DUF6 Conversion Project Quality Assurance Plan* and its implementing procedures are the documentation of that commitment. Together, they are used to perform work on the project. The project quality assurance plan serves as the document to identify the quality requirements for the project quality management system and will serve as the project quality assurance plan for each UDS member organization in the performance of project-related work.

The project quality assurance plan requirements share a management systems approach with the ISMS in achieving their objectives. As such, many opportunities exist for departments to share a single document to describe how each intends to implement quality management systems and ISMS requirements. Safety considerations are a fundamental part of each quality verification effort. The project quality assurance plan is evolutionary and is revised as the lifecycle of the facilities progresses.

9 TRAINING

Adequate training is necessary for all personnel involved with waste management activities. Training should provide the knowledge and skills required to perform specific tasks or to improve job performance as defined in UDS-U-TRN-0001, *Training and Qualification*. Training shall be provided to achieve initial proficiency, maintain proficiency, and help personnel adapt to changes in technology, methods, or job function. To maximize personnel performance, both general and project-specific training will be provided. Training may take the form of orientation/indoctrination, formal and informal training classes, computer-based training, or on-the-job training. Training must be documented and records maintained for each employee.

UDS managers are responsible for determining the need for training based on the scope, complexity, and nature of the activity to be performed, as well as the education, experience, and proficiency of the personnel involved. The Waste Product Disposition Manager, in cooperation with UDS line management and the UDS Training Supervisor, shall identify the training specifically required to implement this waste management plan.

Managers must ensure that personnel are provided with the fundamentals for their assigned work and that an understanding of the associated quality requirements is achieved. Personnel involved in the characterization, processing, and transportation of waste and related activities (e.g., procurement and QA) will have training commensurate with the importance of the task.

Job proficiency will be enhanced through continued training. Continuing or refresher training appropriate for each position will be conducted to support continued competence and to achieve progressive improvement and adaptation to changes in requirements and technology.

10 UNCERTAINTIES AND CONTINGENCIES

The uncertainties with the strategy detailed in this plan are listed in DUF6-UDS-PLN-019, *UDS Risk Management Plan*.

APPENDIX A

WASTE MANAGEMENT PLAN REQUIREMENTS

Requirement Source Document	Waste Management Requirement Description	Procedural/Guidance Documents
Radioactive Waste Management Basis		
Radioactive Waste Management Basis (RWMB)	Health and Safety Plan	Developed from the DUF6-UDS-PLN-040, *Integrated Safety Management System Plan for Operations* and DUF6-UDS-PLN-074, *Worker Safety and Health Program*.
	The Work Smart Standards	Developed from the DUF6-UDS-PLN-040, *Integrated Safety Management System Plan for Operations* and DUF6-G-RGN-006, *Work Smart Standards Final Report*.
	The Radiation Protection Plan	DUF6-UDS-PLN-007, *Radiation Protection Program*
	PQAP	DUF6-UDS-PLN-003, *Project Quality Assurance Plan*
	Documented Safety Analysis supporting technical safety requirements and analysis	DUF6-UDS-PLN-029, *Plan for Safety Basis Documentation*
	Waste Certification Program	DUF6-UDS-PLN-055, *Waste Certification Program Plan*
	Supporting Plans and Procedures	DUF6-UDS-PLN-005, *Waste Management Plan*, throughout
Regulations and Directives		
DOE M 435.1, Analysis of Operations Information	DOE O 210.1, *Performance Indicators, and Analysis of Operations Information*. Data that measure the environmental, safety, and health performance of radioactive waste management facilities, operations, and activities shall be identified, collected, and analyzed.	Analysis of Operations Information is addressed throughout the operating procedures and project plans shown in WMP, Section 4.
DOE M 435.1, Classified Waste	Radioactive waste to which access has been limited for national security reasons and cannot be declassified shall be managed in accordance with the requirements of DOE O 5632.1C, *Protection and Control of Safeguards and Security Interests*, and DOE O 5633.3B, *Control and Accountability of Nuclear Materials*.	UDS has no classified materials.

