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TRANSPORTATION AND DISPOSAL PLAN FOR OPERABLE UNIT 4 - SILO 3

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

OCTOBER 2000

U.S. DEPARTMENT OF ENERGY

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REV. 1

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ACRONYMS

AEA	Atomic Energy Act
AEDO	Assistant Emergency Duty Officer
ALARA	As Low As Reasonably Achievable
ARAR	Appropriate, Relevant and Applicable Requirement
ATMS	Automated Transportation Management System
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CRF	Cancer Risk Factor
DOE	Department of Energy
DOT	Department of Transportation
EMS	Emergency Management System
Envirocare	Envirocare Of Utah, Inc.
EOC	Emergency Operations Center
FAT&LC	Fernald Atomic Trades and Labor Council
FEMP	Fernald Environmental Management Project
FS	Feasibility Study
GCBCTC	Greater Cincinnati Building and Construction Trades Council
H_E	Collective Effective Dose Equivalent For Exposed Population
HMR	Hazardous Materials Regulation
IHA	Integrated Hazard Analysis
ILCR	Incremental Lifetime Cancer Risk
IP-2	Industrial Packaging-Type 2
ISA	Interim Storage Area
LCF	Latent Cancer Fatalities
LSA	Low Specific Activity
MCEP	Motor Carrier Evaluation Program
NCP	National Contingency Plan
NRC	Nuclear Regulatory Commission
NSS	Nuclear Systems Safety
NTS	Nevada Test Site
NTS WAC	Nevada Test Site Waste Acceptance Criteria
OTP	Operator Training Program
OU1	Operable Unit 1
OU4	Operable Unit 4
PCDF	Permitted Commercial Disposal Facility
POP	Total Population Exposed
QA	Quality Assurance
QAJSP	Quality Assurance Job Specific Plan

ACRONYMS (Continued)

Ra-226	Radium 226
Ra-228	Radium 228
RCRA	Resource Conservation Recovery Act
RCT	Radiological Control Technician
RI	Remedial Investigation
RMRS	Rocky Mountain Remediation Services
RPP	Radiological Protection Program
RWP	Radiological Work Permit
SPR	Safety Performance Requirement
TC	Toxicity Characteristic
TEP	Transportation Emergency Plan
Th-230	Thorium 230
U.S. EPA	United States Environmental Protection Agency
WAC	Waste Acceptance Criteria
WGS	Waste Generator Services

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This Transportation and Disposal Plan describes how transportation and disposal operations will be implemented to ensure safe and successful storage, staging and transportation of Operable Unit 4 (OU4) treated Silo 3 material from the Fernald Environmental Management Project (FEMP) to Envirocare Of Utah, Inc. (Envirocare). Fluor Fernald, Inc. (Fluor Fernald) prepared this plan as a component of the overall Silo 3 Project Remedial Design (RD) Package. Based on a transportation evaluation, truck is the preferred mode of transportation for treated Silo 3 material. The criteria used to select the preferred mode of transportation were based on safety, feasibility, and cost-effectiveness. While truck is the preferred mode of transportation at this time, the Silo 3 project will continue to evaluate other transportation alternatives for viability and incorporation into the shipping program. Silo 3 will revise this Transportation and Disposal Plan if other transportation alternatives are to be implemented as part of the project. Section 2.5 of this document describes the transportation evaluation process.

This plan serves to: (1) describe the transportation logistics associated with the treated Silo 3 material; (2) generally describe operational aspects of transportation plans to demonstrate that treated Silo 3 material can be safely transported to the designated disposal site, and in accordance with applicable regulations, and; (3) provide a transition between design and implementation of transportation operations.

Submittal of this Transportation and Disposal Plan complies with the requirements put forth in the Silo 3 Remedial Design Work Plan (40400-WP-0001, Rev. 0, April 1998), which require an "operational description of Fluor Fernald's responsibility for transportation and disposal of treated waste."

1.2 PROJECT APPROACH

Retrieval from Silo 3 and stabilization of Silo 3 material is being performed by Rocky Mountain Remediation Services (RMRS). Plans and requirements for completing RMRS' scope are described in the remainder of the RD Package.

Fluor Fernald will be responsible for selection of the disposal facility and mode of transportation, analysis of the treated Silo 3 material for Waste Acceptance Criteria (WAC) compliance, loading the treated Silo 3 material for shipment, and transportation of the treated Silo 3 material to the disposal facility.

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2.0 OFF-SITE TRANSPORTATION

2.1 INTRODUCTION

The FEMP will conduct its operations in compliance with applicable international, federal, state, local, and tribal requirements governing materials transportation, unless exemptions or alternatives are approved in accordance with the Department of Energy (DOE) Order 460.1A. A description of the pre- and post-treated waste form is included in Section 6.2. The treated Silo 3 material disposal strategy is to maintain the potential to transport (via truck) and dispose of the material at either Envirocare or NTS in the event one of these options becomes unavailable.

2.2 SUMMARY OF PREFERRED TRANSPORTATION AND DISPOSAL OPTION

The preferred option for transportation and disposal of treated Silo 3 material is truck shipment to Envirocare. The evaluation that determined this preference is summarized in Section 2.5 of this document.

The primary factors in selecting truck as the mode of transportation include safety, ease of implementation through site experience, project flexibility, cost effectiveness, and project control of shipment scheduling.

The primary factor in selecting Envirocare as the preferred disposal facility was the lower potential cost through the U.S. Army Corps of Engineers, Kansas City District, disposal contract.

The project will maintain the ability to dispose of treated Silo 3 material at NTS. In the event sampling results of treated Silo 3 material indicate radionuclide concentrations exceed the Envirocare 11(e)(2) WAC, and the containers cannot be shipped to Envirocare in a manner such that the transport vehicle does not exceed the WAC, then the containers will be segregated for transportation to and disposal at NTS.

2.3 DEPARTMENT OF TRANSPORTATION (DOT) REQUIREMENTS

The Low Specific Activity (LSA) determination drives the container requirements for packaging the treated Silo 3 material for off-site shipment to a disposal facility. Based on the evaluation performed, the minimum packaging requirement for the treated Silo 3 material is an IP-2 container. RMRS will use a 55-gallon steel drum to containerize the treated Silo 3 material for storage and subsequent shipment. The table below provides the rationale for the LSA determination.

TABLE 2.3-1
LSA DETERMINATION

LSA-I*	Meets Criteria	RATIONALE	REFERENCE
i	No	Silo 3 contents are identified as waste by-products from the refining of ore and ore concentrates. This waste consists of neither ore nor ore concentrates.	FEMP-OU4RI-6 FINAL, November 3, 1994
ii	No	Silo 3 contents are characterized as waste by-products from the refining of ore and ore concentrates. This waste consists of neither uranium nor thorium compounds per se. The waste contains some uranium and thorium; however, the regulation intends to regulate concentrated uranium compounds, such as U_3O_8. Silo 3 material consists of waste products removed from ore materials. The waste products include small quantities of uranium compounds not retained with the ore concentrates.	FEMP-OU4RI-6 FINAL, November 3, 1994
iii	No	The A_2 values of Th-230 and Ra-226 are NOT unlimited.	FEMP-OU4RI-6 FINAL, November 3, 1994
iv	No	The Silo 3 material exhibits non-homogeneity for Th-230. The waste exceeds the $10E^{-6}$ A_2/g.	FEMP-OU4RI-6 FINAL, November 3, 1994

*LSA-I definitional criteria are identified at 49 Code of Federal Regulations (CFR) 173.403, Definition of LSA-I Material, (1) LSA-I.

A review of the available analytical data for Silo 3 material indicates that this material does not meet any of the definitional criteria for LSA-I material, as defined in 49 CFR 173.403. Four subcategories [i-iv] of LSA-I material are identified in the regulations. Subcategory (i) is not appropriate because the relative radionuclide concentrations in the Silo 3 material are not consistent with that of an ore or ore concentrate. Subcategory (ii) is not appropriate because the Silo 3 material contains radionuclides [Ra-226 and Ra-228] other than uranium or thorium and their compounds. Subcategory (iii) is inappropriate since this material contains radioisotopes [e.g., Th-230 and Ra-226], whose A_2 values are NOT unlimited. Subcategory (iv) is not appropriate to Silo 3 material because this material contains Th-230 at a concentration exceeding 1E-6 A_2/gm.

Definitional and analytical criteria indicate that this material does not meet the regulatory criteria specified for LSA-I material. The Silo 3 material meets the LSA-II criteria in 49 CFR 173.403, (2) LSA-II, subparagraph (ii). Material in which the Class 7 (radioactive) material is distributed throughout and the average specific activity does not exceed 10^{-4} A_2/g for solids and gases, and 10^{-5} A_2/g for liquids. Therefore, this material is appropriately classified as LSA-II material.

2.4 OVER-THE-ROAD (TRUCK)

The carrier will be selected to meet the requirements of each shipment and provide safe, expeditious, and economical delivery to the final destination. For any truckload (i.e., full load) quantities of radioactive material, and hazardous waste in any quantity, only motor carriers with satisfactory ratings under the DOE Motor Carrier Evaluation Program (MCEP) will be considered.

