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REVISED FOCUSED FEASIBILITY STUDY/PROPOSED PLAN FOR OPERABLE UNIT 4 SILO 3 REMEDIAL ACTION

AT THE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

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Revision 0

Prepared Under DOE Contract No. DE-AC24-01OH20115
By Fluor Fernald, Inc.

FERNALD
Environmental Management Project

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ACRONYMS & ABBREVIATIONS

ACA	Amended Consent Agreement
AEA	Atomic Energy Act
ARAR	applicable or relevant and appropriate requirement
AWWT	Advanced Wastewater Treatment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
D&D	decontamination and demolition
DOE	U.S. Department of Energy
DOE-FEMP	U.S. Department of Energy-Fernald Environmental Management Project
DOE-NV	U.S. Department of Energy-Nevada
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
ESD	explanation of significant differences
FEMP	Fernald Environmental Management Project
FMPC	Feed Materials Production Center
FS	Feasibility Study
FS/PP	Feasibility Study/Proposed Plan
FS/PP-EIS	Feasibility Study/Proposed Plan – Environmental Impact Statement
ILCR	incremental lifetime cancer risk
IP-2	Industrial Package – type 2
IRT	Silos Project Independent Review Team
LSA	low specific activity
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for hazardous Air Pollutants
NORM	Naturally Occurring Radioactive Material
NPL	National Priorities List
NRC	United States Nuclear Regulatory Commission
NTS	Nevada Test Site
OEPA	Ohio Environmental Protection Agency
O&M	operations and maintenance
OSDF	On-site Disposal Facility
OU	operable unit
PA	Performance Assessment
Pb	lead
PCDF	Permitted Commercial Disposal Facility
PEIC	Public Environmental Information Center

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ACRONYMS & ABBREVIATIONS

PP	Proposed Plan
PRL	preliminary remediation levels
Ra	radium
RA	remedial action
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act, as amended
RD/RA	remedial design/remedial action
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
Rn	radon
ROD	Record of Decision
RTS	Radon Treatment System
TBC	to be considered
TC	toxicity characteristic
Th	thorium
U	uranium
WAC	waste acceptance criteria

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1.0 INTRODUCTION

The United States Department of Energy (DOE) is issuing this Revised Focused Feasibility Study/Proposed Plan for Operable Unit 4 Silo 3 Remedial Action [hereinafter called the Proposed Plan (PP)] as part of its public participation responsibilities under Section 117(a) of the *Comprehensive Environmental Response Compensation and Liability Act* (CERCLA 1980), as amended, and 40 Code of Federal Regulations (CFR) 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The intent of this PP is to inform and solicit views of the public on a recommended revised remedy for Silo 3 material. In addition to the information by the NCP and associated EPA guidance for inclusion in a PP, the appendices to this document include information regarding Applicable or Relevant and Appropriate requirements (ARARs), transportation risk, and estimated cost to support evaluation of the remedy recommended by the PP.

This PP addresses the proposed revision of the selected remedy for the remediation of Subunit B (Silo 3) of Operable Unit 4 (OU4) at the DOE Fernald Environmental Management Project (FEMP), formerly known as the Feed Materials Production Center (FMPC). The proposed revision to the current remedy consists of revision of the criteria for treatment of Silo 3 materials.

The purpose of the PP is to facilitate public participation in the remedy selection process by:

- Recommending revision of the remedy for the Silo 3 material, and presenting the rationale for DOE's preference.
- Providing necessary information to support evaluation of DOE's recommendation
- Soliciting public review and comment on the alternatives described in **Section 6.0** of this PP and the preferred alternative recommendation documented in **Section 8.0.**
- Providing information on how the public can be involved in the remedy selection process.

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The FEMP site is included on the National Priorities List (NPL) of the U. S. Environmental Protection Agency (EPA). Inclusion on the NPL reflects the relative importance placed by the federal government on ensuring the expedient completion of cleanup operations at the FEMP. DOE owns the facility and is conducting cleanup activities at the site under its Environmental Restoration and Waste Management Program with the support of the EPA and the Ohio Environmental Protection Agency (OEPA). Together, the three agencies actively promote local community and public involvement in the decision making process regarding the remediation of the FEMP site.

Consistent with the NCP, the Department of Energy-Fernald Environmental Management Project (DOE-FEMP) issued the *Final Record of Decision for Remedial Actions at Operable Unit 4* on December 7, 1994 (FEMP 1994) identifying the remedy for Operable Unit 4.

In response to schedule delays and need to reassess the technical path forward for remediation of OU4, the DOE requested an extension of certain Remedial Design/Remedial Action (RD/RA) milestones (FEMP 1996c). The U.S. EPA denied the request for extension and agreed to a period of informal dispute resolution to allow the DOE, in consultation with the U.S. EPA, OEPA, and stakeholders, to reevaluate the path forward for remediation of OU4 (FEMP 1996d).

This reevaluation supported DOE's decision, originally proposed in August 1996, to recommend that remediation of Silo 3 material be implemented separately from Silo 1 and 2 material and that an alternate remedy should be considered for treatment and disposal of Silo 3 material. In July 1997, the DOE and the EPA formally entered into an agreement resolving disputes concerning the schedule and the path forward for the remediation of the OU4 Silos 1, 2 and 3 materials. The EPA directed the DOE-FEMP to proceed with the development of a supplemental Feasibility Study/Proposed Plan (FS/PP) and subsequent Record of Decision (ROD) Amendment for the Silos 1 and 2 material and an Explanation of Significant Differences (ESD) for the Silo 3 material.

In accordance with the dispute resolution agreement with the EPA, the DOE-FEMP issued the *Explanation of Significant Differences for Operable Unit 4 Silo 3 Remedial Actions* (FEMP 1998b) identifying a revised remedy for Silo 3 material, and the *Record of Decision Amendment for Operable Unit 4 Silos 1 and 2 Remedial Actions* identifying a revised treatment remedy for Silos 1 and 2 material (FEMP 2000x).

This PP summarizes key information that can be found in greater detail in the original Remedial Investigation (RI) and FS Reports for OU4 (FEMP 1993a, 1994a), and the *Revised Feasibility Study Report for Silos 1 and 2* (FEMP 2000x). Information relevant to the previous remedy selection processes is in the Administrative Record. The Administrative Record is located at the Public Environmental Information Center (PEIC), and the EPA Region V office in Chicago, Illinois. The PEIC's address and business hours are as follows:

10995 Hamilton-Cleves Highway
Harrison, Ohio 45030
Monday, 7:30 a.m. to 8:00 p.m. (eastern time)
Tuesday – Thursday, 7:30 a.m. to 5:00 p.m. (eastern time)
Friday, 7:30 a.m. to 4:30 p.m. (eastern time)
Phone: (513) 648-7480

This PP will become part of the Administrative Record pursuant to 40 CFR Part 300.825(a)(2) and will be available at the PEIC and the EPA Region V office.

The identification of the preferred alternative in the PP is only an initial recommendation. Changes to the preferred alternative or selection of another alternative may result if public and agency comments or additional data indicate such a change would result in a more appropriate selection. Therefore, all interested individuals are encouraged to provide comments on the alternatives presented in this PP (refer to **Section 6.0**). The DOE and EPA will make the final decision regarding the selected remedy and will document it in a ROD Amendment after all comments from the public and the State of Ohio have been taken into

consideration. A summary of DOE's responses to these comments (called a Responsiveness Summary) will be included in the ROD Amendment document and included in the Administrative Record.

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2.0 SITE BACKGROUND

This section provides a brief summary of the history of the FEMP and description of OU4. A more detailed discussion can be found in Section 1, Section 2, and Appendix F of the revised FS for Silos 1 and 2.

The FEMP is a 425-hectare (1,050 acre) former uranium processing facility located in southwestern Ohio approximately 18 miles northwest of the city of Cincinnati (see **Figure 2.1-1**). It is located just north of Fernald, Ohio and lies on the boundary between Hamilton and Butler Counties.

The FEMP site was constructed from 1950 to 1951 under the authority of the Atomic Energy Commission, eventually known as the DOE. Between 1952 and 1989, the DOE-FEMP facility (then called the *FMPC*) produced high purity uranium metal products for the nation's defense programs. Production ceased in the summer of 1989 due to a declining demand for uranium feed product and plant activities turned their focus to environmental cleanup. In June 1991, the site was officially closed for production by an act of Congress. To reflect a new mission focused on environmental restoration, the name of the facility was changed to the FEMP in August 1991.

Production operations at the facility were limited to a fenced 55-hectare (136-acre) tract of land, now known as the former Production Area, located near the center of the FEMP site. Large quantities of liquid and solid materials were generated during production operations. Before 1984, solid and slurried materials from uranium processing were stored or disposed in the on-property Waste Storage Area. This area, located west of the former Production Area, includes six low-level radioactive waste storage pits; two earthen-bermed, concrete silos containing a total of 8,012 yd^3 of K-65 material and 878 yd^3 of BentoGrout™ clay (Silos 1 and 2); one concrete silo containing 5,088 yd^3 of cold metal oxides (Silo 3); one unused concrete silo (Silo 4); two lime sludge ponds; a burn pit; a clearwell; and a solid waste landfill (see **Figure 2.1-2**).