Requirement Source Document	Waste Management Requirement Description	Procedural/Guidance Documents
DOE M 435.1, Conduct of Operations	Radioactive waste management facilities, operations, and activities shall be conducted in a manner based on consideration of the associated hazards. Waste management facilities, operations, and activities shall meet the requirements of DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*.	This applies to all facilities and is addressed throughout the operating procedures and project plans. The operations plan is DUF6-UDS-PLN-014, *Conversion Facilities O&M* and the procedure is UDS-U-CON-0001, *UDS Conduct of Operations manual*.
DOE M 435.1, Criticality Safety	Radioactive waste management facilities, operations, and activities shall be covered by a Criticality Safety Program in accordance with DOE O 420.1, *Facility Safety*.	The facility safety basis documents address criticality safety requirements including DUF6-UDS-PLN-037, *Safety Management Program Descriptions*.
DOE M 435.1, Emergency Management Program	Radioactive waste management facilities, operations, and activities shall maintain an emergency management program in accordance with DOE O 151.1, *Comprehensive Emergency Management System*.	This applies to all facilities and will be addressed throughout the operating procedures and project plans. DUF6-UDS-PLN-044, *Paducah Emergency Management Plan*, and DUF6-UDS-PLN-045, *Portsmouth Emergency Management Plan* are site specific plans which have been implemented.
DOE M 435.1, Environmental and Occurrence Reporting	Radioactive waste management facilities, operations, and activities shall meet the reporting requirements of DOE O 231.1, *Environment, Safety and Health Reporting*, and DOE O 232.1A, *Occurrence Reporting and Processing of Operations Information*.	This applies to all facilities and will be addressed throughout the operating procedures and project plans. DUF6-UDS-PLN-002, *Regulatory and Permitting Management Plan*, provides the necessary environmental reports, UDS-U-QAP-005, *Condition Reporting* governs the process for reporting events and UDS-U-QAP-0016, Occurrence Reporting establishes the process for occurrence report development and notification.
DOE M 435.1, Environmental Monitoring	Radioactive waste management facilities, operations, and activities shall meet the environmental monitoring requirements of DOE 5400.1, *General Environmental Protection Program*, and DOE 5400.5, *Radiation Protection of the Public and the Environment*. DOE Order 435.1, Chapter IV.R. (1) through (3) describes the facility monitoring requirements for which a facility-monitoring checklist shall be developed.	This applies to all facilities and will be addressed throughout the operating procedures and project plans. Refer to DUF6-UDS-PLN-002, *Regulatory and Permitting Management Plan* for the specific permits and reports necessary to meet environmental monitoring requirements.

Requirement Source Document	Waste Management Requirement Description	Procedural/Guidance Documents
DOE M 435.1, Hazard Analysis Documentation and Authorization Basis	Radioactive waste management facilities, operations, and activities shall implement DOE Standards, DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE 5480.23*; *Nuclear Safety Analysis Reports*; and/or DOE-EM-STD-5502-94, *DOE Limited Standard: Hazard Baseline Documentation*, and shall, as applicable, prepare and maintain hazard analysis documentation and an authorization basis as required by DOE O 425.1A, *Startup and Restart of Nuclear Facilities*; 10 CFR 830 and DOE STD 3009-94, *Unreviewed Safety Questions*;	This applies to all facilities and will be addressed throughout the operating procedures and project plans.
DOE M 435.1, Life-Cycle Asset Management	Planning, acquisition, operation, maintenance, and disposition of radioactive waste management facilities shall be in accordance with DOE O 430.1A, *Life-Cycle Asset Management*, and DOE 4330.4B, *Maintenance Management Program*, including a configuration management process to ensure the integrity of physical assets and systems. Corporate physical asset databases shall be maintained as complete, current inventories of physical assets and systems to allow reliable analysis of existing and potential hazards to the public and workers.	This applies to all facilities and is addressed in DUF6-UDS-PLN-014, *Conversion Facilities O&M*; DUF6-UDS-PLN-023, *Configuration Management Plan*; DUF6-UDS-PLN-056, *Maintenance Implementation Plan*; and DUF6-UDS-PLN-011,*Cylinder Surveillance and Maintenance Plan*.
DOE M 435.1, Mixed Waste	Radioactive waste that contains both source and special nuclear or by-product material subject to the *Atomic Energy Act of 1954*, as amended, and a hazardous component is also subject to RCRA, as amended, and by the applicable specific section of DOE Order 435.1, *Radioactive Waste Management*.	There are mixed wastes that have a potential to be generated through operations and are addressed within this WMP.