2.4.1 Over-The-Road to NTS and Envirocare

2.4.1.1 Routes To NTS

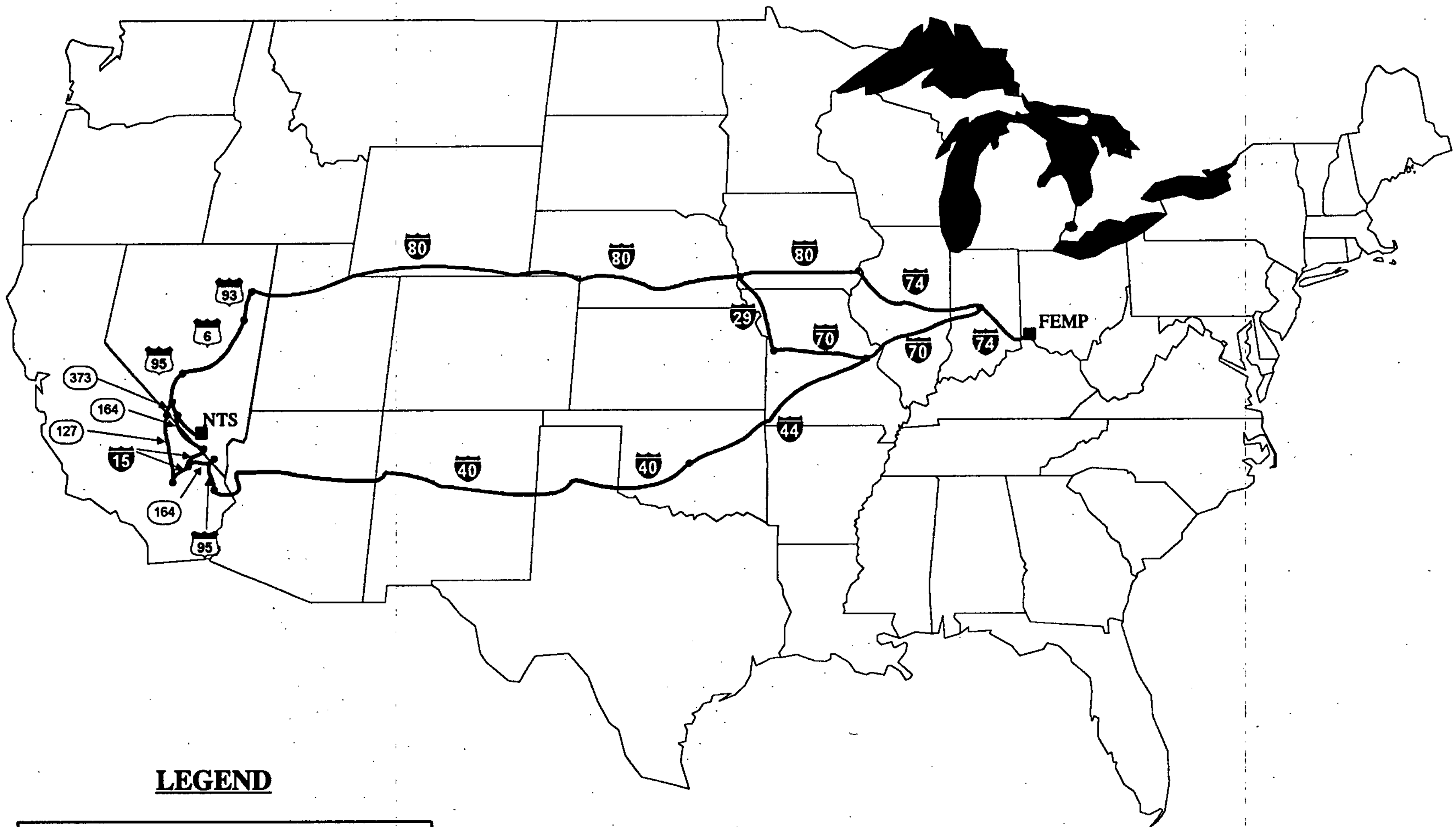
There are one northern route and two southern routes that could be used for transportation of treated Silo 3 material to the NTS via truck. Figure 2-1 shows the three different routes to the NTS.

Northern Route – Route No. 1
South on Route 128 to I-74, to I-80 or Route 128 to I-74, I-70, to I-29, to I-80. I-80 West to Alternate US 93 south to US 93. At Ely, NV, take US 6 to Tonopah, NV. At Tonopah, NV, take US95 to the NTS Mercury Gate.
The Northern Route traverses the following states: Ohio, Indiana, Illinois, Missouri, Iowa, Nebraska, Wyoming, Utah, and Nevada.

Southern Route - Route No. 1
South on Route 128 from the FEMP. Take I-74 west to Indianapolis, IN. Take I-70 west to St. Louis, MO. From St. Louis, MO, follow I-44 to Oklahoma City, OK. Take I-40 through Kingman, AZ to Needles, CA. Proceed North on US 95 into Nevada. Go West on NV 164/Nipton Road to I-15. Proceed north on I-15 and west on Route 160 to Route 95. Take Route 95 East to Mercury, NV.

The Southern Route No. 1 traverses the following states: Ohio, Indiana, Illinois, Missouri, Oklahoma, Texas, New Mexico, Arizona, California, and Nevada.

Figure 2 - 1
NTS Over-The-Road Routes



LEGEND

— Northern Route

— Southern Route #1

— Southern Route #2

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Southern Route - Route No. 2
South on Route 128 from the FEMP. Take I-74 west to Indianapolis, IN. Take I-70 west to St. Louis, MO. From St. Louis, MO, take I-44 to Oklahoma City, OK. Take I-40 through Kingman, AZ to Needles, CA. Proceed North on US 95 into Nevada. At NV 164/Nipton Road proceed west to I-15 at Baker, CA. Travel southwest on I-15 to Baker, CA. Go North on CA 127 and NV 373 to Amargosa Valley, NV. Take US 95 East from Amargosa Valley to Mercury, NV.

The Southern Route No. 2 traverses the following states: Ohio, Indiana, Illinois, Missouri, Oklahoma, Texas, New Mexico, Arizona, California, and Nevada.

2.4.1.2 Routes To Envirocare Of Utah, Inc.

There is one northern and southern route that could be used for transportation of treated Silo 3 material to Envirocare via truck. These routes are shown in Figure 2-2.

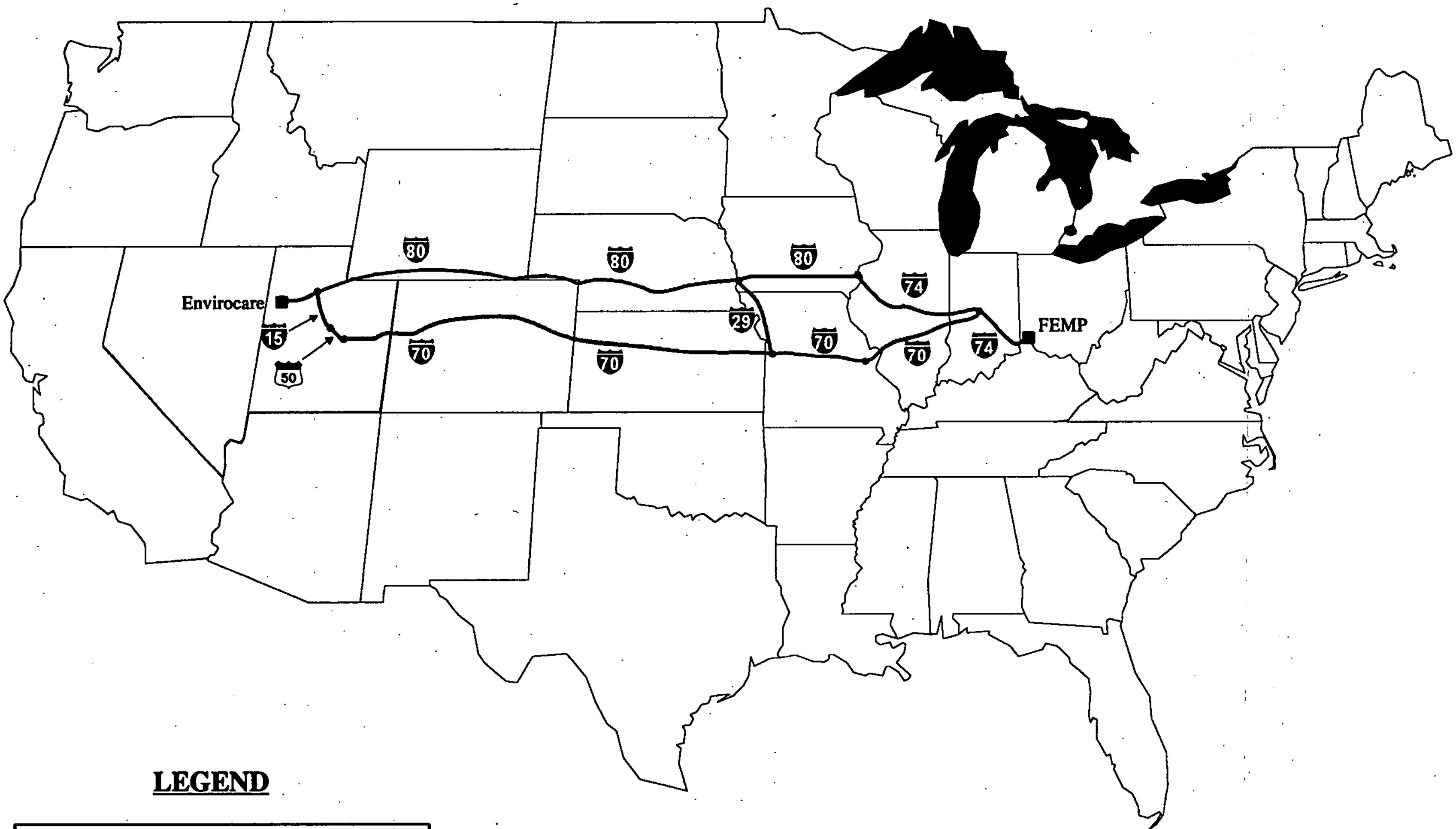
Northern Route
Proceed south on Route 128 to I-74, to I-80 or Route 128 to I-74, I-70, to I-29, to I-80. Proceed on I-80 West through Salt Lake City. Continue West on I-80 to the Clive exit [Exit 49]. Proceed south on Clive Road. Envirocare of Utah is located 3 miles south of I-80.

The Northern Route traverses the following states: Ohio, Indiana, Illinois, Missouri, Iowa, Nebraska, Wyoming, and Utah.

Southern Route
Proceed south on Route 128 from the FEMP to I-74 west to Indianapolis, Indiana. Take Interstate 70 west to St. Louis, Missouri. From St. Louis, Missouri, proceed on Interstate 70 to Denver, Colorado. Continue west on Interstate 70 to Utah State Route 50. Proceed north on Route 50 to State Route 15. Take Route 15 north to Salt Lake City, Utah. At Salt Lake City, proceed on Interstate 80 West. Continue on I-80 to the Clive, Utah exit [Exit 49]. At the Clive exit, proceed south on Clive Road to the Envirocare of Utah facility. The facility is located 3 miles south of Interstate 80.

The Southern Route traverses the following states: Ohio, Indiana, Illinois, Missouri, Kansas, Colorado, and Utah.

Figure 2 - 2
Envirocare Over-The-Road Routes



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Northern Route

Southern Route

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2.4.1.3 Risk and Safety Requirements

A transportation risk assessment comparing the risks associated with intermodal and truck shipments to the NTS for Silo 3 remedial alternatives is provided in Appendix D of the OU4 Feasibility Study (FS), dated February 1994. The assessment evaluated both potential risks associated with accident-free waste transportation (direct radiation) and the risks associated with an accident scenario. As documented in the FS, the calculated excess cancer risk to members of the general public for both scenarios is within the range considered to be acceptable by the United States Environmental Protection Agency (U.S. EPA).