FIGURE 2.1-1
FEMP FACILITY LOCATION MAP

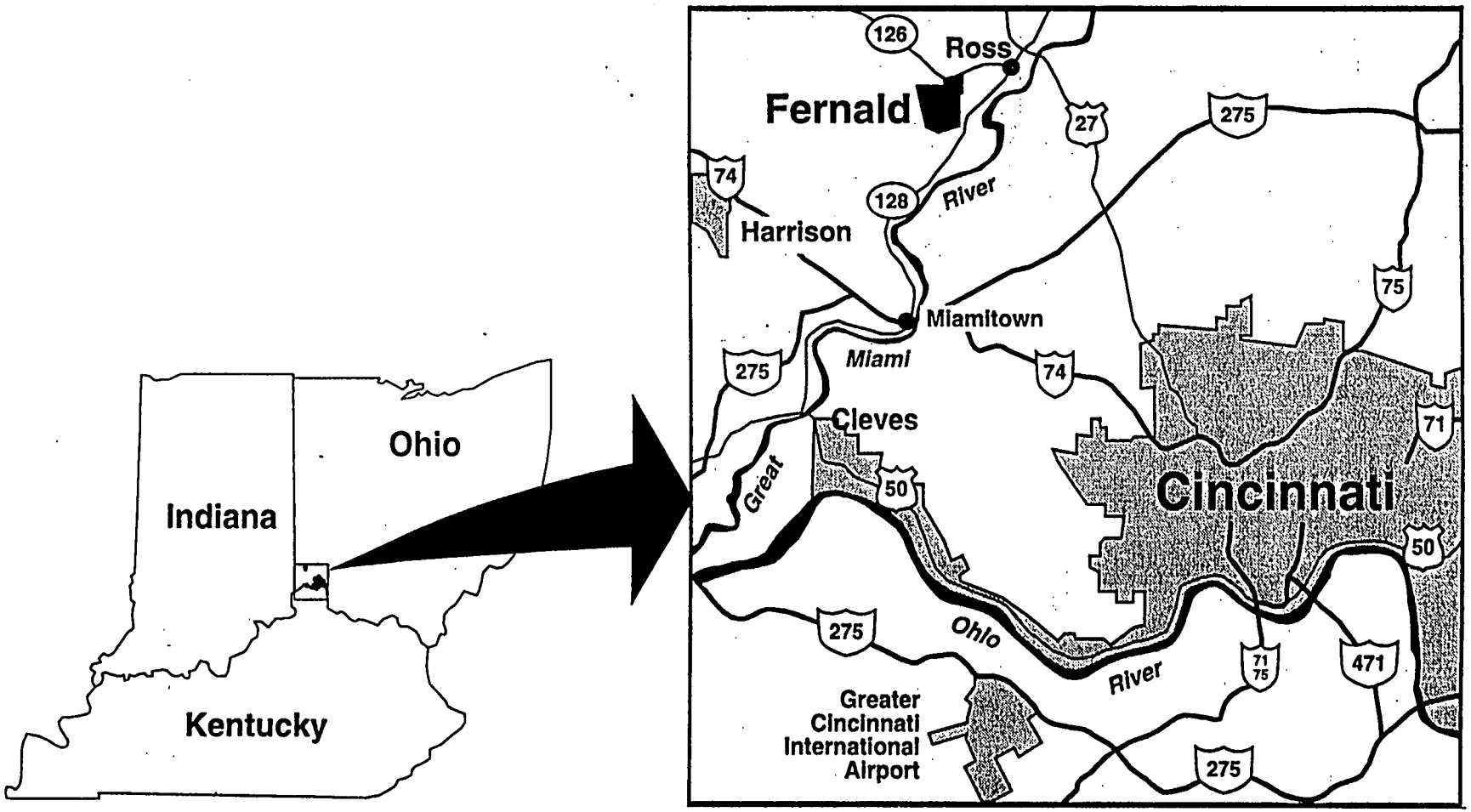

FIGURE 2.1-2
WASTE STORAGE AREA

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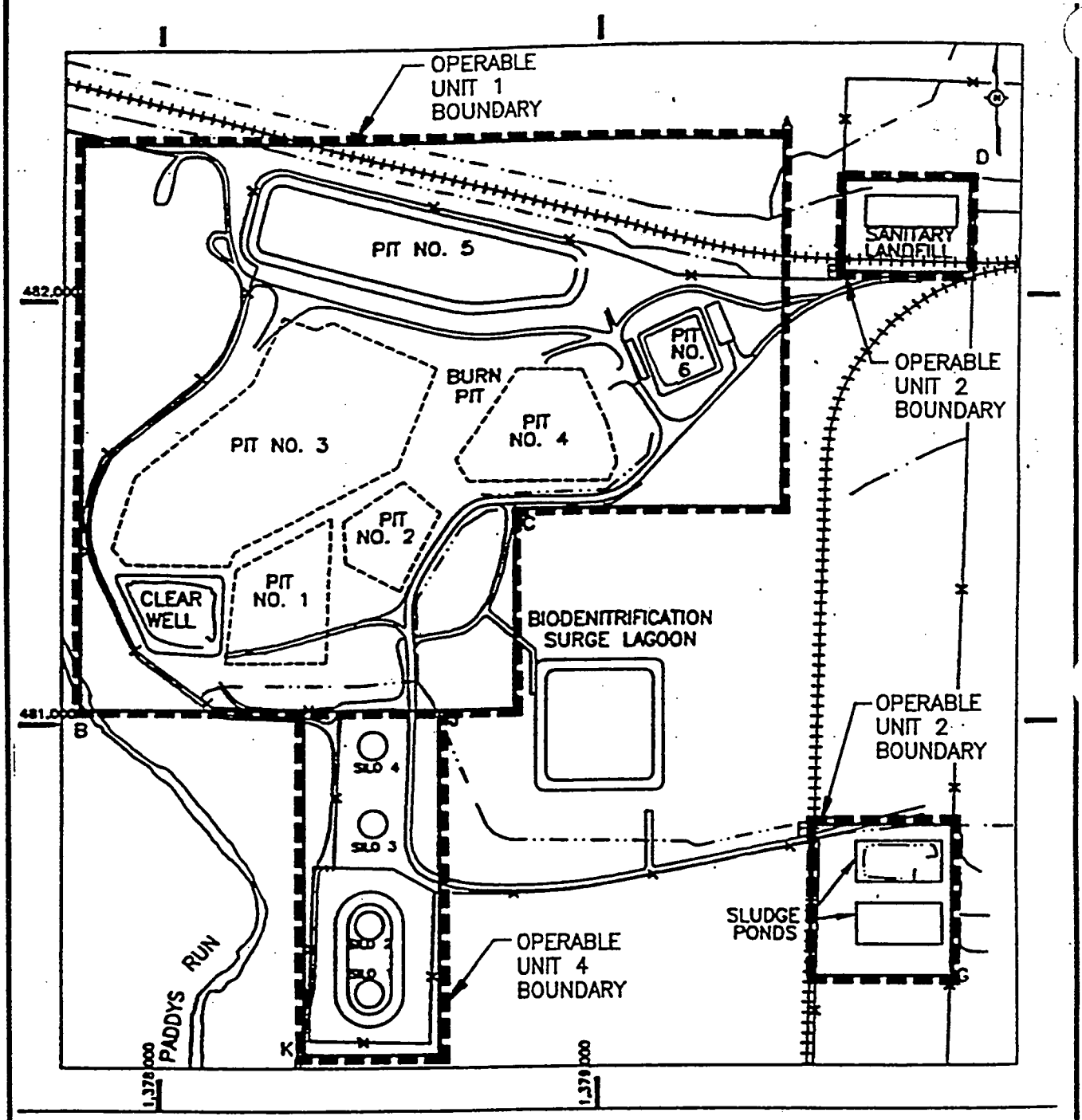

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To establish the legal framework by which to address the releases and threats of hazardous substances from containers and facilities at the FEMP, the DOE-FEMP, as the lead agency for the remediation of the FEMP site, and the EPA entered into a Consent Agreement in 1990, as amended in 1991. The Consent Agreement as Amended Under CERCLA Sections 120 and 106(a) (ACA) is the legal basis that administratively governs the proper management and restoration of the FEMP site.

To promote a more structured and expeditious cleanup, the facility and associated environmental issues of the FEMP site are being managed as five OUs. OU is a term employed under CERCLA to represent a logical grouping of environmental issues at a cleanup site. Separate RI/FS documentation was prepared and issued for each of the five OUs at the FEMP. The five OUs, for which RI/FS documents have been compiled, are defined within the ACA as:

- OU1: Waste Pits 1 through 6, the Clearwell, burn pit, berms, liners, and soil to a determined depth (estimated to be approximately 3 feet) beneath the waste pits.

- OU2: Other waste units including the flyash piles, other South Field disposal areas, lime sludge ponds, solid waste landfills, berms, liners, and soil within the OU boundary.

- OU3: Former production area and production-associated facilities and equipment (includes all above- and below-grade improvements) including, but not limited to: all structures, equipment, utilities, drums, tanks, solid waste, waste product, thorium (Th), effluent lines, a portion of the Silos 1 and 2 material transfer line, wastewater treatment facilities, fire training facilities, scrap metal piles, feedstocks, and the coal pile.

- OU4: Silos 1, 2, 3, and 4, their contents, berms, and Decant Sump Tank System; Radon Treatment System (RTS); a portion of concrete trench and Silos 1 and 2 material transfer line within the boundary of OU4; miscellaneous pads and concrete structures; soils beneath and immediately surrounding Silos 1 through 4; and, perched groundwater in the vicinity of the silos that may be encountered during the implementation of cleanup activities.

- OU5: Environmental media, including groundwater (both perched and the Great Miami Aquifer), surface water, soil not included in the definitions of OUs 1 through 4, sediment, flora, and fauna.

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All five OUs (including OU4) completed the RI/FS process and initiated conducting remedial actions in accordance with their respective EPA-approved final RODs. The original selected remedy for Silos 1 and 2 was reevaluated through a revised FS and revised as documented in a ROD Amendment. The original selected remedy for Silo 3 was revised through an ESD.

2.1 Regulatory Classification of Silo 3 Material

Silo 3 contains material, known as cold metal oxides, which was generated at the FEMP site during uranium extraction operations in the 1950s. These oxides were formed by calcining residues from the solvent extraction process used to extract uranium from ore concentrates and residues. On an activity basis, the predominant radiological constituent of the Silo 3 material is Thorium-230 (Th-230).

Applicable or Relevant and Appropriate Requirements (ARARs) for remediation of Silo 3 material are documented in **Appendix A** of this PP.

The material contained in Silo 3 is material generated from the beneficiation of natural uranium ores and has been classified as by-product material, as defined in Section 11(e)(2) of the Atomic Energy Act (AEA), as amended. It is specifically exempt, as defined, from regulation as solid waste under the Resource Conservation and Recovery Act, as amended (RCRA) 40 CFR Part 261.4(a)(4). The referenced exclusion applies to "... source, special nuclear or by-product material as defined in the Atomic Energy Act of 1954 as amended, 42 U.S.C. 2011 *et seq.*" Since a material must first be a solid waste in order to be a hazardous waste, and since the Silo 3 material is excluded from regulation as solid waste, the Silo 3 material cannot be regulated as hazardous waste under RCRA.

In addition to the exclusion from regulation under RCRA due to 11(e)(2) by-product classification, 40 CFR 261.4(b)(7) provides an exclusion from regulation as hazardous waste for solid waste from the beneficiation of ores, including beneficiation of uranium ore by chemical extraction.