Requirement Source Document	Waste Management Requirement Description	Procedural/Guidance Documents
DOE M 435.1, Waste Characterization	All generated wastes shall be characterized prior to disposition. SW-846, *Test Methods for Evaluating Solid Wastes Physical and Chemical Methods*, and the EPA DQOs shall be applied as appropriate. DOE Order 435.1, Section IV.J states: "The waste certification program shall designate the officials who have the authority to certify and release waste for shipment; and specify what documentation is required for waste generation, characterization, shipment and certification. The program shall provide requirements for auditability, retrievability, and storage of required documentation and specify the records retention period." DOE M 435.1 requires that "Waste shall be characterized using direct or indirect methods, and the characterization documented in sufficient detail to ensure safe management and compliance with the waste acceptance requirements of the facility receiving the waste."	UDS-U-WMP-1001, *Waste Characterization* and DUF6-UDS-PLN-055, *Waste Certification Program Plan*
DOE M 435.1, Packaging and Transportation	Radioactive wastes shall be packaged and transported in accordance with DOE O 460.1A, *Packaging and Transportation Safety*, and DOE O 460.2, *Departmental Materials Transportation and Packaging Management*.	UDS will generate a transportation plan in accordance with DOE O 460.2 and a certification and test plan for using the cylinders as a package in accordance with DOE O 460.1. Procedure UDS-U-WMP-2001, *Waste Shipping* will also address radioactive waste shipments.
DOE M 435.1, Quality Assurance Program	Radioactive waste management facilities, operations, and activities shall develop and maintain a quality assurance program that meets the requirements of 10 CFR 830.120, *Quality Assurance Requirements*, and DOE O 414.1, *Quality Assurance*, as applicable.	DUF6-UDS-PLN-003, *Project Quality Assurance Plan* is referenced throughout the WMP and summarized in WMP, Section 7.0.
DOE M 435.1, Radiation Protection	Radioactive waste management facilities, operations, and activities shall meet the requirements of 10 CFR Part 835, *Occupational Radiation Protection*, and DOE 5400.5, *Radiation Protection of the Public and the Environment*.	DUF6-UDS-PLN-007, *Radiation Protection Program* is referenced throughout the WMP and summarized in WMP Section 7.0.

Requirement Source Document	Waste Management Requirement Description	Procedural/Guidance Documents
DOE M 435.1, Records Management	Radioactive waste management facilities, operations, and activities shall develop and maintain a recordkeeping system as required by DOE O 200.1, *Information Management Program*, and DOE O 414.1, *Quality Assurance*. Records shall be established and maintained for radioactive waste generated, treated, stored, transported, or disposed. To the extent possible, records prepared in response to other requirements may be used to satisfy the documentation requirements of this manual. Additional records may be required to satisfy the regulations applicable to the hazardous waste components of mixed waste.	DUF6-UDS-PLN-015, *Document Management Plan* is referenced throughout the WMP
DOE M 435.1, Release of Waste Containing Residual Radioactive Material	Processes for determining and documenting that waste is suitable to be released and managed without regard to its radioactive content shall be in accordance with the criteria and requirements in DOE O 5400.5, *Radiation Protection of the Public and the Environment*.	Release process will be on a case-by-case basis and performed in compliance with DOE O 5400.5. DUF6-UDS-PLN-007, *Radiation Protection Program* and its implementing procedures govern how materials are released from the sites.
DOE M 435.1, Safeguards and Security	Appropriate features shall be incorporated into the design and operation of radioactive waste management facilities, operations, and activities to prevent unauthorized access and operations and for purposes of nuclear materials control and accountability, where applicable, and shall be consistent with DOE O 470.1, *Safeguards and Security Program*.	This applies to all facilities and will be addressed in the site security plans. Refer to DUF6-UDS-PLN-033, *Paducah Security Plan and* DUF6-UDS-PLN-035, *Portsmouth Security Plan* for requirement implementation.
DOE M 435.1, Safety Management System	Radioactive waste management facilities, operations, and activities shall incorporate the principles of integrated safety management as described in DOE P 450.4, *Safety Management System Policy*, and DOE P 450.5, *Line Environment, Safety and Health Oversight*, and meet the requirements of the safety management systems sections of 48 CFR Chapter 9, *Department of Energy Acquisition Regulations*, and DOE M 411.1-1, *Manual of Safety Management Functions, Responsibilities, and Authorities*.	This applies to all facilities and is addressed in DUF6-UDS-PLN-040, *Integrated Safety Management System Plan for Operations*.
DOE M 435.1, Site Evaluation and Facility Design	New radioactive waste management facilities, operations, and activities shall be sited and designed in accordance with DOE O 420.1, *Facility Safety.*	This applies to all facilities and is addressed in the UDS nuclear safety procedures and documented safety analyses. DUF6-UDS-PLN-037, *Safety Management Program Descriptions* provides additional details to the implementation of facility safety in the UDS facilities.