Per 49 CFR 397 Subpart D, Routing of Class 7 (Radioactive) Materials, the routes selected for shipment of radioactive material shall ensure that the radiological risk is minimized. Accident rates, transit time, population density and activities, and the time of day and week during which transportation occurs are to be included in the radiological risk determination.

Section 2.5.3.4 provides a detailed discussion on a transportation risk assessment, performed in August 2000 which addresses the specific waste loading, packaging configuration, radiological concentrations, isotopes of concern, shipment routes and mode of transport for the current design of the Silo 3 project.

2.4.1.4 Shipping Requirements

<u>Department of Transportation Requirements</u>

The FEMP shall comply with 49 CFR and applicable tribal, state, and local regulations. Each package and shipment of hazardous materials for off-site shipment shall be prepared in compliance with 49 CFR 100-185, Hazardous Materials Regulations and applicable tribal, state, and local regulations.

2.4.1.5 Department of Energy Requirements

The primary DOE transportation and packaging requirements are contained in DOE Orders 460.1A, Packaging and Transportation Safety, and 460.2, Departmental Materials Transportation and Packaging Management.

The FEMP will participate in and use the DOE MCEP in the selection of motor carriers as needed, or upon request from the DOE Field Element. Upon request from the DOE Field Element, the FEMP shall evaluate carriers, in accordance with the DOE MCEP. Carrier selection will be performed consistent with DOE Orders and 41 CFR 101-40, Transportation and Traffic Management. Shipments will be consolidated to the extent practicable into larger shipping quantities or units whenever such arrangements will result in transportation or administrative economies. To the maximum extent practicable, the FEMP shall utilize the Automated Transportation Management System (ATMS) to perform transportation tasks.

2.5 TRANSPORTATION EVALUATION

The transportation evaluation performed as part of the Silo 3 project concluded that truck provides the safest, least-cost mode of transport while allowing schedule flexibility and better control of shipments. The evaluation documented in this section demonstrates that truck is the mode of transport that best fits the project requirements. However, other transportation modes for treated Silo 3 material will continue to be considered as part of the site effort to investigate the potential implementation of off-site rail/intermodal shipments. If alternatives become available that are not currently being considered, the Silo 3 project will evaluate those options for viability and incorporation into the shipping program.

2.5.1 Transportation Evaluation

As part of the transportation evaluation of treated Silo 3 material, several options were explored, including:

- Rail shipments to Envirocare and NTS
- Truck shipments to Envirocare and NTS
- Intermodal shipments to NTS

These options were evaluated in 1999 by the Silo 3 Project as part of a study to assess potential disposal sites, waste form and mode of transportation. This study utilized the Kepner-Tregoe decision analysis technique to evaluate the alternatives in a qualitative manner.

The objectives (categories) were segregated as a "must" or a "want". The "must" category was for mandatory requirements, which resulted in a go/no go decision. The other objectives were "wants" and were used to evaluate the relative performance of acceptable alternatives. Because the wants were not of equal value, weights were attached to them to reflect their relative desirability. Weights reflect the impact that objectives had in evaluating alternatives.

The "musts" were as follows:

- The waste form, mode of transportation, waste container, and regulated characteristics of the waste must meet the disposal facility WAC.
- The waste form, mode of transportation, waste container, and regulated characteristics of the waste must meet the requirements of the Explanation of Significant Differences for OU4 Silo 3 Remedial Action.

The categories that were weighted (0-10) and ranked (0-10) during the 1999 evaluation included:

DOT regulations/requirements — The waste form, mode of transportation, waste container, and regulated characteristics of the waste meets the current DOT regulations and requirements.

Transportation costs — Estimated transportation costs from the FEMP to the disposal site were evaluated for each alternative. The lowest cost was the most desirable.

Disposal costs — Total disposal costs for each option were compared. The cost was estimated by calculating the disposal volume for each alternative multiplied by the disposal fees for the disposal facility. If special containers were required for a particular alternative, such as sealands or intermodals, these costs were also included in the estimate. The lowest total disposal cost was the most desirable.

Documentation costs — Cost of preparing documentation was evaluated for each scenario. Costs included waste profiling, shipping documentation (e.g., manifests), and DOT certifications. The lowest total disposal cost was the most desirable.

RMRS costs — RMRS costs were compared for each alternative. Aspects affecting RMRS' cost included final waste form, quantity and type of waste containers, and sampling and analysis requirements.

Stakeholder acceptance — Stakeholder acceptance was assessed for each scenario.

Radiological safety/ Industrial safety/ — Radiological and industrial safety were assessed for each scenario.

Technical viability	The technical viability of each alternative was judged based upon proven technology versus first-of-a-kind technology.
Schedule	The schedule to completely remove and dispose of all Silo 3 waste was considered for each case.
Logistics for emergency response	The FEMP is required to provide emergency response at the site and during transportation of waste to a disposal facility. Each scenario was assessed for potential impacts to the logistics of emergency response (e.g., transfer points and routes).
Impact on FEMP infrastructure	Each option was evaluated for the impact to the FEMP infrastructure (e.g., rail extensions, road upgrades, loading facilities).
OU1 Operations	The impact on OU1 operations was assessed for each alternative.
Shipping interface	Interfaces with Fluor Fernald shipping were reviewed for the various options.
Low Level Waste operations	Potential impacts to the Low Level Waste operations were considered for each scenario.
Silos 1 & 2 interface	Since the Silo 3 project is adjacent to Silos 1 and 2, potential impacts on projects related to Silos 1 and 2 were reviewed.

The transportation alternatives were narrowed to a short list of three, based on total weighted score. The three alternatives, in order from highest to lowest score, were truck shipments to NTS, truck shipments to Envirocare, and rail shipments to Envirocare. At the time of the analysis truck shipments to NTS scored the highest, however with the lower disposal rates through the U.S. Army Corps of Engineers contract, disposal at Envirocare became more economical.

Since the 1999 evaluation, the Silo 3 project has continued to collect information and worked with teams from OU1 and Waste Generator Services (WGS) to determine the optimal approach for shipping treated Silo 3 material. The waste form/packaging configuration being considered at the time of this study was bricks in metal boxes. Although the final waste form/packaging configuration is now briquettes/55-gallon drums, the information contained in the study remains valid except for the transportation costs. The transportation costs associated with shipping drums of briquettes to Envirocare by truck and rail, as well as additional information gained from working with OU1 and WGS have been re-evaluated and factored into the decision regarding transportation.

Table 2.5-1 on the following page shows the rank and weights for each alternative (NTS by truck, Envirocare by truck, and Envirocare by rail).

TABLE 2.5-1
SUMMARY OF RANKINGS AND WEIGHTS
August 1999 K-T Analysis

		Rankings (Scores)		
Category	**Weight**	**Truck To NTS**	**Truck To Envirocare**	**Train To Envirocare**
DOT regulations/ Requirements	8	10	10	5
Transportation Costs	8	5	8	6
Disposal Costs	8	8	9 (10)*	10
Documentation Costs	3	10	5 (10)*	5
RMRS Costs	8	7	6 (7)*	9
Stakeholder acceptance	8	10	10	10
Radiological Safety	10	10	10	10
Industrial Safety	10	10	10	6
Completion Schedule	6	10	9	9
Technical Viability	10	10	10	10
Logistics For Emergency Response	2	10	10	10
Impact On FEMP Infrastructure	8	10	10	4
OU1 Interface	3	10	10	8
Shipping Interface	3	10	10	10
LLW Interface	3	10	10	10
Silos 1 & 2 Interface	3	10	10	10
Total Weighted Score		**931**	**930 (964)***	**815**

* Revised score based on recent transportation evaluation. Disposal costs changed to a 10 due to Envirocare disposal cost through the Army Corps Of Engineers contract being lower than anticipated. Documentation costs would not be any different than truck shipments to NTS, therefore a 10 was assigned. RMRS costs would also be no different than truck to NTS, therefore changed to a 7. The total weighted score for truck to Envirocare is now 964.

2.5.2 Transportation Cost Evaluation

The costs for transportation of treated Silo 3 material to Envirocare by rail and truck were recently re-evaluated to address the change in the shipping container (55-gallon drums) and waste form (briquettes) and to include most up to date information regarding rail transportation logistics and costs. An estimate was also recently performed for truck transport and disposal at NTS. These estimates address labor, materials, equipment lease, infrastructure improvements, freight and burial.

2.5.2.1 Rail Transportation

The rail transportation estimate was performed for three different alternatives (boxcar, flat car, and articulated bulk container car). The estimates for articulated bulk container car and boxcar were approximately $1.6 million. The estimate was approximately $2.1 million for flatcars. The following assumptions were utilized for the rail estimates:

Packaging

Flatcars and Articulated Bulk Container Cars

- Drums would be packaged in intermodal roll-off containers if shipments are made via flatcars or articulated bulk container cars.
- Drums would be packaged loose in a chevron pattern allowing 34 to 36 loaded drums to be shipped per intermodal container. Intermodal containers could be double stacked on the articulated bulk container cars, and single stacked on the standard flatcar.

Boxcars

- Pallets would be stacked two high in a boxcar. Assuming the floor area of the boxcar between the sliding doors is left open, 192 loaded drums could be transported in a common sixty foot boxcar.

Loading

- Container loading would be at railroad crossing #2, north of the Plant 1 pad.
- A roadway of crushed limestone base would be required to facilitate heavy mobile equipment movement during loading.
- A concrete apron along one side of the crossing would be necessary for flatcar loading by a container handler or forktruck.
- A steel ramp would be need to be constructed at railroad crossing #2 to load boxcars by forktruck.

Freight

- Freight costs are based on the current rate per railcar charged to Operable Unit 1. Rail shipment would be with the OU1 unit train.

2.5.2.2 Truck Transportation To Envirocare And NTS

The estimate for truck transport and disposal of the treated Silo 3 material to Envirocare is approximately $1.59 million. The estimate for truck transport and disposal of the treated Silo 3 material to NTS is approximately $2.1 million. See Table 2.5-2 for a summary of the transportation costs.

The following assumptions were utilized for truck transportation:

Packaging
- Forty drums will be loaded into each truck van for shipment.
- Two truck vans will be shipped per day, four days per week.

Loading
- Loading of the drums for shipment will occur at the ISA pad.
- Labor contingency is included for transport of drums to Plant 1 pad prior to shipment in the unlikely event the ISA pad reaches capacity. The cost associated with this contingency is approximately $291,000 and is included in the estimate below for truck transport to Envirocare.