The material in Silo 3 consists solely of by-products from the beneficiation (chemical extraction) of uranium from ores. Neither solid nor hazardous wastes nor hazardous constituents (metals) were added to the silo nor mixed with the Silo 3 residues. The metals found in the material were present in the natural ore and were unintentionally extracted from the parent ore along with the uranium, during the process of beneficiation, becoming more concentrated in the residue after the uranium was removed. The presence of natural metals is expected in by-product material and invalidates neither the definition nor the exclusion. Also, no hazardous waste or waste constituents were created at any time during the beneficiation process. Although some RI/FS data identified leachability of metals (cadmium, arsenic, chromium, and selenium) in the Silo 3 material which exceeds the RCRA toxicity characteristic level, this does not cause the material to become subject to RCRA regulation, due to a hazardous waste characteristic, because the metals are not from an external source; they are associated with the parent material [whose residues, including any ancillary metals, are excluded from the definition of solid waste pursuant to 40 CFR 261.4(a)(4)].

2.1.1 Packaging and Transportation

For purposes of proper transportation, the material is governed by the U.S. Department of Transportation (DOT) regulations under 49 CFR Subtitle B Chapter I Subchapter C, *Hazardous Materials Regulations*. Federal regulations promulgated by the DOT on September 28, 1995 (60 Federal Register 50292) categorize low specific activity (LSA) material into three classifications: LSA-I, LSA-II, and LSA-III. Evaluation of the radionuclide content for the Silo 3 material indicates that this material meets one of the criteria for LSA-II material. Specifically, Silo 3 material is classified as LSA-II material because the "Class 7 (radioactive) material is essentially uniformly distributed and the average specific activity does not exceed $10^{-4}A_2/g$ for solids" (49 CFR Part 173.403). Therefore, the Silo 3 material is classified as LSA-II material for proper transportation (See **Appendix B**).

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2.1.2 Disposal

The Nevada Test Site (NTS) is a DOE-owned and managed facility utilized for disposal of low-level radioactive wastes and certain other wastes from other DOE sites. Historically, the NTS Waste Acceptance Criteria (NTSWAC) has required that waste accepted for disposal not contain a listed hazardous waste, nor "exhibit characteristics of" a hazardous waste, regardless of the exclusion defined for by-product material at 40 CFR261.4(a)(4). The current NTSWAC (DOE 2002a) has revised this criterion to state that "waste regulated under Title 40 CFR 261—268 and State of Nevada hazardous waste regulations shall not be accepted for disposal." The DOE Nevada Operations Office (DOE-NV) has confirmed that untreated Silo 3 material may be accepted for disposal at the NTS as 11(e)(2) by-product material following completion of the NTS waste approval process (DOE 2002b).

The United States Nuclear Regulatory Commission (NRC), as well as certain state agencies given the authority by the NRC, has the authority to permit commercial disposal facilities to dispose of radioactive materials, including low-level radioactive waste, naturally occurring radioactive material (NORM), and 11(e)(2) by-product material. Waste acceptance criteria, license limits, and other requirements are established to regulate disposal of specified categories of radioactive materials. In permitting the disposal of radioactive materials at a permitted commercial disposal facility (PCDF), the regulatory agency with authority over the facility determines and ensures that disposal of the specified material performed in accordance with the criteria, is protective of human health and the environment.

2.2 Remediation Under CERCLA

The FEMP site was placed on the NPL pursuant to the NCP in 1989. Therefore, contamination at the FEMP site is undergoing remediation pursuant to CERCLA. The material in Silo 3 is considered "pollutants or contaminants," as that term is defined under CERCLA and the NCP. The term includes but is not limited to:

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> "any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring .... For purposes of the NCP, the term pollutant or contaminant means any pollutant or contaminant that may present an imminent and substantial danger to public health or welfare."

CERCLA provides guidance on the specific cleanup standards that should be applied to a remedial action, or to the criteria for choosing among remedial alternatives when implementing regulations for CERCLA under 40 CFR Part 300 (which is the NCP). The EPA has established nine evaluation criteria for choosing among remedial actions in Subpart E - *Hazardous Substance Response*, 40 CFR Part 300.430(e)(9).

The NCP under 40 CFR Part 300.430(f)(1)(ii)(D) requires that "each remedial action shall be cost effective, provided that it first satisfies the threshold criteria." The NCP defines cost effective as a remedy with costs proportional to the overall effectiveness of the remedy. The NCP also specifies that in comparing cost-effective alternatives, preference shall be given to alternatives that provide treatment as a principle element and bias against off-site land disposal of untreated waste. The selected alternative shall provide long-term protectiveness of human health and the environment, meet all ARARs that are identified in the ROD, and provide the best balance of trade-offs among alternatives in terms of the five balancing criteria.

2.2.1 Purpose and Need for Decision

Facilities and environmental media at the FEMP site, including OU4, contain radioactive and chemical constituents at levels that exceed certain federal and state standards and guidelines for protecting human health and the environment. Currently, DOE-FEMP maintains custody of the property and restricts access with fences and security forces, precluding a member of the public from being exposed to site areas that have

contamination. A formalized risk assessment process was established by the EPA to determine the necessity for implementation of cleanup actions. Under this process, several hypothetical scenarios that could expose members of the public to site contamination were examined. One of these scenarios assumed that site access was not controlled (i.e., unrestricted) and a member of the public could be exposed to the higher contamination areas. Results of the risk assessment performed for this hypothetical, unrestricted access scenario indicated that an individual establishing residence within the highly contaminated portions of the OU4 area, under existing conditions, would be subjected to an increased risk of incurring an adverse health effect. Risk assessment calculations performed for OU4 indicate the projected level of increased risk exceeds established federal regulatory guidelines. Based on the results of the baseline risk assessment, the DOE-FEMP concluded in the *Remedial Investigation Report for Operable Unit 4* (FEMP 1993a) that existing site conditions warrant remedial action. A summary of the original assessment results can be found in Appendix F of the revised FS.

2.2.2 Original OU4 Record of Decision

The decision documented by the original OU4 ROD (EPA 1994) was based on the information available in the Administrative Record for OU4 and maintained in accordance with CERCLA and the NCP. The major documents prepared through the CERLCA process include the RI, the FS, and the PP for OU4.

The national Environmental Policy Act of 1969 (NEPA) requires the evaluation of potential environmental impacts associated with proposed actions at federal facilities. It is DOE policy to integrate NEPA requirements into the procedural and documentation requirements of CERCLA, wherever practicable. This policy is embodied within DOE Order 5400.4 defining the roles and responsibilities of the DOE regarding compliance with CERCLA and the integration of the remedial process with NEPA. The original OU4 ROD and the supporting CERCLA documentation [e.g., FS and PP (FEMP 1994 a,b)] prepared for remediation of the FEMP site (including OU4) also includes the NEPA evaluations. These

integrated CERCLA/NEPA evaluations considered the potential impacts from remediation activities at the FEMP. The *OU4 FS/PP-Environmental Impact Statement (FS/PP-EIS)* (FEMP 1993b) was the lead CERCLA/NEPA document for remediation of the FEMP. It was intended that the original OU4 ROD serve as DOE-FEMP's ROD for OU4 under both CERCLA and NEPA; however, it was not the intent of the DOE-FEMP to make a statement on the legal applicability of NEPA to CERCLA actions.

The original remedy was selected (after the original FS/PP-Draft EIS was issued) with consideration of input received from public hearings held on March 21, 1994, in Harrison, Ohio and on May 11, 1994, in Las Vegas, Nevada. In preparation of the original OU4 ROD, DOE-FEMP considered the comments received both during the public comment period for the original FS/PP-Draft EIS and following issuance of the final EIS. The original OU4 ROD was approved by the EPA in December 1994.

On the basis of the evaluation of remedial alternatives conducted in the original FS/PP, the major components of the selected remedy documented in the original OU4 ROD (EPA 1994) are as follows:

- Removal of the contents of Silos 1, 2, 3 and the decant sump tank sludge.
- Treatment of the Silos 1, 2, and 3 material and sludges removed from the silos and the decant sump tank by vitrification to meet disposal facility WAC.
- Off-site shipment of the vitrified contents of Silos 1, 2, 3 and the decant sump tank for disposal at the NTS.
- Demolition of Silos 1, 2, 3 and 4 and decontamination, to the extent practicable, of the concrete rubble, piping, and other generated construction debris.
- Removal of the earthen berms and excavation of the contaminated soils within the boundary of OU4, to achieve remediation levels. Placement of clean backfill to original grade following excavation.
- Demolition of the remediation and support facilities after use. Decontamination or recycling of debris before disposition.

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- On-property interim storage of excavated contaminated soils and contaminated debris in a manner consistent with the approved *Work Plan for FEMP Removal Action No. 17 - Improved Storage of Soil and Debris* (DOE 1996)[1], pending final disposition of soil and debris in accordance with the RODs of OUs 5 and 3, respectively.

- Continued access controls and maintenance and monitoring of the stored waste inventories.

- Institutional controls of the OU4 area such as deed and land-use restrictions.

- Potential, additional treatment of stored OU4 soil and debris using OU5 and OU3 waste treatment systems.

- Pumping and treating, as required, of any contaminated perched groundwater encountered during remedial activities.

- Disposal of the OU4 FEMP contaminated debris and soils consistent with the RODs for OUs 3 and 5, respectively.

Although the selected remedy documented in the original OU4 ROD specifies on-site disposal for the OU4 soil and certain debris, the final decision regarding the final disposition of the OU4 debris and soils was placed in abeyance, until the OU3 and OU5 RODs were completed. This approach allowed DOE to take full advantage of planned waste management and treatment strategies by these OUs and enabled the integration of disposal decisions for contaminated soils and debris on a site-wide basis.

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[1] This component of the selected remedy was documented in the original Operable Unit 4 Record of Decision in 1994. However, for purposes of this revised Proposed Plan, the reference has been updated to the most recent revision.

2.2.3 Current Selected Remedy

During the treatability testing of the original treatment remedy, many technical and operational difficulties were encountered which resulted in documented schedule delays and cost increases. The DOE-FEMP recognized that the technical path forward for remediation of the Silos 1, 2, and 3 materials needed to be reassessed in order to address the issues experienced. In September 1996, DOE formally requested extension of enforceable milestones associated with implementing the OU4 remedy.

In October 1996, the EPA denied DOE's request for extension of the milestones. EPA and DOE then initiated informal dispute resolution and began reevaluation of the technical path forward for the remediation of the silo material. This reevaluation, with input from independent technical reviewers [Silos Project Independent Review Team (IRT) 1997], the public and other FEMP stakeholders, resulted in a decision that vitrification of the Silo 3 material, although possible, would not be practical because of its significant cost and extension to the cleanup schedule. Also, the concentrations of hazardous and radiological constituents in Silo 3 material are low compared to the levels present in the Silos 1 and 2 material; this was an additional key factor for deciding to treat the Silo 3 material separately from the Silos 1 and 2 material.