Requirement Source Document	Waste Management Requirement Description	Procedural/Guidance Documents
DOE 435.1, Training and Qualification	A training and qualification program shall be implemented for radioactive waste management program personnel and shall meet the requirements of DOE O 360.1, *Training*, and DOE 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*.	This applies to the whole facility and is addressed in DUF6-UDS-PLN-027, *UDS Project Training Plan*. Training requirements as they pertain to Waste Management are addressed in WMP, Section 8.0.
DOE M 435.1, Pollution Prevention/Waste Minimization	Pollution prevention/waste minimization shall be implemented for radioactive waste management facilities, operations, and activities to meet the requirements of Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*; Executive Order 13101, *Greening the Government through Waste Prevention, Recycling, and Federal Acquisition*; and DOE 5400.1, *General Environmental Protection Program*.	Pollution prevention/waste minimization is covered under DUF6-UDS-PLN-031, *Pollution Prevention and Waste Minimization Plan*.
DOE M 435.1, Worker Protection	Radioactive waste management facilities, operations, and activities shall meet the requirements of DOE O 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*.	This applies to the whole facility and is addressed throughout DUF6-UDS-PLN-040, *Integrated Safety Management System for Operations*; DUF6-UDS-PLN-007, *Radiation Protection Program*; UDS-HRP-001, *Human Resources Policy Manual*; and DUF6-UDS-PLN-029, *Safety Basis Documentation Plan*.
10 CFR 830.120, *Quality Assurance Requirements*	10 CFR 830.120, *Quality Assurance Requirements*	The process of handling the waste will be compliant with the quality assurance requirements of 10 CFR 830.120 as discussed in DUF6-UDS-PLN-003, UDS *Project Quality Assurance Plan*.
EPA Requirements		
40 CFR 110, *Discharge of Oil*	40 CFR 110, *Discharge of Oil*	Oils will be generated through maintenance activities. They will be collected and recycled when practical or treated as discussed in WMP, Section 3.0. No oil will be discharged into the environment.
40 CFR 260, *Hazardous Waste Management System-General*	40 CFR 260, *Hazardous Waste Management System-General*	This part provides definitions of terms, general standards, and overview of information applicable to this regulation. UDS will use this part in implementing hazardous waste management practices and systems as required by 40 CFR as shown in this plan.
40 CFR 261, *Identification and Listing of Hazardous Waste*	40 CFR 261, *Identification and Listing of Hazardous Waste*	This part defines “solid waste” and “hazardous waste” and identifies the characteristics of hazardous waste as well as lists particular hazardous wastes. UDS will implement this part from design through operations as discussed in this plan.