Freight
- Freight per shipment was obtained from carriers utilized in the past.

TABLE 2.5-2
SUMMARY OF TRANSPORTATION & DISPOSAL COSTS

	Envirocare By Truck	Envirocare By Rail (1,2,3)*	NTS By Truck
Cost (loading, infrastructure improvements)	$609,173	(1)$1,281,825 (2)$1,181,989 (3)$1,404,311	$610,047
Freight Cost	$675,500	(1)$342,000 (2)$475,000 (3)$674,500	$843,500
Disposal Cost	$309,041	$309,041	$651,375
Total Cost	**$1,593,714**	**(1)$1,932,866 (2)$1,966,030 (3)$2,387,852**	**$2,104,922**

* 1 = Articulating Bulk Container Car, 2 = Boxcar, 3 = Flatcar

2.5.3 Other Factors Influencing Transportation Mode Selection

Factors that cannot be quantitatively measured but impacted the decision to utilize truck shipments are discussed below.

2.5.3.1 Multiple Handling

Multiple handling of drums of treated Silo 3 material is of concern due to the potential increase of the likelihood of accidents and radiological exposure to personnel and the environment. Multiple handling of drums occurs during loading operations for rail shipments. For Silo 3 to implement rail shipments, the drums would have to be removed from storage and staged for shipment on the ISA pad. Once prepared for shipment, the drums would have to be un-banded and removed one at a time from the pallets. The drums would then be loaded singularly into an intermodal container staged on the ISA pad. Once full, the intermodal container would then be transported to the north end of the Plant 1 pad for loading onto a railcar.

Multiple handling also occurs for boxcar shipments because the drums, once certified for shipment on the ISA pad, would have to be transported to the north end of the Plant 1 pad for loading. The distance to the north end of the Plant 1 pad is approximately six tenths of a mile from the ISA pad, adding to the potential for an accident due to the distance traveled.

Multiple handling is less of a concern for truck shipments. The Silo 3 project can prepare and load truck shipments on the ISA pad, therefore only moving the drums from their storage location directly to the shipping area. Truck shipments will be loaded with the drums banded and strapped to the pallet (the same configuration as when the drums exit the treatment facility), requiring no further individual drum handling, thereby minimizing the risk associated with movement and handling of containers

2.5.3.2 Truck Shipment Experience

A factor that applies to the overall transportation evaluation is the experience the FEMP has in loading and shipping waste and nuclear material via truck. Since 1985 the FEMP has made over 4,500 shipments to NTS alone, demonstrating successful program and procedural implementation ability. The shipping program and procedures used for shipment to NTS will be modified for use to ship the treated Silo 3 material to Envirocare. Recently, the FEMP shipping program has passed several readiness reviews in support of off-site shipments to NTS, Portsmouth, and Oak Ridge, demonstrating the years of experience and capabilities of program implementation. The Silo 3 project will be performing a pre-operational assessment in preparation for start-up, including the scope of off-site shipments. The project will have to demonstrate its ability to stage, prepare, certify, and load drums for shipment to Envirocare and NTS. The experience that has been gained over the past several years in the shipping program should make the pre-operational assessment process much easier to fulfill.

2.5.3.3 Shipment/Schedule Flexibility

Use of truck shipments offers greater schedule flexibility than use of rail shipments. Additional or fewer shipments can be scheduled if the need arises due to changes in the operations schedule, weather or other unforeseen factors. This type of flexibility will allow the Silo 3 project to maintain the proper storage capacity on the ISA pad and reduce the need to move drums to the

Plant 1 pad for storage. Truck shipments allow the Silo 3 project more control over the timing of treated material shipments.

Rail shipments to Envirocare would have to be scheduled with the unit train shipments through Operable Unit 1 (OU1). This would require coordination with OU1 to have empty rail cars staged for loading, transfer of loaded rail cars for shipping, shipment of the rail cars to Envirocare and their return to the FEMP. The rail cars containing Silo 3 treated material are off-loaded in a different area at Envirocare. There is no guarantee that the rail cars/intermodal containers that contained Silo 3 treated material will return with the OU1 unit train, thereby increasing the storage time between shipments and the likelihood of exceeding the ISA pad capacity, thus causing additional handling of containers.

2.5.3.4 Transportation Risk Assessment

This section provides the evaluation of the radiological risk posed to the general public and workers by the routes proposed for transporting treated Silo 3 material from Fernald to the selected disposal facility (i.e., NTS or Envirocare of Utah). Flour Fernald, Inc. evaluated two direct truck routes to the NTS, one direct truck route to Envirocare of Utah, one intermodal route to the NTS, and one direct rail route to Envirocare of Utah. The assessment demonstrated that both truck and rail shipments are well within the range considered to be acceptable by U.S. EPA for calculated excess cancer risk to members of the general public

Evaluation of Risk

DOT requires carriers to utilize routes that minimize radiological risk when transporting radiological material. When determining radiological risk, DOT regulation 49 CFR Part 397.101(a)(2) requires the carrier to consider available information, such as, accident rates, population densities, and transit time.

The estimated radiological risk to the public and workers during transportation was calculated using the RADTRAN5® computer model developed by Sandia National Laboratories. RADTRAN5® produces estimates of incident-free population dose, accident dose-risk, nonradiological mortality, as well as individual dose estimates. Calculation of incident-free population dose considers persons adjacent to the route, persons in vehicles sharing the route, crew members, and persons at stops. Potential dose-risks are also calculated for populations that are downwind from hypothetical releases associated with accidents of varying severity or within stated radial distances of loss-of-shielding accidents of varying severity.

Where possible, "standard" RADTRAN5® values for parameters were used if they were not specific to the radioactive material, package, vehicle, or route.

RADTRAN5® relies on various parameters, which are defined by the user, for calculating dose. This information relates to the radioactive material, the package, the vehicle, and the route. It includes parameters for the number of shipments, the number of containers per shipment, the radionuclide content of the container, the radiation dose associated with the container, and the radiation dose associated with the shipment. Table 2.5-3 presents the user-defined package-specific and vehicle-specific parameters associated with the four alternatives.

TABLE 2.5-3
PACKAGE-SPECIFIC AND VEHICLE-SPECIFIC PARAMETERS
FOR RADTRAN5® ANALYSIS

Parameter	DIRECT TRUCK	INTERMODAL		DIRECT RAIL
		TRUCK	RAIL	
Number of Shipments	192	192	96	96
Number of Containers per Shipment	50	50	100	100
Dose Rate 1 m from Package (mrem/hr)	0.05	0.05	0.05	0.05
Characteristic Package Dimension (m)	0.864	0.864	0.864	0.864
Dose Rate 1 m from Vehicle (mrem/hr)	2.5	2.5	2.5	2.5
Characteristic Vehicle Dimension (m)	12.20	12.20	24.38	24.38
Number of Crew Members	2	2	2	2
Average Distance from Package to Crew Members (m)	7.62	7.62	100	100
Crew View Package Dimension (m)	1.22	1.22	1.22	1.22

RADTRAN5® requires data that expresses the likelihood of accidents of a given severity for urban, suburban, and rural population areas. Accident severity categories with their respective probabilities of occurrence for each population area were obtained from the Nuclear Regulatory Commission document, "Final Environmental Statement on the Transportation of Radioactive Material by Air and other Modes," (NUREG-0170) and are presented in Tables 2.5-4 and 2.5-5 for truck and rail, respectively. The tables are arranged from high probability, low speed, low impact accidents (Severity Category 1) that are more likely to occur in urban areas to low probability, high speed, high impact accidents (Severity Category 8) that are more likely to occur in rural areas.

TABLE 2.5-4
REGIONAL FRACTION OF ACCIDENT SEVERITY OCCURENCES, TRUCK

Severity Category	Rural	Suburban	Urban
1	0.055	0.055	0.44
2	0.036	0.036	0.288
3	0.021	0.028	0.021
4	0.0048	0.0064	0.0048
5	0.0014	0.00084	0.00056
6	0.00077	0.00022	0.00011
7	0.000068	0.0000085	0.0000085
8	0.0000135	0.00000075	0.00000075

TABLE 2.5-5
REGIONAL FRACTION OF ACCIDENT SEVERITY OCCURENCES, RAIL

Severity Category	Rural	Suburban	Urban
1	0.05	0.05	0.4
2	0.03	0.03	0.24
3	0.054	0.072	0.054
4	0.0054	0.0072	0.0054
5	0.0009	0.00054	0.00036
6	0.000091	0.000026	0.000013
7	0.000048	0.000006	0.000006
8	0.000009	0.0000005	0.0000005

In addition, for each accident severity category, the user inputs data on the fraction of material that could be expected to be released from a container during an accident, the fraction of material released that can become aerosol, and the fraction of aerosol material that can become respirable. The accident release fractions for treated Silos 1 and 2 material is presented in Table 2.5-6.

TABLE 2.5-6
ACCIDENT RELEASE FRACTIONS

Severity Category	Release Fraction	Aerosol Fraction	Respirable Fraction
1	0.0	N/A	N/A
2	0.01	0.000007	1
3	0.1	0.00002	1
4	1	0.00009	1
5	1	0.0002	1
6	1	0.0004	1
7	1	0.001	1
8	1	0.002	1

Results

As stated previously, RADTRAN5® estimates the risk of fatalities to workers and the public due to non-radiological accidents, dose to workers and the public resulting from incident-free transport of radiological material, and dose to populations that are downwind from hypothetical releases associated with accidents of varying severity.

Table 2.5-7 presents data on the non-radiological risk of fatality to workers and the public for each of the proposed routes. There are two types of risk to the public for non-radiological fatalities. One is the risk of a fatality resulting from an accident and the other is the risk of a fatality resulting from exhaust emissions from the operation of a motor vehicle.