In addition, the evaluations concluded that separating the Silos 1 and 2 material from Silo 3 material would significantly reduce the technical uncertainties and programmatic risks of developing an effective treatment process for the separate waste streams. Together, DOE-FEMP and stakeholders decided that an alternate remedy should be considered for treatment and disposal of the Silo 3 material. On July 22, 1997, the DOE-FEMP and the EPA formally entered into the "Agreement Resolving Dispute Concerning Denial of Request for Extension of Time for Certain OU4 Milestones," (EPA 1997), resolving disputes concerning the schedule for the remediation of the Silos 1, 2, and 3 materials. In the Settlement, the EPA directed DOE-FEMP to proceed with the

development of a revised FS, PP, and ROD Amendment to reevaluate the treatment remedy for Silos 1 and 2 material, and an ESD documenting the change in remedy for Silo 3 material.

An ESD was completed by DOE-FEMP and approved by the EPA in March 1998 to document the change in remedy for treatment of the Silo 3 material to:

- Treatment, using either Chemical Stabilization/Solidification or a Polymer-Based Encapsulation process, to stabilize characteristic metals to meet RCRA TCLP limits and attain disposal facility WAC; and

- Off-site disposal at either the NTS or an appropriate PCDF.

The ESD specified that the treatment portion of the alternate remedy could be accomplished through either on-site treatment at the FEMP to meet disposal facility WAC, or off-site treatment. The ESD specifies that shipment of untreated Silo 3 material to an off-site facility for treatment must be preceded by on-site pretreatment if required to reduce dispersability and, in combination with packaging in accordance with DOT regulations, result in a risk to the public during routine transportation less than $1x10^{-6}$.

2.2.4 Need and Basis for Modifying the Record of Decision

The NCP specifies that remedies be identified by selecting the alternative that meets the threshold criteria of overall protection of human health and the environment and compliance with ARARs, and offers the "best balance of trade-offs" in the five primary balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost), with emphasis on long-term effectiveness and reduction in toxicity, mobility, or volume through treatment. The current treatment remedy for Silo 3 was selected due to a determination that the revised treatment remedies (chemical stabilization or polymer encapsulation) had advantages in short-term effectiveness and implementability which outweighed the advantages of vitrification in reduction of toxicity, mobility, or volume through treatment.

In addition, the NCP specifies that a selected remedy be cost effective (40 CFR 300.430(f)(ii)(D). Cost effectiveness is to be evaluated by first determining the "overall effectiveness" of the remedy, through a combination of long-term effectiveness and permanence, short-term effectiveness, and reduction in toxicity, mobility, or volume through treatment. The overall effectiveness is then compared with the cost to ensure that "the cost is proportional to the overall effectiveness." Consistent with the statutory requirement that a remedy be cost-effective, the reevaluation of the Silo 3 remedy documented in this PP is intended to evaluate the necessary degree of treatment for characteristic metals required, in combination with the disposal location and configuration, to provide long-term effectiveness and protectiveness.

As documented in the original FS, the revised FS and the Silo 3 ESD, a significant criterion in selecting both current treatment remedies are significant implementability and short-term effectiveness issues resulting from the unique physical, chemical and radiological characteristics of the material. The radiological properties of Silo 3 material (Th-230 content) result in radiological exposure impacts to on-site workers involved in handling, treating, and sampling the material. These same radiological characteristics result in short-term environmental impacts due to air emissions and secondary waste generated by treatment of the material. Similarly, the original FS, revised FS and the Silo 3 ESD document the operational complexity and implementability impacts of treating the Silo 3 material due to its physical characteristics. These implementability issues increase the risk of successfully completing remediation in a timely manner. Incremental increases in the level of treatment prior to disposal result in incremental negative impacts in short-term effectiveness, implementability, and cost.

At the time that the existing treatment remedy for Silo 3 was finalized, the NTS was the only potentially viable alternative for disposing of the material. No commercial facility existed at that time with license limits allowing disposal of Silo 3 material. As discussed in **Section 2.1.2**, at the time the Silo 3 ESD was finalized, the NTSWAC prohibited disposal of material, regardless of regulatory classification, with levels of metals above

RCRA Toxicity Characteristic (TC) limits. Accordingly, the RCRA TC limits were adopted as an appropriate performance standard for treatment due to the fact that the only potentially viable disposal alternative incorporated the TC limits as part of their WAC, not due to an ARAR determination nor a quantitative determination that treatment to stabilize heavy metals was required to achieve protectiveness.

Since the time the ESD was approved, viable commercial disposal options have been identified for the disposal of Silo 3 material without treatment to stabilize characteristic metals. In addition, the NTS WAC has been revised such that, contingent upon completion of the NTS waste approval process, untreated Silo 3 material can be accepted for disposal at the NTS as 11(e)(2) by-product material (DOE 2002b).

In this PP, DOE proposes to revise the criteria for treatment of Silo 3 material prior to offsite disposal, such that treatment to stabilize characteristic metals is only required if necessary to achieve the WAC of the selected disposal facility. As detailed in Sections 7 and 8 of this PP, the basis for DOE's proposed revision to the criteria for treatment of Silo 3 material is DOE's conclusion that:

- The current criteria requiring treatment to meet TC limits were adopted due to the fact that the only potentially viable disposal alternative incorporated the TC limits as part of their WAC, not due to an ARAR determination nor a quantitative determination that treatment to stabilize heavy metals was required to achieve protectiveness.

- Since the time the ESD was approved, viable commercial disposal options have been identified for the disposal of Silo 3 material without treatment to stabilize characteristic metals.

- Treatment to stabilize characteristic metals is not required to attain the Remedial Action Objectives (RAOs) for OU4 remediation and is not required in order to attain the threshold criteria of overall protection of human health and the environment or compliance with ARARs.

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- Treatment above the level, if any, that is required to achieve WAC which have been demonstrated to be protective, results in negative impacts on the balancing criterion of short-term effectiveness (increased worker exposure, worker risk, increased on-site environmental impact, longer time to complete remediation), implementability (increased complexity, increased risk of successful & timely completion), and cost that outweighs the nominal advantage in the balancing criterion of reduction in toxicity, mobility or volume through treatment

- The proposed revised treatment criteria maximize the implementability and likelihood of achieving the timely completion of remedial actions in accordance with all of the current ARARs and Remedial Action Objectives; and will assure that the remedy is cost effective, as defined by the NCP (40 CFR 300.430(f)(ii)(D), such that the cost, short-term risk, and short-term environmental impacts of the remedy are proportional to its overall effectiveness.

<END OF SECTION>

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3.0 SITE CHARACTERISTICS

This section summarizes available characterization data obtained during the original RI (FEMP 1993a) on the nature of the radiological and chemical constituents of the material presently stored within Silo 3. More detailed discussions on the nature of these stored materials can be found in Chapter 4.0 of the RI .

3.1 Contents of Silo 3

Silo 3 contains approximately 5088 yd^3 of material, known as cold metal oxides, that was generated at the FEMP site during uranium extraction operations in the 1950s. These oxides were formed by calcining residues from the solvent extraction process used to extract uranium from ore concentrates and residues. The material in Silo 3 is substantially different from that in Silos 1 and 2. The K-65 material is silty and clay-like, whereas Silo 3 material is dry and powdery. Second, while the radiological constituents in Silo 3 material are similar to those found in the Silo 1 and 2 material, certain radionuclides, such as radium, are present in much lower concentrations in the Silo 3 material. On an activity basis, the predominant radiological constituent of the Silo 3 material is Th-230. Due to the lower radium content, Silo 3 exhibits a much lower direct radiation field and has substantially lower Rn-222 emanations than Silos 1 and 2. Some of the RI data identified leachability of cadmium, arsenic, chromium, and selenium in the Silo 3 material that exceeds the RCRA TC limits.

3.2 Contaminated Environmental Media

In addition to the waste areas described, contamination is present in environmental media within the OU4 area, such as surface and subsurface soil, soils within the earthen berm surrounding Silos 1 and 2, groundwater, surface water, and perched water. This material will be remediated in accordance with the OU5 ROD.

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Principal Threats

The NCP describes principal threats as those involving liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials. Consistent with the NCP, the original OU4 RI provided a detailed characterization of the source term within OU4 and identified those contaminants that contributed to an incremental lifetime cancer risk (ILCR) value greater than the CERCLA criterion of 1×10^{-6} and a hazard quotient greater than the CERCLA criterion of 1.0. The original OU4 RI identified that the principal threats to human health and the environment posed by the material in Operable Unit 4 are from the following contaminant/transport pathways:

- Direct radiation
  - Direct exposure to gamma radiation from radioactive constituents within the silos.
  - Direct exposure to gamma radiation from radioactive constituents in surface soil.
- Air emissions
  - Dispersion of radon that escapes from the silos into the atmosphere.
  - Dispersion of Silo 3 material in the event of structural collapse of the Silo.
  - Dispersion of volatile organic compounds or fugitive dust generated from soil.
- Surface water runoff
  - Erosion of contaminated soils into Paddys Run from the vicinity of the silos.
- Groundwater transport
  - Leaching of contaminants from the silos contents via soils to underlying groundwater.
  - Leaching of contaminants from the silo contents via soil to a sand silty/clay lens in the glacial till, which could carry contaminants to surface water and sediment in Paddys Run.

Potential remedial alternatives for OU4 were developed in order to: mitigate the short-term and long-term exposure and associated risks from gamma radiation; reduce radon emanation rates from the Silos 1 and 2 material; minimize the leachability of contaminants from the waste material; eliminate potential of air dispersion from a silo collapse; eliminate the dispersion of fugitive dust generated from the soil; and, eliminate contaminated surface water runoff from contaminated soils into Paddys Run.

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3.3 Overview of the Nature and Extent of Contamination

This section summarizes the nature and extent of contamination within environmental media in the OU4 study area. Also included in this section is an overview of the levels of direct radiation associated with the current conditions within OU4. Additional detail on these conditions is provided in Section 4.0 of the original OU4 RI.

Surface Soils

Sampling performed, as part of the RI/FS and other site programs, in the vicinity of OU4 indicates the occurrence of above-background concentrations of uranium, and to a lesser degree other radionuclides, in the surface soils within and adjacent to the OU4 study area. These above-background concentrations appear to be generally limited to the upper six inches of soil. Available survey data and process knowledge do not indicate a direct relationship between the surface soil contamination in the OU4 study area and the silo contents.

Soil samples were also collected from the soils contained in the earthen embankment (berm) surrounding Silos 1 and 2. The analytical data from the berm fill show only slightly elevated radionuclide activity concentrations.