Requirement Source Document	Waste Management Requirement Description	Procedural/Guidance Documents
40 CFR 262, *Standards Applicable to Generators of Hazardous Waste*	40 CFR 262, *Standards Applicable to Generators of Hazardous Waste*	This part establishes standards for generators of hazardous waste including manifesting, pre-shipment requirements, recordkeeping, and reporting. UDS will implement this part from design through operations as discussed in this plan.
40 CFR 268, *Land Disposal Restrictions*	40 CFR 268, *Land Disposal Restrictions*	This part identifies hazardous wastes that are restricted from land disposal and defines those limited circumstances when prohibited wastes can be land disposed. UDS will implement this part from design through operations as discussed in this plan.
40 CFR 279, *Standards for the Management of Used Oil*	40 CFR 279, *Standards for the Management of Used Oil*	This part provides standards for the generators of used oil for storage and shipment. UDS will implement this part from design through operations as discussed in this plan.
40 CFR 761, *Polychlorinated Biphenyls (PCBs) Manufacturing, Distribution in Commerce, and Use Prohibitions*	40 CFR 761, *PCBs Manufacturing, Distribution in Commerce, and Use Prohibitions*	This part provides standards for generators and for the disposal of PCBs. UDS will implement the part during operations as discussed in this plan.
DOT Requirements		
49 CFR 171-173	49 CFR 171, *General Information, Regulations and Definitions*; 49 CFR 172, *Hazardous Materials Table, Special Provision, Hazardous Material Communication, Emergency Response Information and Training Requirements*; 49 CFR 173, *General Requirements for Shipment and Packaging*	All materials transported off-site will be subject to these requirements. These requirements will be implemented in the transport procedure listed in WMP, Section 10.3.
Commonwealth of Kentucky Requirements		
401 KAR 5, *Water Quality*	401 KAR 5, *Water Quality*	Applies to Paducah site. This chapter establishes administrative regulations for the issuance of permits to construct, modify, and operate facilities that discharge pollutants to the waters of Kentucky. UDS will abide by these regulations throughout construction and operations as shown in DUF6-UDS-PLN-002, *Regulatory and Permitting Management Plan*.

Requirement Source Document	Waste Management Requirement Description	Procedural/Guidance Documents
401 KAR 30, *Waste Management; General Administrative Procedures*	401 KAR 30, *Waste Management; General Administrative Procedures*	Applies to Paducah site. This chapter establishes the administrative procedures for the management of solid and hazardous waste. UDS will ensure compliance with this chapter throughout operations as discussed in this plan.
401 KAR 31, *Identification and Listing of Hazardous Waste*	401 KAR 31, *Identification and Listing of Hazardous Waste*	Applies to Paducah site. This chapter identifies the characteristics of and provides the basis for the listing of hazardous wastes. This is a Kentucky- specific regulation that functions in conjunction with 40 CFR 260. UDS will implement this part from design through operations as shown in this plan
401 KAR 32, *Standards Applicable to Generators of Hazardous Waste*	401 KAR 32, *Standards Applicable to Generators of Hazardous Waste*	Applies to Paducah site. Provides administrative standards for generators of hazardous waste. UDS will implement this part from design through operations as shown in this plan.
401 KAR 37, *Land Disposal Restrictions*	401 KAR 37, *Land Disposal Restrictions*	Applies to Paducah site. Essentially equivalent to the federal standards set forth in 40 CFR 268. UDS will comply with these requirements as shown in this plan
401 KAR 40, *Enforcement and Compliance Monitoring Hazardous Waste*	401 KAR 40, *Enforcement and Compliance Monitoring Hazardous Waste*	Applies to Paducah site. This chapter establishes standards for enforcement and compliance monitoring of hazardous waste and solid waste management and practices. The commonwealth of Kentucky is responsible for implementing this, but UDS will conduct internal audits and reviews of practices to ensure with compliance as discussed in DUF6-UDS-PLN-003, *Project Quality Assurance Plan*.
401 KAR 44, *Standards for the Management of Used Oil*	401 KAR 44, *Standards for the Management of Used Oil*	Applies to Paducah site. This chapter identifies material subject to regulation as used oil. UDS will implement this as one component of the waste oil program as shown in this plan.
State of Ohio Requirements		