TABLE 2.5-7
ESTIMATED NON-RADIOLOGICAL FATALITIES

Route	Estimated Non-Radiological Fatalities	
	Non-Occupational	Occupational
Southern Route to the NTS	0.033	0.009
Northern Route to the NTS	0.034	0.010
Intermodal Route to the NTS	0.033	0.006
Direct Truck Route to Envirocare of Utah	0.030	0.008
Direct Rail Route to Envirocare of Utah	0.017	0.001

Table 2.5-8 presents data on the estimated collective dose equivalent received by workers and the public resulting from incident-free transport of treated Silo 3 material. In the case of the public, the collective dose equivalent includes individuals living along the proposed route (off-link) and individuals sharing the road (on-link), as well as individuals exposed during vehicular stops (e.g., refueling, eating, and sleeping). The collective dose equivalent is the sum of the estimated individual doses received by each transportation crew member or member of the public. For example, the sum of the estimated individual radiation doses received by each transportation crew member during the 192 direct truck shipments to the NTS over Southern Route is 1.62 person-rem. The sum of the estimated individual radiation doses received by each member of the public either living along, sharing the road, or occupying stops at the same time as normal transport of the 192 direct truck shipments to Envirocare of Utah is 56.99 person-rem. The table also presents data on the estimated collective dose equivalent from releases resulting from accidents. For example, the sum of the individual radiation doses estimated to be received by members of the public due to hypothetical releases resulting from an accident while shipping treated Silo 3 material by direct rail to Envirocare of Utah is 0.0316 person-rem.

TABLE 2.5-8
COLLECTIVE DOSE EQUIVALENT

Route	Collective Dose Equivalent, person-rem		
	Occupational	Non-Occupational, Normal	Non-Occupational, Accident
Southern Route to the NTS	1.62	65.24	8.18E-03
Northern Route to the NTS	1.66	64	5.18E-03
Intermodal Route to the NTS	6.19	18.82	2.44E-02
Direct Truck Route to Envirocare of Utah	1.37	56.99	6.14E-03
Direct Rail Route to Envirocare of Utah	2.36	3.31	3.16E-02

The risk from exposure to ionizing radiation is measured in latent cancer fatalities (LCF), which is the number of potential cancer fatalities estimated as a result of radiation exposure. An incremental lifetime cancer risk (ILCR) - the increased potential of an individual developing a cancer over a lifetime as a result of exposure - can be determined by comparing the potential number of cancers against the total exposed population. LCFs are calculated by Eq.1.

$LCF = H_E \bullet CRF$ (Eq. 1)

where,

H_E = collective effective dose equivalent for exposed population
LCF = latent cancer fatalities
CRF = cancer risk factor, LCF/person-rem

The cancer risk factor for workers is 4.00E-04 LCFs per person-rem while for the public it's 5.00E-04 per person-rem. These values are used in the RADTRAN5® computer model and are from the latest edition of ICRP-30.

A range of $10^{-4} - 10^{-6}$ for an additional lifetime cancer risk to the public has been determined to be acceptable under CERCLA. To determine whether the transportation options meet this requirement, the ILCR to the public was determined using Equation 2.

ILCR = LCF/POP (Eq. 2)

where,

LCF = latent cancer fatalities
POP = total population exposed

Table 2.5-9 presents the estimated ILCRs for the routes evaluated for incident-free transportation (i.e., no accidents). Total exposed populations for each route are based on population density used for the RADTRAN5® computer model. Using as an example the collective dose equivalent of 64 person-rem for incident free shipment of the treated Silo 3 material to the NTS on the Northern Truck Route and the exposed population of 586,000, the ILCR is calculated to be 5.46E-08. This equates to 1 additional cancer for approximately every 18,000,000 people.

TABLE 2.5-9
INCREMENTAL LIFETIME CANCER RISK FOR EXPOSED POPULATION

Route	Collective Dose Equivalent, person-rem	Total Exposed Population	Incremental Lifetime Cancer Risk
Southern Route to the NTS	65.24	1.04E+06	3.14E-08
Northern Route to the NTS	64	5.86E+05	5.46E-08
Intermodal Route to the NTS	18.82	5.39E+05	1.75E-08
Direct Truck Route to Envirocare of Utah	56.99	9.05E+05	3.15E-08
Direct Rail Route to Envirocare of Utah	3.31	6.01E+05	2.75E-09

3.0 ON-SITE WASTE MANAGEMENT

3.1 INTRODUCTION

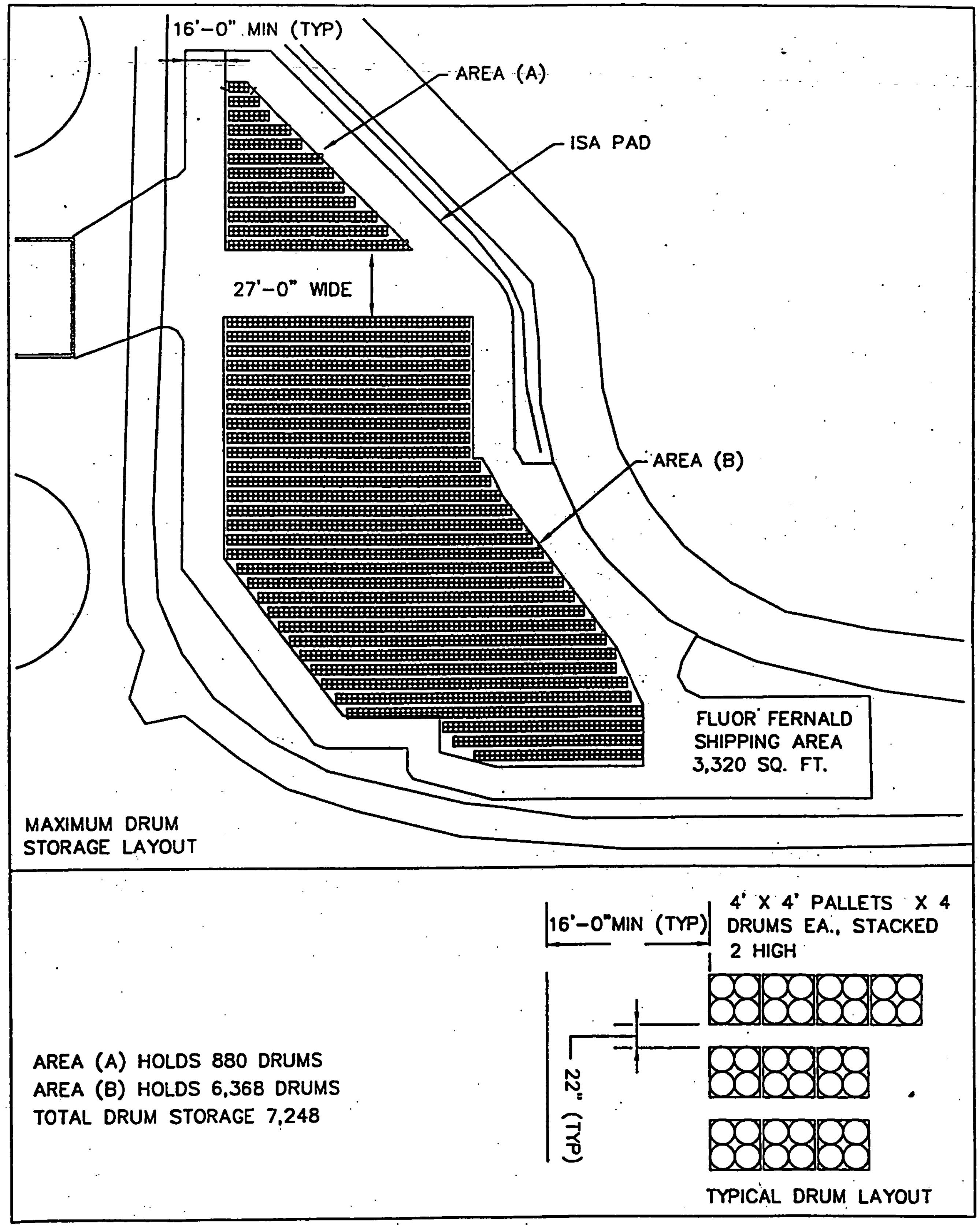
This section addresses the on-site management of the treated Silo 3 material, including the facilities, storage, inspections and treated Silo 3 material container movements. RMRS has the responsibility to treat, containerize, and label the treated Silo 3 material utilizing Fluor Fernald-supplied labor. As part of the treatment operations, Fluor Fernald Quality Assurance personnel will verify that disposal facility requirements have been met. The containers of treated material will be weighed prior to turning them over to Fluor Fernald. Once Fluor Fernald receives from RMRS the containers of treated material verified to have met the Silo 3 WAC, the containers will be stored and managed by Fluor Fernald until shipment to the off-site disposal facility (NTS or Envirocare). Individual containers of material will be tracked using the existing on-site waste tracking databases.

3.2 FACILITIES

The interim storage area (ISA) pad will be used for staging treated Silo 3 material containers while awaiting results of confirmatory sampling. The concrete ISA pad will be approximately one acre in size and will be located east of the Silo 3 treatment facility. See Figure 3-1 for the location of the ISA pad in relation to the Silo 3 treatment facility. Figure 3-1 also demonstrates the proposed drum storage layout for the ISA pad. Once the waste containers have been approved for disposal, they will be prepared for shipment on the ISA pad in the shipping area (see Figure 3-1).

Current plans are to ship drums of treated Silo 3 material within 45 calendar days of filling. The treatment facility production rate is approximately 120 drums per working day (480 drums per work week). After 45 calendar days, the ISA pad will have approximately 3,100 drums of treated Silo 3 material staged, awaiting confirmatory analysis results. The capacity of the ISA pad is approximately 7,200 drums. The planned shipping rate, to commence after 45 calendar days, is two truck shipments (50 drums each), four days per week, totaling 400 drums per week. At this rate it would take just over 400 calendar days to fill the ISA pad (taking into account the production rate minus the shipping rate). This is well beyond the current production schedule. Therefore, under normal operating and shipping conditions, the ISA pad should never reach its design storage capacity. The Plant 1 pad will only be utilized for staging or storage of drums in the unlikely event the ISA pad becomes full or is nearing capacity.

Figure 3 - 1
Interim Storage Area Pad Layout



3.3 STORAGE AND INSPECTIONS

Storage and inspections will be performed consistent with applicable site procedures and substantive Resource Conservation and Recovery Act (RCRA) container management requirements. Although the Silo 3 material is 11(e)(2) by-product material and therefore exempt from regulation under RCRA, the OU4 applicable, relevant and appropriate requirements (ARARs) require compliance with certain substantive requirements of the RCRA regulations. Table 3.3-1 below lists the substantive requirements from the RCRA container management regulations that need to be met for management of containers of treated Silo 3 material, and secondary waste containing, or contaminated with, Silo 3 material.