Subsurface Soils

As part of the original OU4 RI, samples were collected from the subsurface soils located under and adjacent to Silos 1 and 2. Analytical results revealed elevated concentrations of radionuclides from the uranium decay series in the soils at the interface between the berm and the original ground level. Elevated concentrations [up to 53 pCi/g for uranuim-238 (U-238), about 40 times background] were also noted in slant boreholes, which passed in close proximity to the silo underdrains.

Groundwater

With the exception of perched groundwater encountered during potential remedial action, groundwater within the Great Miami Aquifer underlying the silo area is not within the scope of OU4. Groundwater in the Great Miami Aquifer underlying the entire FEMP site is being addressed as part of OU5.

Uranium was the major radionuclide contaminant found in the perched water. Elevated concentrations of total uranium were detected in the slant boreholes under and around Silos 1 and 2.

Great Miami Aquifer

The concentration of total uranium in the upper portion of the Great Miami Aquifer, based on analysis of samples from the 2000-series wells, ranged from less than 1 µg/L to 40.3 µg/L. Both upgradient and downgradient wells contain above-background concentrations of total uranium. Therefore, other sources of contamination must exist besides Silos 1 and 2.

3.4 Overview of the Baseline Risk Assessment

Baseline Risk Assessments were performed in 1994 to determine the potential human health effects and ecological risks that could result from exposure to the contaminants present in OU4.

The baseline assessment of human health risks quantified the health risks to hypothetical human receptors due to exposure from radioactive and chemical sources in OU4, under the no-action alternative. The process analyzed the potential, human health consequences under different scenarios if no remedial actions were taken to address identified environmental concerns.

The major constituents of concern (COCs) related to the Silo 3 material are heavy metals such as arsenic, cadmium, chromium, and lead, and radionuclides in the U-238, U-235, and Th-232 decay chains such as, Radium-226 (Ra-226), Th-230, and lead-210 (Pb-210). [Appendix E of the *RI Report for OU4* (FEMP 1993a) provides full details of the process for selecting COCs.] COCs were detected in Silos 1 and 2, and 3, the surrounding surface soil and subsurface soil, and the silo berm soils. Baseline Risk Assessment source term concentrations were determined for the COCs in these media. Fate and transport modeling were then conducted to estimate the exposure point concentrations of contaminants in environmental media (e.g., groundwater, air, and surface water). On the basis of the results of the baseline risk assessment, the DOE-FEMP concluded in the OU4 RI that existing site conditions warrant remedial action.

Appendix D and Section 6.0 of the OU4 RI provide detailed information on the baseline assessment of human health risks.

3.5 Overview of the Baseline Ecological Risk Assessment

A Sitewide Baseline Ecological Risk Assessment was completed and included in the *Site-wide Characterization Report* (FEMP 1993c). Its purpose was to estimate the potential and future risks of FEMP contaminants to ecological receptors if no remediation was implemented. The following is a summary of the Baseline Ecological Risk Assessment found in the Sitewide Characterization Report.

The EPA and DOE agreed in the September 1991 ACA that the Site-wide Ecological Risk Assessment would be performed as part of the *Remedial Investigation Report for Operable Unit 5* (FEMP 1994c). The Site-wide Ecological Risk Assessment in the RI for OU5 quantifies and assesses the possible risks from current concentrations of site contaminants to ecological receptors inhabiting on-property and off-site areas not presently targeted for remediation based on human-health concerns.

Although radionuclides are the most ubiquitous contaminants at the FEMP, estimated ecological risks to both terrestrial and aquatic organisms are primarily associated with nonradioactive inorganic chemicals. Although estimated risks are substantial in some instances, they are based on soil inorganic chemical concentrations comparable to background levels; and, deleterious effects have not been observed in the field. This suggests that FEMP site-specific ecological risks are low. However, remedial actions are appropriate to address contaminants that have potential to cause harm in the future.

More discussion on the Risk Assessment and Ecological Risk issues specific to OU4 can be found in Appendix F of the revised FS for Silos 1 and 2 and in the original *Proposed Plan for Remedial Actions at Operable Unit 4* (FEMP 1994b).

<END OF SECTION>

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4.0 SCOPE AND ROLE

4.1 Scope of OU4

OU4, commonly referred to as the "Silos Project," consists of four concrete silos, three of which contain waste classified as 11(e)(2) by-product material. OU4, as depicted in **Figure 4.1-1**, consists of the following FEMP facilities and associated environmental media:

- Silos 1 and 2 and their contents (also termed *K-65 Silos*).
- Silo 3 and its contents (also termed *cold metal oxide silo*).
- Silo 4 (empty).
- Silos 1 and 2 decant sump tank, its contents, and associated silo underdrain system.
- The Radon Treatment System (RTS) [removed during 2001].
- The portion of a concrete pipe trench within the boundaries of OU4 [removed during 2002], and other concrete structures.
- An earthen berm surrounding Silos 1 and 2.
- Soils beneath and immediately adjacent to Silos 1, 2, 3 and 4.
- Perched groundwater in the vicinity of the silos that may be encountered during the implementation of cleanup activities.

The goal of the OU4 remedial action is to safely remediate the OU4 components in a timely, efficient, and cost-effective manner, that ensures compliance with all ARARs and is protective of human health and the environment. After the OU4 remedial actions are complete, the former waste storage area will be restored to a natural habitat in accordance with the *Natural Resource Restoration Plan, Draft* (FEMP 1998a). The complete remediation of the OU4 area will eliminate the FEMP's most significant inventory of contaminated (activity) material and chronic source term of radon emissions at the FEMP site.

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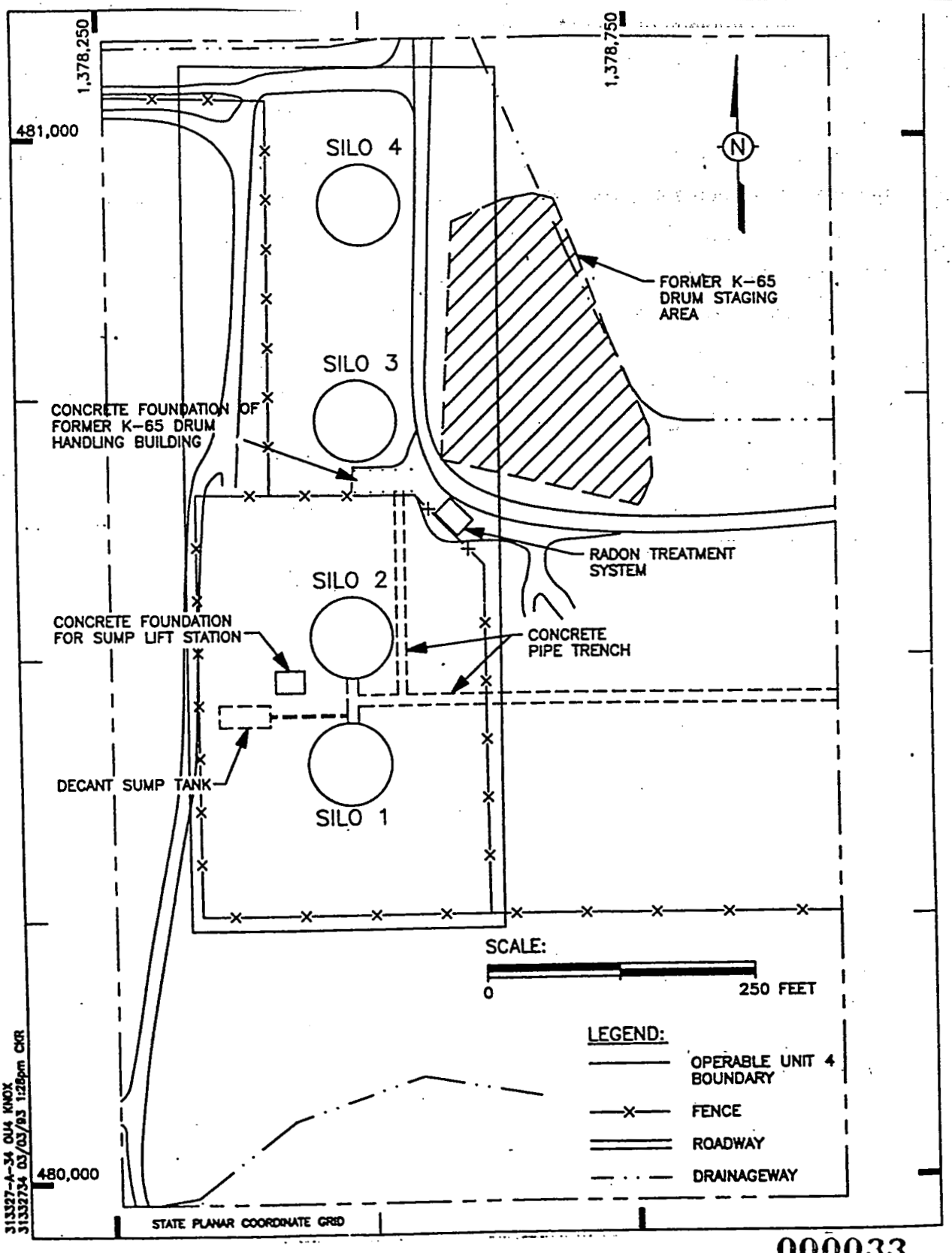
FIGURE 4.1-1
OPERABLE UNIT 4



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This PP recommends revision of the criteria for treatment of Silo 3 material prior to protective off-site disposal. Because the proposed revised remedy still specifies off-site disposal as part of the remedy for Silo 3 material, the FEMP on-site residual risk from Silo 3 material is virtually nonexistent.

Integration with OU3

The decontamination and demolition (D&D) of the OU4 silos and the above-grade remediation facilities is addressed under the original OU4 ROD, but will be performed in accordance with the OU3 implementing remedial action documents (i.e., the Facility Closure and Demolition Project's "Project Execution Plan"). The hierarchy of regulatory and site requirements that govern the performance of OU4 D&D activities, flow down directly from the OU3 regulatory process by the OU3 Integrated Remedial Design/Remedial Action (RD/RA) Work Plan and the OU3 Project-Specific Implementation Plan.

Integration with OU5

Discrete data points were collected as part of the OU5 RI (FEMP 1994c) to characterize the nature and extent of contamination in environmental media at the site; the results of the data analyses are summarized in the OU5 FS (FEMP 1995b) and are discussed below.