Requirement Source Document	Waste Management Requirement Description	Procedural/Guidance Documents
OAC 3745-50, *Hazardous Waste Management System-General*	OAC 3745-50, *Hazardous Waste Management System-General*	Applies to the Portsmouth site. Provides the definitions and permit requirements for facilities generating hazardous waste. UDS will use this chapter during the permitting phase of the project. Note that the DOE and UDS take exception to some parts of the interpretation of Ohio EPA (OEPA) with respect to the classification of the UF_6 and permits required to construct and operate the conversion plants. As a result, OEPA and DOE have negotiated a set of exemptions to the Ohio code. These exemptions and additional requirements, found in the OEPA DFFO (Director's Final Findings & Orders), currently apply to DUF6 storage. DOE and UDS with Ohio will negotiate for a new set of exemptions and permits for operation of the conversion facility.
OAC 3745-51, *Identification and Listing of Hazardous Waste*	OAC 3745-51, *Identification and Listing of Hazardous Waste*	Applies to the Portsmouth site. This chapter identifies the characteristics of and provides the basis for the listing of hazardous wastes. This is an Ohio-specific regulation that functions in conjunction with 40 CFR 260. UDS will implement this chapter from design through operations as discussed in this plan.
OAC 3745-52, *Generator Standards*	OAC 3745-52, *Generator Standards*	Applies to the Portsmouth site. Provides administrative standards for generators of hazardous waste. UDS will implement this chapter from design through operations as discussed in this plan
OAC 3745-270, *Hazardous Wastes Restricted for Land Disposal*	OAC 3745-270, *Hazardous Wastes Restricted for Land Disposal*	Applies to the Portsmouth site. Essentially equivalent to the federal standards set forth in 40 CFR 268. UDS will comply with these requirements as shown in this plan.
OAC 3745-279, *Used Oil Management Standards*	OAC 3745-279, *Used Oil Management Standards*	Applies to the Portsmouth site. This chapter identifies material subject to regulation as used oil. UDS will implement this as one component of the waste oil program as discussed in this plan.

APPENDIX B

DUF6 CONVERSION PROJECT
Waste Management Plan

Revision Summary

TITLE: Waste Management Plan	DOCUMENT NO: DUF6-UDS-PLN-005	REV: 2

REVISION DESCRIPTION

Issued waste certification program plan, sampling and analysis plan and several implementing procedures. Updated plan to show flowdown to implementing plans and procedures

Incorporated IPT comments to revision 0B.

Incorporated additional IPT comments to revision 0C.

Incorporated additional IPT comments to revision 0D.

Incorporated additional IPT comments to revision 0E.

Incorporated additional IPT comments and updated to new format in revision 0F. Approved Revision 0F became Revision 1. Revision 1 was submitted to the Department of Energy for review. DOE comments were integrated into Revision 1. DOE comments included the following:

- Acronyms added to acronym table. Acronyms corrected in acronym table.
- Section 1 – Approximate number of cylinders and weight corrected.
- Section 1 – Work scope modified to more accurately reflect current status.
- Section 1.1 – Compliance with CERCLA added as a requirement.
- Table 1-1 – Included requirement to certify all waste to Waste Acceptance Guidelines for EnergySolutions as well as any other TSDF.

- Section 2.1 – Added detail for the duration of the aging process.
- Section 2.1 – Added detail to explain when heels and small/non-acceptable cylinders would be sampled.
- Section 2.1.1 – Text was revised to clarify the meaning of unidentified cylinders.
- Section 2.1.1 – Additional detail was added to clearly state that a disposal outlet was available for waste regardless of waste classification.
- Section 2.1.1 – Revised text to state analytical data would not exceed WAC for intended TSDF.
- Table 2-4, 2-6, 2-7, 2-8 and 2-9 to correct or add detail to descriptions, DOT terminology and proper shipping names.
- Section 2.8 – Added detail as to how fines could contribute as a contamination source.
- Section 2.8 - Added clarification as to how PCB waste will be managed and classified as PCB Bulk Product Waste.
- Section 4.1 – Added analytical data as an item requiring approval from the Waste certification Official.
- Section 4.6 - Added reference to Waste Certification Plan.
- Section 4.7 – Added detail as to which regulations will apply when preparing shipments.
- Section 6.2.1 - Deleted the requirement for a Certification Test Plan.
- Section 6.2.2 - Added option to dispose of CaF2 as low level waste.
- Section 6.5.2 – Added reference that MCEP will be used when selecting trucking vendors.

No changes were made from Revision 1 to Revision 2. Revision 1 was assigned Revision 2 following UDS approval of DOE Revision 1 comments/resolutions.