TABLE 3.3-1
SUBSTANTIVE REQUIREMENTS

Requirement	Compliance Method
Containers must be made of, or lined with, materials that will not react with and are otherwise compatible with the material stored in the container.	The briquettes of treated Silos 1 and 2 material will be packaged in 55-gallon steel drums, which will be compatible with the treated Silo 3 material.
Access to the container storage area must be controlled (e.g., locked building, fenced or roped off pad, etc.). The area must be marked with "Danger – Authorized Personnel Only" signs, visible from at least 25 feet away.	The Interim Storage Area (ISA) Pad will be fenced to control access. The pad will also be marked with the required "Danger – Authorized Personnel Only" signs.
Documented inspections of the storage area for deteriorated containers, leaks, etc. must be conducted on a weekly basis.	Weekly inspections of containers stored on the ISA Pad will be conducted and documented consistent with FEMP site procedures.
Documentation of inspections must be retained and available.	Documentation of the weekly inspections will be retained and available in the RCRA Operating Record and in Silo 3 Project files.
Spill response equipment must be located in the area.	As specified in the Silo 3 Project Contingency Plan, (Section 8.0 of the RD Package) appropriate spill response equipment stored at an accessible location in the Silo 3 Project Area.
Emergency procedures must define response to emergencies (fires, etc.) in the storage area; these procedures must be incorporated into the RCRA Contingency Plan.	Response to emergencies in the area is detailed in the Silo 3 Project Contingency Plan, (Section 8.0 of the RD Package). This plan will be incorporated into the site RCRA Contingency Plan.

**TABLE 3.3-1 (Continued)
SUBSTANTIVE REQUIREMENTS**

Requirement	Compliance Method
Secondary containment (e.g., dike, overpack containter) must be provided for containers that contain/may contain free liquids).	Containers of treated Silo 3 material will not contain free liquids. No materials containing free liquids will be stored on the ISA Pad.
The storage area must be constructed/operated in a manner that protects the containers from contact with liquid from accumulated precipitation.	The drums of treated Silo 3 material will be stored on pallets. The ISA pad is designed such that the entire pad surface drains to a stormsewer system that discharges to the Waste Pit Area Stormwater Runoff Control Sump.
Containers must be handled in a way that prevents rupture, leakage, or spillage and must remain closed during storage.	Lids will be fixed to the drums of treated Silo 3 material before they are transferred to the ISA Pad. The containers will be transported, loaded and secured for shipment in accordance with site procedures to assure that they are protected from damage during transportation.

Interim (outdoor) storage of containers will be minimized to the extent possible. Approximately 30 calendar days will elapse from the point of generation until the results from confirmatory sampling indicate if the treated Silo 3 material meets the Silo 3 WAC. During this time the containers will be stored on the ISA Pad. Once the characterization and manifest paperwork are completed and the containers approved for disposal, the containers will be loaded for shipment. The longest planned duration any one container will be in storage on the ISA Pad is 75 calendar days from the day the container was filled with treated Silo 3 material.

3.4 CONTAINER MOVEMENTS

Once the treated Silo 3 material is sampled, containerized, weighed and labeled, the containers will be moved to the ISA pad. The containers will remain there until the sampling data shows that the treated Silo 3 material meets the Silo 3 WAC. Containers not meeting these requirements will remain on the ISA pad for rework or reprocessing by RMRS or transported to the Plant 1 pad within 90 days. Containers meeting the requirements can be shipped directly from the ISA Pad or transported to Plant 1, if necessary, until shipment off-site.

RMRS will access the ISA pad via the apron on the west side of the pad (see Figure 3-1) to transport drums of treated Silo 3 material for storage. The containers will remain in storage on the ISA pad, under RMRS oversight, until confirmatory samples indicate the treated material meets the Silo 3 WAC. RMRS will manage the containers in accordance with the requirements (ARARs) of Section 3.3.

Access to the ISA pad for Fluor Fernald personnel to remove containers that have met the Silo 3 WAC will be primarily via the apron on the east side of the pad from the Infrastructure Road. An area will be established on the ISA pad for loading drums of treated material verified to have met the Silo 3 WAC.

Once an inventory of material is approved for shipment, the final shipping certification will occur prior to loading. Containers will be loaded into vans using fork trucks.

4.0 HEALTH AND SAFETY

4.1 INTRODUCTION

The focus of this section will be the Health and Safety approach for on-site transportation operations-related activities. The overall on-site project Health and Safety responsibility lies directly with the DOE and its contractors. The specific functional areas of safety addressed in this section are Nuclear and Systems Safety, Occupational Safety and Health, Radiological Protection, and Security.

4.2 NUCLEAR AND SYSTEMS SAFETY

The FEMP Nuclear and System Safety Program is identified in RM-2116, System Safety Requirements and is implemented by Fluor Fernald through site procedures. An evaluation will be required of any existing safety analysis documentation for applicability. Safety analysis is performed to help ensure the health and safety of the public, the workers, and the environment.

Fluor Fernald will categorize the shipping area in accordance with DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports. Based on the categorization, the level of safety basis documentation required will be identified. Safety analysis documentation has been developed and approved for storage of material and over-the-road shipping activities. However, this will be a new shipping facility that will require new safety analysis documentation. The Fluor Fernald Silo 3 Project team will use as much of the existing analysis as possible for developing the safety basis.

4.3 OCCUPATIONAL SAFETY AND HEALTH

The FEMP Occupational Safety and Health Program requirements are defined in the RM-0021, Safety Performance Requirements (SPR) Manual. The SPRs apply to activities at the FEMP. SPRs identify requirements established by federal, state, and local regulations. In addition, requirements from DOE Orders and Best Management Practices established by Fluor Fernald through experience, lessons learned, and employee input. SPRs identify safety and health standards for assessing and planning work at the FEMP. They contain specific information on what must be done to safely execute work and are not intended to specify how to execute work.

The Fluor Fernald Silo 3 Project team will implement the SPRs by incorporating their requirements into procedures that will be developed to guide the performance of transportation activities.

Specific safety and health requirements may need to be developed as the details of the project unfold. For planning purposes, however, existing SPRs are being used as the basis for Health and Safety on this project. The SPRs and additional project-specific safety requirements are incorporated into planning documents and implementing procedures.

4.4 SAFETY PRECAUTIONS

This section addresses safety precautions related to storage and over-the-road activities involving treated Silo 3 material.

4.4.1 Storage of the Treated Silo 3 Material

The treated Silo 3 material will be transported directly from the treatment area to the ISA pad. From there, the containers will be prepared and loaded for shipment from the ISA pad or may be transported to the Plant 1 pad (if necessary) for staging for shipment.

A hazard analysis has been performed for these types of activities in other areas of the FEMP. The Silo 3 Project team will use as much of the existing analyses as possible. Further project-specific hazard analyses will be performed, as necessary and the results will be used to identify controls and mitigators, as necessary. The controls and mitigators will be incorporated into project documentation (e.g., design, plans, and procedures).

4.4.2 Over-The-Road

Since over-the-road shipping is the preferred method of transport, the FEMP will use existing FEMP programs and procedures for these activities.

Hazard analyses have been performed, and controls and mitigators identified for these activities. The FEMP will review and update these analyses, as necessary, to identify specific hazards and incorporate controls and mitigators identified for the shipping operations.

4.5 RADIOLOGICAL SAFETY

Equipment and material, including containers with treated Silo 3 material, will be released from the treatment facility when the exterior of the containers are free of loose contamination. Therefore, it is planned that shipping activities will take place in a Controlled Area. FEMP Radiological Control Technicians (RCTs) will conduct routine radiological surveys to ensure contamination levels are maintained below Contamination Area limits.

If the equipment or material in the Controlled Area exceeds Contamination Area levels, a Contamination Area will be established and a new Radiation Work Permit (RWP) will be issued. The RWP will define the level of anti-contamination clothing and RCT coverage required. If decontamination is feasible, decontaminating the work surface to a level below Contamination Area limits will eliminate the need for routine wearing of anti-contamination clothing and reduce the RCT coverage requirements. If/when Contamination Areas are established, whole body monitoring will be required for exiting the area. Immediately following the completion of work, the area will be decontaminated, as necessary, and surveyed for the purpose of down-posting.

As the shipment loading area for the treated Silo 3 material is identified and constructed, more detailed project specific radiological control requirements will be developed. These requirements will be incorporated into procedures and work permits.

4.6 ACCESS OF PERSONNEL

Only necessary personnel with the appropriate training will be given access to the radiologically-controlled areas. The crew will ingress/egress through a radiological control point and will be subject to personal contamination monitoring upon exit. Incidents of personal contamination will be addressed per existing, approved site procedures.

4.7 SUBCONTRACTOR/FEMP OPERATIONS BOUNDARY

RMRS will maintain access control and establish identifiable boundaries for their work area. Before accepting containers of treated material from RMRS, the exterior of each container will be surveyed by FEMP Radiological Control for compliance with DOT regulations and Fluor Fernald RPP requirements. Exterior non-fixed contamination levels will be determined per 49 CFR 173.443, Contamination Control for shipments and 10 CFR 835, Occupational Radiation Protection for storage. Once the containers have been surveyed and are ready for release, RMRS will notify Fluor Fernald and provide the necessary documentation.

4.8 SECURITY

Areas where treated Silo 3 material will be loaded and stored pending the completion of shipment, will be fenced and provided with the appropriate levels of security and lighting. FEMP security monitors site access by using stationary posts, conducting walking, driving, and perimeter patrols on a 24-hour basis.

5.0 EMERGENCY RESPONSE

5.1 INTRODUCTION

This section documents the emergency response procedures that are in place to respond to transportation accidents involving shipments of treated Silo 3 material. The scope of this discussion focuses on off-site occurrences and references procedures for on-site occurrences.

DOE Order 151.1, Comprehensive Emergency Management, provides for a DOE Emergency Management System (EMS). Pursuant to this order, DOE must maintain a Transportation Emergency Preparedness Program that enhances and integrates transportation emergency preparedness capabilities within the EMS. The Transportation Emergency Preparedness Program has been established at DOE headquarters. The FEMP has a similar program. The Transportation Emergency Preparedness Program ensures that an adequate DOE response to transportation incidents involving DOE materials is performed and that DOE's responsibilities under the National Contingency Plan (NCP) and the Federal Radiological Emergency Response Plan are adequate. The Transportation Emergency Preparedness Program also provides technical advice and assistance as required for transportation incidents involving radioactive wastes.

5.1.1 Department of Energy Requirements

The primary DOE requirements are contained in DOE Orders 460.1A, Packaging and Transportation Safety, and 460.2, Departmental Materials Transportation and Packaging Management, which cover DOT requirements that regulate the operations and activities associated with the transportation and packaging of hazardous materials in interstate and intrastate commerce.