The OU5 RI/FS examined soil on a site-wide basis. All soil at the FEMP, not contemplated to be exhumed as part of a remedy for OUs 1 through 4, is considered within the scope of OU5. This approach has been adopted to examine soil on a site-wide basis to formulate and evaluate comprehensive remedial alternatives that are consistent with presentations in the FS reports for OUs 1, 2, and 4. The ROD for OU4 established OU-specific soil preliminary remediation levels (PRLs) that were revisited by OU5. The OU5 ROD (FEMP 1996b) established final remediation levels for the site-wide soils, including OU4, based on a future land-use scenario. The OU5 ROD modified the OU4 soil

remediation levels, which are in some cases more restrictive that the original OU4 PRLs. A more detailed discussion is provided in Appendix F of the revised FS.

The OU5 RI/FS process also examined perched groundwater on a site-wide basis. It should be noted, however, that the ACA provides that each OU address perched groundwater envisioned to be encountered as a consequence of conducting RAs. Perched groundwater collected as a result of remediation activities will be directed to OU5 wastewater treatment systems.

Process wastewaters generated during RAs conducted by all OUs will be directed to OU5 treatment systems [i.e., Advanced Wastewater Treatment (AWWT) Facility]. OU5 has established pretreatment requirements to ensure that available treatment capabilities will not be exceeded by incoming wastewater streams. These requirements have been included in the Design Basis and Description for the alternatives (Appendix G of the revised FS). These projected process wastewater streams have been factored into each of the OU4 remedial alternatives presented in this report.

Integration with OU2

The FEMP On-site Disposal Facility (OSDF) has a WAC for soils and debris that ensures that materials disposed within its confines are protective of human health and the environment. The OSDF will be available for disposal of the existing Silos 3 and 4 structures and associated facilities (i.e., remediation facilities, and superstructures). Soil and debris from D&D activities associated with these facilities will be disposed in the OSDF, if they meet the WAC for disposal. Any soils and debris that do not satisfy the OSDF WAC will be disposed at the NTS or an appropriate PCDF.

4.2 Integration of OU4 with the National Environmental Policy Act

It is DOE policy to integrate NEPA requirements into the procedural and documentation requirements of CERCLA, wherever practicable. This policy is embodied within DOE Order 5400.4 defining the roles and responsibilities of the DOE regarding compliance with CERCLA and the integration of the remedial process with NEPA.

The incorporation of NEPA values into the original OU4 FS and PP (FEMP 1994b) resulted in a broader and more detailed analysis of the potential environmental impacts associated with implementing the alternatives. The original OU4 FS and PP also included a broad evaluation of cumulative impacts of all FEMP site remediation activities. The resulting integrated process and documentation package for OU4 was termed a *Feasibility Study/Proposed Plan – Environmental Impact Statement* (FS/PP-EIS) (FEMP 1993b).

Integrated CERCLA/NEPA documents (i.e., FS and PP) were prepared for each of the four ensuing OUs at the FEMP. These documents were "tiered" from the original OU4 FS/PP-EIS. Tiering is a process allowed for in the NEPA regulations in which a project that will be accomplished in a series of steps (e.g., remediation of the Fernald site) can be evaluated in stages. Since the OU4 FS/PP-EIS provided the OU4 NEPA evaluation and resulted in a decision for OU4 only, cumulative impacts were evaluated and updated as each remaining OU (i.e., 1, 2, 3, and 5) prepared its FS/PP documents.

This PP utilizes the same CERCLA/NEPA strategy by integrating the RI/FS documentation previously completed by all five operable units at the FEMP. This includes the original OU4 FS, PP, and ROD (EPA 1994), the revised Silos 1 and 2 FS/PP and ROD Amendment, and the ESD for Silo 3. Prior to submittal of the ESD for Silo 3, a NEPA Supplement Analysis was issued by DOE in 1996 evaluating several potential alternatives to the original selected remedy for Silo 3. The potential alternatives evaluated at that time included on-site treatment with disposal at the NTS or a PCDF, as well as transportation of untreated

Silo 3 material to an off-site facility for treatment with disposal at a PCDF. No additional impacts were identified as a result of the reevaluation, and DOE determined that no additional NEPA evaluation or documentation was required.

The potential change recommended by DOE in this PP is bounded by the alternatives evaluated in the Supplement Analysis prepared prior to issuance of the ESD for Silo 3. Therefore, it is DOE's determination that potential NEPA issues associated with the change recommended in this PP have been adequately evaluated and that no additional NEPA documentation or evaluation is necessary.

In accordance with both CERCLA and NEPA processes, these documents are made available to the public for comment. Public involvement is an important factor in the decision-making process for site remediation. Public comments will be considered in the selection of a revised remedy for Silo 3 material, which will be presented in a ROD Amendment. Applying the integrated approach for CERCLA and NEPA, DOE plans to prepare and issue a single ROD Amendment, which will be signed by both DOE and EPA. The contents of the documents prepared for the remedial actions at the FEMP site are not intended to represent a statement on the legal applicability of NEPA to remedial actions conducted under CERCLA.

<END OF SECTION>

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5.0 REMEDIAL ACTION OBJECTIVES

In accordance with the ACA and the NCP, DOE performed a RI/FS for OU4 that was approved by the EPA in August 1994. The initial phase of evaluating alternatives for the remediation of Silo 3 involved the development of Remedial Action Objectives (RAOs) and ARARs for each portion of the remedial action. The RAOs for remediation of Silo 3 are presented below:

- Prevent direct contact with or ingestion of Silo 3 material.

- Prevent release or migration of waste materials to soil, groundwater, surface water or sediment.

- Prevent exposures to Silo 3 material that may cause an individual to exceed applicable dose limits.

As documented in the Silo 3 ESD, these original RAOs remained unchanged as the basis for selecting the revised remedy for Silo 3 material. The original RAO's are again being maintained as the basis for the revised remedy being recommended in this PP.

<END OF SECTION>

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6.0 SUMMARY OF ALTERNATIVES

The remedy recommended in this revised PP is based upon DOE's evaluation of two alternatives, consisting of the current remedy as documented in the ESD for Silo 3, and one alternate remedy. These two alternatives are summarized as follows:

Current Remedy

- Treatment, using either Chemical Stabilization/Solidification or a Polymer-Based Encapsulation process, to stabilize characteristic metals to meet RCRA TCLP limits and attain disposal facility WAC; and

- Off-site disposal at either the NTS or an appropriately-permitted commercial disposal facility.

Alternate Remedy

- Treatment, to stabilize characteristic metals, only if required to attain disposal facility WAC; and

- Off-site disposal at either the NTS or an appropriately-permitted commercial disposal facility.

For either alternative, it is assumed that any required treatment would be accomplished at an off-site facility. As specified as part of the current remedy in the Silo 3 ESD, off-site shipment of untreated Silo 3 material for either alternative must be preceded by on-site pretreatment and/or packaging such that the transportation risk to the public during routine transportation to the off-site facility is less than $1X10^{-6}$.

6.1 Evaluation of ARARs and TBC Requirements

Section 121 of CERCLA requires that remedial actions (RAs) achieve a standard or level of control that is consistent with environmental laws or regulations, which are termed ARARs. ARARs pertain to all aspects of a RA, including the establishment of cleanup levels and the operation and performance of treatment systems.

ARARs consist of two sets of requirements, those that are *applicable* and those that are *relevant and appropriate*. Applicable requirements are those substantive standards or requirements that specifically address a situation at a CERCLA site. Relevant and appropriate requirements are standards or requirements that address problems sufficiently similar to the situation at a CERCLA site, such that their use is well suited to the site. In certain cases, standards may not exist in the promulgated regulation that address the proposed action or COCs. In these cases, non-promulgated advisories, criteria, or guidance that were developed by the EPA, other federal agencies, or states are to be considered (TBC) in establishing criteria to ensure that a remedy is protective of human health and the environment.

The ARARs and TBC criteria for remediation of OU4 were identified in accordance with the NCP during preparation of the original OU4 RI/FS. The ARARs and TBC criteria for Silo 3 remediation are identified in Appendix B of the Final ROD for OU4.

The NCP requires attainment or waiver of ARARs that become effective after a ROD is signed only when it is determined to be "necessary to ensure that the remedy is protective of human health and the environment" [40 CFR Part 300.430(f)(1)(ii)(B)(1)]. In cases where a new component of the remedy, not described in the original ROD, is added, the new component of the remedy must attain or waive any ARAR promulgated at the time that the ROD Amendment or ESD, which added the new component to the remedy, is signed [40 CFR Part 300.430(f)(1)(ii)(B)(2)]. In preparing the Silo 3 ESD, no new ARARs meeting either of the preceding criteria were identified. Therefore, the ARARs and TBC requirements documented in the OU4 ROD remained unchanged as the basis for the revised remedy.

The revised FS for Silos 1 and 2 included a detailed evaluation of the original OU4 ARARs, as well as evaluation of new requirements promulgated since the signature of the original OU4 ROD. This evaluation identified no new ARARs required to be attained in order to ensure that the OU4 remedy would be protective of human health and the environment.

Consistent with both of the previous reevaluations of the original OU4 ARARs, it is DOE's determination that the potential change in treatment criteria recommended in this Proposed Plan does not require modification of the existing ARARs identified for Subunit B (Silo 3) in the original OU4 ROD.

A complete list of the ARARs and TBC requirements associated with the Silo 3 remedy is contained in **Appendix A** of this PP. Neither the current remedy nor the alternate remedy require a waiver or variance from any of the existing ARARs. Both alternatives attain all ARARs.

6.1.1 CERCLA Off-Site Rule

The CERCLA Off-Site rule (found in CERCLA Section 121(d)(3) and promulgated at 40 CFR Part 300.440) 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 these terms are 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 (which includes Nevada) granted approval to the NTS to dispose of CERCLA waste from DOE facilities in waste management units 3 and 5 in accordance with the Off-Site Rule (40 CFR Part 300.440). In a letter dated December 4, 1998, EPA Region 9 stated that the CERCLA Off-Site Rule approval for the NTS waste management units 3 and 5 includes management of small volumes of 11(e)(2) by-product materials from Fernald OU4 under the provisions of Chapters III and IV of DOE Order 435.1 or any subsequent applicable DOE directive. Any PCDF utilized for treatment and/or disposal of Silo 3 material will also be required to be approved in accordance with the CERCLA Off-Site Rule.