DOE Order 435.1, Radioactive Waste Management and associated manual DOE M 435. 1-1, Chapter IV, Section L.2., Transportation, also state, "To the extent practical, the volume of waste and number of low-level waste shipments shall be minimized." The requirement will be considered in development of the treated Silo 3 material form and associated transportation planning. The treatment process by RMRS will provide a volume reduction of the material in its final form, which supports waste minimization objectives.

5.2 FEMP EMERGENCY RESPONSE PREPAREDNESS PLANS

The FEMP Transportation Emergency Plan (TEP), PL-3043, is part of the DOE-FEMP Transportation Emergency Preparedness Program. The FEMP TEP provides a centralized program approach to off-site transportation emergency response including products, samples, waste, and rail shipments.

The FEMP TEP describes the overall DOE/FEMP process developed for the coordination of response efforts to off-site transportation incidents. This assistance planning is accomplished by adherence to applicable federal, state, and local transportation-related emergency response requirements, plus utilizing existing DOE programs designed to protect the well-being of citizens and the environment from accidental release of transported materials.

Procedures for on-site emergencies are addressed in PL-3020, FEMP Emergency Plan, which details the procedures to be followed at the FEMP in the event of an accident or emergency, highlights FEMP safety features, and governs the spill response actions. The FEMP Emergency Plan is distributed to participating mutual aid organizations, such as local fire departments and hospitals, in the general vicinity of the FEMP. Additionally, PL-2194, the FEMP Spill Prevention Control and Countermeasure Plan will be implemented accordingly for incidents on, or in close proximity to, the FEMP.

5.3 EMERGENCY RESPONSE FOR THE FEMP OFF-SITE SHIPMENTS

A treated Silo 3 material shipment will become an off-site shipment at the point when the entire shipment crosses the facility boundary. When the shipment is off-site, the carrier will be responsible for providing emergency response support to the local authorities in proximity of any incident. The carrier also has contractors available for containment and cleanup as necessary. DOE will advise and provide support as requested by the local response authority (49 CFR 174.750). Local response personnel including police, firefighters, and emergency responders, typically are the first to arrive on the scene of an incident. They must be provided the technical information needed by first responders to accurately identify the hazards involved in the incident. Information contained in the shipping papers includes source terms, health and safety concerns, and recommended protective actions. The information is consistent with the DOT, Research and Special Programs Administration publication, North American Emergency Response Guidebook, Guide 162.

The following is an overview of the emergency response responsibilities of the carrier, DOE, individual states and the FEMP to support local authorities at an accident scene.

1. Carriers
   - Trained in accordance with DOT Emergency Response Guidebook
   - Stabilize situation
   - Provide notification of incident to carrier home office
   - Provide notification to FEMP/DOE

2. Carrier Emergency Response Organization
   - Make appropriate additional notification (local authorities, DOE, etc.)
   - Dispatch Emergency Response Personnel to the scene to support On-Scene Commander
   - Mobilize strategically positioned emergency response subcontractors, if necessary
   - Responsible for Recovery Actions

3. Local Authorities
   - Typically function as the On-Scene Commander

4. State Emergency Response Organizations
   - Each state possesses an Emergency Response Organization capable of responding to radiological emergencies

5. DOE Regional Radiological Assistance Teams
   - Eight Radiological Assistance Teams across the United States
   - Provide On-Scene Commanders with support in terms of radiological monitoring, communications, and information coordination during an emergency
   - Consist of DOE and contracted personnel possessing expertise in health physics, public information, and communications

The FEMP TEP is activated when the carrier or the local response organization contacts the FEMP to notify DOE that an incident has occurred. The 24-hour emergency phone number provided on the bill of lading, as required by 49 CFR 172.604, Emergency Response Telephone Number, is a direct telephone line to the FEMP Communications Center.

The FEMP Communications Center provides communication capability for the FEMP, monitors conditions, and makes notifications as required. The FEMP Communication Center establishes and maintains direct communication with the on-scene Incident Commander and the FEMP Assistant Emergency Duty Officer (AEDO) until the Emergency Operations Center (EOC) is activated.

The FEMP EOC is activated at the direction of the AEDO or EDO for events categorized at the emergency level, including transportation events and for non-emergency events at the discretion of the EDO. The EOC officially becomes operational when the Emergency Director or Deputy Emergency Director arrives on the scene, determines that sufficient personnel are available to manage the response and declares the EOC operational. The combined efforts of EOC staff members provide support, guidance, and direction to the Incident Commander in the field. The EOC staff assumes responsibilities such as making protective action recommendations, providing notifications, and obtaining necessary resources, as required by the specific circumstances of the event.

5.3.2 Motor Carriers

Motor carriers maintain an Emergency Response Plan which outlines the procedures the carrier's employees must take in the event of an incident. The plan includes notification responsibilities, emergency response procedures for personnel on the scene, environmental considerations, and additional precautions to take in the event of an incident. DOE, as the shipper, will be notified by the carrier immediately should an incident occur. Both the carrier and DOE will initiate emergency procedures simultaneously upon notification.

6.0 WASTE DISPOSAL

6.1 INTRODUCTION

This section discusses disposal of treated Silo 3 material at the NTS and Envirocare and the related regulatory and waste acceptance information.

6.2 SILO 3 MATERIAL QUANTITIES/CHARACTERISTICS

Silo 3 contains approximately 5,100 yd^3 of material that was generated at the FEMP during uranium extraction operations in the 1950s. Samples collected from Silo 3 indicate the presence of significant activity and concentrations of the radionuclides within the uranium decay series, confirming prior process knowledge. The predominant radionuclide of concern identified within Silo 3 is Th-230, a radionuclide produced from the natural decay of Uranium-238. Approximately 450 curies of Th-230 are distributed within the Silo 3 material. (Note: The 450 curies is a mean inventory value. The 95% upper confidence limit inventory value is approximately 530 curies. For most determinations, the upper confidence limit values are used for conservatism.)

The Silo 3 material is classified as 11(e)(2) by-product material under the Atomic Energy Act (AEA) of 1954, as amended, because the material resulted from the processing of uranium ore concentrate and is specifically exempt, as defined, from regulation as solid waste under RCRA, 40 CFR 261.4(a)(4), Identification and Listing of Hazardous Waste, Exclusions. Since Silo 3 material is not a solid waste, requirements under RCRA are not "applicable".

Based on data from the OU4 RI, Silo 3 material includes the following RCRA-regulated metals; arsenic, cadmium, chromium and selenium at levels that exceed the RCRA Toxicity Characteristic (TC) limits. Data from the OU4 RI also identifies that Silo 3 material contains other RCRA-regulated metals such as beryllium, nickel, and thallium. The levels of these other metals do not exceed the RCRA TC limit. Concentrations of beryllium are below the 0.1 percent level as defined in 10 CFR 850, Chronic Beryllium Disease Prevention Program. Although Silo 3 material is not regulated by RCRA, the Silo 3 material is considered sufficiently similar to hazardous waste under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidelines. Therefore, some RCRA requirements have been identified as "relevant and appropriate" for the management and remediation of the material.

The treatment process proposed by RMRS will provide a volume reduction of the waste in its final form, which supports waste minimization objectives.

6.3 NEVADA TEST SITE

This section provides information pertinent to disposal of treated Silo 3 material at the NTS. This section describes regulatory requirements, the NTS waste acceptance, and the receipt of waste at the NTS.

6.3.1 Regulatory Information

In agreement with the State of Nevada, the NTS is permitted to accept low-level radioactive waste and mixed waste from DOE affiliated on-site and off-site generators for storage or disposal at its Area 3 and Area 5 radioactive waste management sites. However, mixed waste will only be accepted from State of Nevada DOE affiliated generators. The DOE, Nevada Operations Office Waste Acceptance Criteria, Nevada Test Site Waste Acceptance Criteria (NTSWAC) establishes the requirements for disposition of waste at the NTS. Additionally, the NTS WAC, DOE/NV-325 Revision 2, requires that packaging and shipments to the NTS be performed in accordance with DOE Order 435.1, "Radioactive Waste Management", 40 CFR, and 49 CFR. As applicable, other federal, state, and local requirements, including generator site requirements, must be met.

The DOE derives authority from the AEA to manage small quantities of 11(e)(2) by-product material as "low-level waste" so that it may dispose of such small quantities at DOE low-level waste facilities (NTS). Such quantities must not be "too large for acceptance at DOE low-level waste disposal sites," and such wastes must meet the requirements for low-level waste in accordance with DOE Order 435.1, Chapter IV(B)(4).

The treated Silo 3 material is 11(e)(2) by-product material and may be managed as a low-level waste pursuant to DOE Order 435.1. As a low-level waste, it must meet the NTS WAC and, therefore, may not contain a RCRA-listed waste, or exhibit a RCRA characteristic, regardless of the exclusion defined for by-product material at 40 CFR Part 261.4(a)(4).

The CERCLA off-site rule (found in CERLCA Section 121(d)(3) and promulgated at 40 CFR Part 300.440, Procedures for Planning and Implementing Off-Site Response Actions) requires that waste from a remedial action that is shipped off-site for treatment and/or disposal be transferred only to those units at a facility that (1) are operating in compliance with RCRA and other applicable federal and state requirements, and (2) do not have any uncontrolled releases of hazardous waste or constituents. The rule applies to any remedial action involving the transfer of hazardous substances, pollutants, or contaminants as defined under CERCLA Sections 101(14) and (33) pursuant to any CERCLA authority, including cleanups at federal facilities [40 CFR Part 300.440(a)(1)].

In a letter dated July 7, 1998, the EPA Region 9 granted approval to the NTS to dispose of CERCLA waste from DOE facilities in waste management areas 3 and 5, in accordance with the Off-site Rule (40 CFR 300.440). As clarification, the EPA Region 9, in a letter dated December 4, 1998, stated that the CERCLA Off-site Rule approval for the NTS waste management areas 3 and 5, included management of small volumes of 11(e)(2) by-product materials from Fernald OU4 as low-level waste under the provisions of Chapters III and IV of DOE Order 435.1, or any subsequent applicable DOE directive.

6.3.2 NTS Waste Acceptance

DOE/Nevada Operations Office requires that prior to generator approval to ship waste to the NTS, they must develop a certification program to ensure waste is compliant with the requirements of the NTSWAC. The process used by DOE/Nevada Operations Office for approval of a generators certification program includes program reviews and evaluations of implementation at the generators' facility.

Once the generator has an approved program, a waste profile must be developed and submitted for each waste stream that is to be disposed at the NTS. These profiles provide NTS with an understanding of the characterization and quantities of the material. If the profiles as stated are approved, the generator is then notified in writing of the authorization and packaging and shipment may commence.

The generator's Waste Certification Official and his designees, in accordance with the Waste Certification Program Plan, will provide oversight of any packaging and shipping operations that are performed to ensure and document that requirements have been met for waste disposal at the NTS. If requirements are met then the waste packages, the documentation packages, and the transport vehicles are "certified" in accordance with the NTSWAC and Fluor Fernald requirements and released for transport to the NTS.

Nevada Test Site performed a Performance Assessment per DOE Order 435.1 on Area 5 which established volumetric radionuclide concentration limits. Informal review indicates Silo 3 material meets the radionuclide concentration limits and could be disposed in Area 5.

6.3.3 Receipt of Waste at the NTS

Once the waste generator has received approval to ship and has performed certification activities to release shipments for disposal, the generator must notify the Nevada Site Manager to arrange for transfer of the waste and accompanying records.

Prior to shipment, certain records must be sent electronically. Pre-notification information such as time of departure, estimated time of arrival; carrier, trailer and security seal numbers; description of load; waste type; and a copy of the Package Storage and Disposal Request.

Once the shipment arrives at the NTS, Mercury location the driver must provide a copy of the Nuclear Materials Transaction Report, completed proper shipping papers with shippers certification, original Package Storage Disposal Request, and an appropriate Waste Certification Statement signed by the Waste Certification Official or an alternate designee (Alternate Waste Certification Official). Once these documents are reviewed and accepted, the shipment may be unloaded at the disposal location.

Once unloaded, the containers are monitored for contamination and the bar code labels are read for accuracy. At this point, each container is verified to have a Package Certification Label attached indicating approval from the generator for disposal. Skids are off-loaded while drums are being monitored for leakage and/or contamination. Once out of the trailer the drums are un-banded from the skids, hoisted into place by lifting equipment and placed in the disposal cell by operations personnel ensuring that available space is utilized efficiently in order to meet performance assessment objectives for placement. Eventually the placement area is filled with drums and soil is placed over the containers, compacted and readied for another level of containers as feasible.

6.4 ENVIROCARE OF UTAH, INC.

As a result of an analysis of the commercial disposal options for 11(e)(2) wastes, the FEMP has identified Envirocare as the only source with license/permit limits that will allow for the disposal of treated Silo 3 material. Accordingly, it is the intention of the FEMP to dispose of the treated Silo 3 material at Envirocare using the competitively awarded U.S. Army Corps of Engineers, Kansas City District, contract.

6.4.1 Introduction

This section provides regulatory information pertaining to the disposal of treated Silo 3 material at Envirocare.

As stated before, Silo 3 material is not regulated under RCRA. However it is sufficiently similar to hazardous waste under CERCLA guidelines that some of the RCRA requirements have been identified as "relevant and appropriate" for the remediation and management of Silo 3 material.

To address these "relevant and appropriate" requirements, a treatment process is proposed by RMRS to chemically immobilize associated RCRA metals. In addition, sampling and analysis of the subject treated Silo 3 material will be performed to ensure waste being offered for disposal meets the Envirocare Of Utah, Inc. WAC. Therefore, only waste that meets the disposal facility's WAC will be accepted for transportation and disposal under this plan.

6.4.2 Regulatory Information

Envirocare is a permitted commercial disposal facility (PCDF) licensed to receive and dispose of Uranium and Thorium Mill Tailings By-product Material as defined by Section 11(e)(2) of the AEA of 1954, as amended. Disposal of this material shall comply with the regulations set forth in 10 CFR Chapter I, Nuclear Regulatory Commission, Parts 19; 20; 21; 40, including Appendix A; 51; 61.80; and 61.82 and is subject to the additional conditions specified or incorporated. The PCDF must also have approval under the CERCLA Off-Site Rule (40 CFR 300.440).

Accordingly, packaging and transportation of shipments to Envirocare Of Utah for disposal must be in compliance with DOE Order 435.1, "Radioactive Waste Management," 40 and 49 CFRs. As applicable, other federal, state, and local requirements including generator site requirements must be met.

6.4.3 Envirocare Of Utah, Inc. Acceptance

Prior to determining waste stream acceptability at Envirocare for disposal, the proposed waste stream must be completely and accurately characterized, including appropriate sampling and analysis. Once the waste is adequately characterized, a waste profile would be developed and submitted for each waste stream proposed for disposal. Information entered into these profiles provides the Envirocare with an understanding of the physical, chemical, and radiological properties of the waste material. Additionally, the history of the waste and the process by which the waste was generated would be fully documented in the profile.

Once the information is documented, the profile will be submitted to Envirocare for review and approval. The technical review will evaluate the waste stream based on its physical, chemical, and radiological properties. In addition, the waste stream will be evaluated upon existing or desired shipment packaging and mode of transportation. This portion of the review process is to help determine if the waste stream is acceptable and if any special handling is necessary to accept and dispose of the waste. Following this technical review process, a pre-shipment sample of the subject waste stream may be sent to the Envirocare site for analysis. The purpose of this sample would be to establish "bounding parameters" for incoming waste shipments prior to receiving the approval of a waste stream for disposal.
Incoming waste shipments may be sampled and analyzed at the Envirocare site according to an established Waste Characterization Plan to verify compliance with the approved profile, and for compliance with the disposal facility's WAC.

6.4.4 Receipt of Waste at Envirocare Of Utah, Inc.

Once the generator has received profile/waste stream approval, delivery must be scheduled. The first step would be contacting the Scheduling Department at the disposal site. A minimum of five working days written request must be provided prior to the arrival of each shipment. In addition to this advance notice, the generator must provide advance copies of the Uniform low-level Radioactive Waste Manifest (Nuclear Regulatory Commission [NRC] 540 and 541) and other shipping documents at least three days prior to the scheduled arrival date.

Waste containers received at Envirocare can be taken directly to the Disposal Cell, Container Transfer Area, Container Storage Area, or the Truck Unloading Facility for acceptance processing. Processing takes approximately four hours to be checked in; inspected; sampled; evaluated; and, if accepted, unloaded.

Typically, the acceptance process initiates at the Truck Unloading Facility. For the purposes of this document the described acceptance process will initiate at the Truck Unloading Facility. The acceptance process consists of the following steps:

- Unload the containers from the transport vehicle via fork truck
- Open each container to perform visual inspection compared against pre-shipment samples and description in the Waste Profile
- Perform sampling for "fingerprint" and independent analysis
- Acceptable fingerprint analysis results allow for unloading of waste
- Acceptable independent analysis confirms shipment compliance
- Once the material is deemed compliant/accepted, lids are replaced on the containers and the pallet of containers is transported for storage or disposal

- Within 48 hours of material being unloaded at the Truck Unloading Facility, the waste must be moved to either the Disposal Cell or the Container Storage Area
- Waste that does not meet the waste acceptance criteria will remain in the Truck Unloading Facility until the problem is resolved, or the waste will be returned to the generator
- Prior to release of the transport vehicle, Envirocare will perform radiological survey of the portion of the delivery truck used to transport the waste. If the truck meets Envirocare's release criteria, the truck will be released.
- Trucks that fail the initial release criteria survey will be decontaminated prior to release

7.0 REFERENCES

Code of Federal Regulations, 10 CFR 835, "Occupational Radiation Protection"

Code of Federal Regulations, 10 CFR 850, "Chronic Beryllium Disease Prevention Program"

Code of Federal Regulations, 10 CFR Chapter I, "Nuclear Regulatory Commission"

Code of Federal Regulations, 40 CFR 261.4, "Identification and Listing of Hazardous Waste, Exclusions"

Code of Federal Regulations, 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan"

Code of Federal Regulations, 40 CFR 300.440, "Procedures for Planning and Implementing Off-Site Response Actions"

Code of Federal Regulations, 41 CFR 101-40, "Transportation and Traffic Management"

Code of Federal Regulations, 49 CFR 106-199, "Hazardous Materials and Oil Transportation"

Code of Federal Regulations, 49 CFR 107.103, "Hazardous Materials Program Procedures"

Code of Federal Regulations, 49 CFR 172.604, "Emergency Response Telephone Number"

Code of Federal Regulations, 49 CFR 173.403, "Definition of LSA-I and LSA-II Material"

Code of Federal Regulations, 49 CFR 173.443, "Contamination Control"

Code of Federal Regulations, 49 CFR 174.450, "Incidents Involving Leakage"

Code of Federal Regulations, 49 CFR 350-399, "Commercial Motor Carrier Safety Assistance Program"

Code of Federal Regulations, 49 CFR 397, Subpart D, "Routing of Class 7 (Radioactive) Materials"

Fernald Environmental Management Project, 1994, "Remedial Investigation Report, Operable Unit 4," OU4RI-6-Final, November, 1994

Fluor Daniel Fernald, 1998, "Silo 3 Remedial Design Work Plan," 40400-WP-0001, Revision 0, April 1998

Fluor Daniel Fernald, 1999, "FEMP Emergency Plan," PL-3020, Revision 4, May 1999

Fluor Daniel Fernald, 1999, "FEMP Spill Prevention Control and Countermeasure Plan," PL-2194, Revision 3, September 1996

Fluor Daniel Fernald, 1999, "FEMP Transportation Emergency Plan," PL-3043, Revision 3, June 1999

Fluor Daniel Fernald, 1999, "Radiological Control Requirements Manual," RM-0020, Revision 9, August 1999

Fluor Daniel Fernald, 1999, "System Safety Requirements," RM-2116, Revision 5, July 1999

Fluor Fernald, 2000, "Safety Performance Requirements," RM-0021, Revision 24, February 2000

U.S. Department of Energy, 1992, "Hazard Categorization and Accident Analysis Techniques For Compliance With DOE Order 5480.23, Nuclear Safety Analysis Reports," DOE-STD-1027-92, December 1992

U.S. Department of Energy, 1994, "Nuclear Safety Analysis Reports," DOE-5480.23, March 1994

U.S. Department of Energy, 1995, "Departmental Materials Transportation and Packaging Management," DOE-460.2, October 1995

U.S. Department of Energy, 1996, "Packaging and Transportation Safety," DOE-460.1A, October 1996

U.S. Department of Energy, 1999, "Nevada Test Site Waste Acceptance Criteria," DOE/NV-325 Revision 2, May 1999

U.S. Department of Energy, 1999, "Radioactive Waste Management," DOE-435.1, July 1999