6.2 Current Remedy – Treatment to TC Limits and Off-site Disposal

This alternative consists of retrieval, treatment to meet TC limits for characteristic metals, and off-site disposal of the Silo 3 material in accordance with the current remedy defined in the ESD for Silo 3. The current remedy, defined in the ESD for Silo 3, allows that the treatment may be either on-site at the FEMP or off-site at an appropriately-permitted commercial facility, and that disposal may occur at either the NTS or at a PCDF. For the purposes of comparison with the alternate remedy, it is assumed that the Silo 3 material will be retrieved, packaged, and transported to a PCDF for chemical stabilization and disposal. The concept assumed as the basis for evaluation is summarized as follows:

- The material will be retrieved from Silo 3 using a combination of pneumatic and mechanical retrieval.
- The untreated Silo 3 material will be packaged in DOT industrial package-type 2 (IP-2) containers, which will be loaded into an overpack container and shipped by rail to a PCDF in accordance with the criteria for off-site treatment specified by the Silo 3 ESD.
- The Silo 3 material will be treated at the PCDF by chemical stabilization to stabilize characteristic metals to achieve RCRA TC limits, and then disposed in accordance with the WAC of the PCDF.

Estimated costs are have been developed for both on-site and off-site treatment (see Section 6.2.3 and Appendix C)

6.2.1 Packaging and Transportation

After retrieval from Silo 3, an estimated total waste volume of 5088 yd^3 of untreated Silo 3 material would be packaged in soft-sided DOT IP-2 shipping containers, which would be loaded into overpack containers and shipped to the disposal facility in accordance with applicable DOT requirements. Although the evaluation assumes rail shipments as a basis for evaluation, transportation to the disposal facility by truck would also be possible.

6.2.1.1 Transportation Risk

The current remedy for Silo 3 specifies that off-site shipment of untreated Silo 3 material be preceded by "pretreatment on-site as required to reduce dispersability of thorium-bearing particulates and render the material acceptable for transportation." The remedy further specifies that the combination of pretreatment and/or packaging in accordance with DOT regulations results in a transportation risk less than $1X10^{-6}$.

To demonstrate attainment of this criterion, a transportation risk assessment was performed of the packaging and transportation configuration assumed for this alternative.

In order to provide a 'worst case' evaluation, the Transportation Risk Analysis, which is documented in **Appendix B** of this PP, evaluated the risk to the public during transportation of untreated Silo 3 material, with no on-site pretreatment, to a representative PCDF. This evaluation calculates a risk to the public during routine transportation of $1.5X10^{-8}$ for direct truck transportation, and $1.62X10^{-8}$ for rail transportation, both of which demonstrate a transportation risk well within the criterion specified by the Silo 3 ESD.

6.2.2 Treatment

It is assumed that the treatment would consist of a standard chemical stabilization process involving bulk blending of the Silo 3 material with chemical additives such as lime, cement, or phosphates, to reduce the leachability of characteristic metals (arsenic, cadmium, chromium, and selenium) to attain RCRA TC limits. Addition of the chemical additives would result in some increase in the total disposal volume. The treatment would be accompanied by demonstration, based upon sampling and analysis, or process control data, that the treatment had attained the TC limits, in addition to any criteria specified by the disposal facility WAC prior to disposal. Any treated Silo 3 material found not to attain TC limits would have to be re-processed.

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6.2.3 Cost

The estimated cost for this alternative is documented in **Appendix C** and is summarized below.

	On-site Treatment	Off-Site Treatment
Capital Cost:	$22.0 million	$13.3 million
Engineering and Project Management Cost:	$9.7 million	$8.0 million
Construction Management and Startup Cost:	$1.9 million	$1.9 million
Operations and Maintenance (O&M) Cost:	$5.6 million	$4.0 million
Transportation and Disposal Cost:	$5.8 milllion	$10.4 million[1]
Shutdown Cost:	$0.1 million	$0.1 million
Decontamination and Demolition Cost	$2.2 million	$2.1 million
Total Estimated Cost:	$47.4 million	$39.9 million

[1]Includes the estimated cost for treatment stabilization of characteristic metals, performed at the offsite facility, prior to disposal.

6.3 Alternate Remedy – Treatment Only if Required to Attain WAC and Off-site Disposal

This alternative is identical to the Current Remedy Alternative, with the exception that treatment to stabilize characteristic metals would only be provided if required to attain the WAC of the selected disposal facility. This alternative assumes that the Silo 3 material would be retrieved from Silo 3, packaged, and transported to the disposal facility in the same manner as described in Section 6.2 for the Current Remedy Alternative.

The concept assumed as the basis for evaluation of this alternative is summarized as follows:

- The material will be retrieved from Silo 3 using a combination of pneumatic and mechanical retrieval.
- The untreated Silo 3 material will be packaged in DOT IP-2 containers, which will be loaded into overpack containers and shipped by rail to a PCDF in accordance with the criteria for off-site treatment specified by the Silo 3 ESD.
- The untreated Silo 3 material will be disposed in accordance with the WAC of the PCDF.

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6.3.1 Packaging and Transportation

Packaging and transportation for this alternative is identical to that described in **Section 6.2.1** for the Current Remedy Alternative.

6.3.1.1 Transportation Risk

The current remedy for Silo 3 specifies that off-site shipment of untreated Silo 3 material be preceded by "pretreatment on-site as required to reduce dispersability of thorium-bearing particulates and render the material acceptable for transportation." The remedy further specifies that the combination of pretreatment, if required, and packaging in accordance with DOT regulations results in a transportation risk less than $1X10^{-6}$. Under this alternative, the untreated Silo 3 material will be packaged and transported to the disposal facility in the same manner as described in **Section 6.2.1** for the Current Remedy alternative. The Transportation Risk Analysis, which is documented in **Appendix B** of this PP, demonstrates that the transportation risk resulting from this packaging and transportation configuration is well within the criterion specified by the Silo 3 ESD.

6.3.2 Treatment

As described in **Section 2.1**, DOE has determined that the Silo 3 material is exempt from regulation as a hazardous waste under RCRA. The current NTSWAC allows disposal of untreated Silo 3 material as 11(e)(2) by product material contingent upon completion of the NTS waste approval process. Also, potentially viable commercial disposal options have also been identified for the disposal of untreated Silo 3 material. Provided that the material is not regulated as a hazardous waste under RCRA, or the corresponding state regulations, and the material meets all other requirements of the WAC, the WAC of these facilities do not preclude protective disposal of material with levels of characteristic metals at levels in excess of RCRA TC limits.

While the WAC of individual disposal facilities may require some level of treatment for characteristic metals dependant upon site-specific WAC requirements viable disposal options have been identified for the disposal of untreated Silo 3 material. Therefore, for the purpose of comparison with the Current Remedy Alternative, the cost evaluation summarized in Section 6.3.3, and the Evaluation of Alternatives documented in **Section 7** assume that no treatment for characteristic metals is required prior to disposal. In addition, since the transportation risk evaluation summarized in Section **6.3.1.1** demonstrated that transportation of the Silo 3 material with no pretreatment meet the transportation risk criterion, the costs for this alternative assume no on-site pretreatment prior to shipment.

6.3.3 Cost

The cost evaluation of this alternative is documented in **Appendix C.** The estimated cost for this alternative is summarized below:

Capital Cost:	$13.3 million
Engineering and Project Management Cost:	$8.0 million
Construction Management and Startup Cost:	$1.9 million
Operations and Maintenance (O&M) Cost:	$4.1 million
Transportation and Disposal Cost:	$3.4 million
Shutdown Cost:	$0.1 million
Decontamination & Demolition (D&D) Cost	$2.1 million
Total Estimated Cost:	$32.9 million

<END OF SECTION>

7.0 EVALUATION OF ALTERNATIVES

7.1 Evaluation Criteria

The NCP divides the evaluation criteria used in this comparative analysis into three categories: threshold, primary balancing, and modifying.

Threshold criteria consist of the two criteria that must be satisfied by the selected alternative:

- Overall protection of human health and the environment; and
- Compliance with ARARs.

These criteria are of greatest importance in the comparative analysis because they reflect the key statutory mandates of CERCLA, as amended. An alternative must satisfy both of these *threshold criteria* before it is eligible to be selected as the final remedy.

Primary balancing criteria consist of the five criteria under which the relative advantages and disadvantages of the alternatives are compared to determine the best overall remedy:

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability; and
- Cost.

The first four of these primary balancing criteria form the basis for determining the general feasibility of each potential remedy. In addition, the primary balancing criteria are used to determine whether costs are proportional to the overall protectiveness, in order to determine whether a potential remedy is cost-effective as specified by the NCP (40 CFR300.430(f)(ii)(D).

The final two criteria, identified in the NCP as *modifying criteria,* will be evaluated following public and agency comments on this revised PP and will be addressed in the ROD Amendment, once a final proposed remedy is selected. The modifying criteria are:

- State acceptance; and
- Community acceptance.

7.1.1 Threshold Criteria

7.1.1.1 Overall Protection of Human Health and the Environment

Both the alternatives attain the threshold criterion of overall protection of human health and the environment, as defined by the NCP. Both alternatives limit exposure to contaminants by removing the sources of contamination from the FEMP and disposing the material in a protective manner at an off–site facility, in accordance with waste acceptance criteria which have been demonstrated to be protective with the approval of the regulatory agency with jurisdiction over the facility.

The *Environmental Assessment for Proposed Final Land Use at the Fernald Environmental Management Project* (DOE 1999) establishes the future land use of the FEMP to be continued under federal ownership with the area of OU4 being restored to a riparian and upland forest. This scenario is similar to that which was evaluated in the original OU4 FS (FEMP 1994a). Similar to the original OU4 FS, both alternatives specify that the Silo 3 material will be removed from the FEMP and transported off-site for disposal in a protective configuration. Further, both alternatives specify that all surrounding soil will be excavated, removed and disposed to meet final remediation levels documented in the OU2 ROD (FEMP 1995c) and the OU5 ROD (FEMP 1996b). Therefore, the residual risk outlined in the original OU4 FS is still applicable to evaluation of the current alternatives. The results of the original analysis state that long-term risk to the public is within CERCLA guidelines because the Silo 3 material and contaminated soil are removed from the OU4 area.

Both alternatives provide overall protection at the off-site disposal facility by disposal in a configuration that isolates the waste from potential contaminant transport mechanisms and exposure pathways. As previously stated, the engineering design and location of the disposal facility, as well as the site-specific WAC of either the NTS or a PDCF will have been reviewed and approved as protective by the appropriate regulatory agency as a condition of disposal.

The NTSWAC requires demonstration that waste accepted for disposal meet radionuclide waste concentration limits that have been demonstrated as protective through the Performance Assessment (PA) process.

Through the licensing process for a PCDF, the regulatory agency with jurisdiction over the facility reviews the engineering design and site-specific WAC to assure that disposal of waste at the facility, in accordance with the specified criteria, maintains protectiveness of human health and the environment.

The nature and extent of impacts to biota from implementing the technologies are similar. Each alternative involves site preparation and construction for a retrieval and packaging facility, removal of the material from Silo 3, packaging and transport of the material to the NTS or a PCDF for treatment and/or disposal. Short-term impacts include the temporary loss of habitats at the FEMP site and possible impacts from accidental spills of construction and operation materials. Mitigative measures would be employed to minimize these short-term risks.

The location of the NTS facility has been used by the DOE for disposal of low-level radioactive waste, incorporates engineering and institutional controls to isolate the waste from exposure pathways and is located in a climatic, demographic, and hydrogeologic setting that favors minimization of contaminant migration to both human

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and environmental receptors. In the event of long-term degradation of engineered features or loss of institutional controls, these site characteristics ensure that protectiveness of human health and the environment is maintained.

The licensing process for a PCDF ensures that the location and design of a commercial disposal facility provide these same measures to ensure protectiveness of human health and the environment.

7.1.1.2 Compliance with ARARs

Both alternatives attain the threshold criterion of compliance with ARARs. A comprehensive list of ARARs is presented in **Appendix A**. The following paragraphs document the evaluation of both alternatives against this threshold criterion.

Chemical-Specific ARARs

Both alternatives meet the chemical-specific ARARs associated with potential releases to groundwater, surface water, and air. The most critical chemical-specific ARARs relative to airborne releases relate to emissions of radionuclides. Both alternatives meet all ARARs related to emissions of particulate radionuclides, radon and other air emissions from on-site remediation activities through incorporation of necessary air-emission control measures. In addition, both alternatives will achieve compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart Q radon flux limit applicable to disposal of the Silo 3 material at the NTS or PCDF. The impact of air emissions during on-site remediation is evaluated as part of the short-term effectiveness criterion.

Location-Specific ARARs

Both alternatives meet all location-specific ARARs as they relate to floodplains, wetlands, and endangered species and their habitats. Compliance with these alternatives is met through proper planning, siting, design, and operational procedures.

Action-Specific ARARs

Both alternatives meet all action-specific ARARs. Appropriate engineering controls are implemented for each alternative to comply with Ohio Water Quality Standards and Air Quality Standards. All RCRA and State of Ohio hazardous waste requirements identified as ARARs are met through compliance with the appropriate waste characterization and storage and inspection requirements. Hazardous waste and hazardous material transportation ARARs are complied with by following the appropriate regulations under 40 CFR Parts 262 and 263, and the appropriate DOT shipping standards under 49 CFR Subchapter C Hazardous Materials regulations.

7.1.2 Primary Balancing Criteria

7.1.2.1 Long-term Effectiveness and Permanence

Both alternatives ensure long term protectiveness of human health and the environment by providing removal of the Silo 3 material from the FEMP and disposal at an off-site facility, in a configuration demonstrated to meet applicable criteria for long-term protectiveness.

The contaminant fate and transport analysis documented in Section 5 of the OU4 RI concluded that radiological contaminants, primarily uranium isotopes, are the primary contaminants of potential concern for long-term migration to the environment. No characteristic metals were predicted to migrate to the groundwater during the 1000-year simulation period.

Both the current remedy and the alternate remedy provide long-term protection from migration of contaminants of concern into the environment through disposal at an off-site facility, in a configuration that incorporates engineering and institutional controls demonstrated to isolate the treated waste from exposure pathways. In addition, the disposal facility will be located in a climatic, demographic, and hydrogeologic setting that favors long-term minimization of contaminant migration to both

human and environmental receptors. These site characteristics ensure that protectiveness of human health and the environment is maintained even in the event of long-term degradation of engineered features or loss of institutional controls.

The WAC of the NTS have been in accordance with criteria specified by the applicable DOE Orders to ensure long-term protectiveness of human health and the environment. Similarly, although these same DOE orders do not regulate disposal at a PCDF, the licensing process for a PCDF ensures that the WAC for the facility has been demonstrated to meet the limits specified by the applicable NRC and/or state regulations to ensure long-term protectiveness of human health and the environment.

The current remedy provides an incremental increase in long-term effectiveness by including treatment to chemically reduce the mobility of characteristic metals. As previously stated, however, characteristic metals were not identified to be of significant concern with respect to long-term migration to the environment.

There are no long-term environmental impacts at the FEMP site pertaining to the implementation of either alternative. The projected FEMP site residual risk to viable receptors is less than the NCP criterion of 10^{-6} ILCR, and non-carcinogenic effects are expected to be below 0.2 (HI) specified by the NCP, for both alternatives. Long-term environmental impacts at the NTS or a PCDF involve some permanent disturbance of soils (i.e., acquisition of borrow material) associated with disposal activities. Significant long-term impacts are not expected to water quality or hydrology, air quality, biotic resources, socioeconomics, land use, or cultural resources. Wetland or floodplain areas have not been delineated at the NTS.

The reduction in mobility of characteristic metals accomplished by chemical stabilization results in a nominal advantage in this criterion for the Current Remedy alternative. Since, however, both alternatives are equally effective in providing long-term protectiveness for the primary contaminants of concern identified in the OU4 RI, the advantage in this criterion is not substantial.

7.1.2.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

The Current Remedy includes treatment (chemical stabilization) which chemically reduces the mobility of characteristic metals. Because of the addition of the chemical additives used in the stabilization process, however, the chemical reduction in the mobility of characteristic metals would likely be accompanied by some increase in volume of the material for disposal, compared to the original volume of material in Silo 3.

The Alternate Remedy relies solely upon the location and design of the disposal facility to prevent migration of characteristic metals, and does not provide a reduction in mobility through treatment.

This criterion favors the Current Remedy alternative. The advantage provided by the chemical reduction in mobility of metals, however, would be partially offset by increased disposal volume due to the addition of chemical additives required for chemical stabilization.

7.1.2.3 Short-term Effectiveness

The NCP identifies the components of short-term effectiveness as short-term risks to the community during implementation of the alternative, potential impacts to workers during RA, potential environmental impacts during implementation, and time until protection is achieved.

Due to the dispersible nature and high thorium-230 content of the Silo 3 material, a primary short-term effectiveness issue it the potential for worker exposures due to Silo 3 material becoming airborne during retrieval, material handling, processing and packaging. Equipment and operational controls, such as ventilation through dust collection equipment, dust control measures during bulk retrieval, and contamination control practices, must be implemented at each unit operation to minimize the risk of worker exposure to airborne Silo 3 material.

Operation and maintenance of the additional equipment required for chemical stabilization of characteristic metals results in increased non-radiological risk (worker injury), and increased radiological exposures to workers for the current remedy alternative. In addition, operation of the chemical stabilization process results in an incremental increase in short-term environmental impacts due to increased generation of secondary waste (wastewater, solid waste, and air emissions).

As will be discussed under the implementability criterion (Section 7.1.2.4), the addition of the chemical stabilization operation in addition to the retrieval and packaging, transportatio and disposal operations, increases the operational complexity of the Current Remedy alternative. This increased complexity results in increased uncertainty in the schedule for completion of Silo 3 remediation. This criterion favors the Alternate Remedy due to lower on-site worker risk, lower short-term environmental impacts, and higher schedule certainty.

7.1.2.4 Implementability

This criterion favors the Alternate Remedy due to less complexity of operations and a resulting greater confidence in its ability to be successfully implemented.

The equipment and operations required to retrieve the Silo 3 material from the Silo, and package the treated or untreated material for transportation to the disposal facility are common to both alternatives. Chemical stabilization of the characteristic metals for the current remedy alternative requires additional equipment and unit operations to provide storage and material handling of the additives, and adequate blending of the additives and Silo 3 material. In addition, assuring that the process accomplishes adequate chemical stabilization to meet the TC limits requires additional sampling and process controls to monitor the characteristics of the feed stream and control the stabilization recipe. Additional product sampling to verify attainment of TC limits, and the ability to reprocess treated waste failing to meet the TC limits is also required.

As documented in the Silo 3 ESD, a primary factor in the selection of the current remedy for Silo 3 was the significant implementability issues associated with treatment of the material due to its unique physical, chemical and radiological characteristics. The dispersible nature of the Silo 3 material, in combination with its Th-230 content, results in dust control and contamination concerns. The need to mitigate these concerns in the design of equipment such as the material handling and mixing equipment associated with a chemical stabilization process, further increases the complexity of the design, operation, process control, and maintenance aspects of the Current Remedy alternative.

This additional equipment and greater number of unit operations increases the operational and maintenance complexity and risk of operational upsets, and thereby results in a greater implementability risk for the current remedy alternative.

For those operations activities to be performed at the FEMP, permits and licenses are not required for either alternative. However, these activities will comply with the substantive requirements that would otherwise be required for permitting.

Both alternatives include offsite disposal of Silo 3 at either the NTS or a PCDF. The administrative feasibility associated with obtaining the necessary permit or license changes or other approvals is equivalent for either alternative.

7.1.2.5 Cost

The cost evaluation is based on estimates documented in **Appendix C** of this PP. The cost estimates were developed for (1) capital costs; (2) engineering and project management costs; (3) construction management and startup costs; (4) operations and maintenance (O&M) costs; (5) transportation and disposal costs; (6) shutdown costs; and (7) D&D costs. The accuracy of both estimates is considered +50/-30%, consistent with CERCLA guidance. **Table 7.1-1** summarizes the major cost elements for the two alternatives.

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TABLE 7.1-1
SUMMARY COST DATA ($ MILLION)

Alternative	Current Remedy		Alternate Remedy
	On-site Treatment	Off-site Treatment	
Capital Cost	22.1	13.3	13.3
Engineering and Project Management Cost	9.7	8.0	8.0
Construction Management and Startup Cost	1.9	1.9	1.9
Operation and Maintenance Cost	5.5	4.0	4.1
Transportation and Disposal Cost	5.8	10.4[1]	3.4
Shutdown Cost	0.1	0.1	0.1
D&D Cost	2.2	2.1	2.1
Total Cost	47.4	39.9	32.9

[1]Includes the cost of treatment for characteristic metals at the off-site facility prior to disposal

Due to the cost of providing treatment to stabilize characteristic metals to achieve TC limits, the estimated cost for the current remedy alternative is between 44% (on-site treatment) and 21% (offsite treatment) higher than the estimated cost for the alternate remedy. Therefore, the cost criterion favors the alternate remedy.

7.1.3 Modifying Criteria

7.1.3.1 State Acceptance

State acceptance of the preferred alternative will be addressed following the public comment period for the PP and will be included in the Responsiveness Summary of the ROD Amendment .

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7.1.3.2 Community Acceptance

Community acceptance of the preferred alternative will be addressed following the public comment period for the PP and will be included in the Responsiveness Summary of the ROD Amendment.

<END OF SECTION>

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8.0 PREFERRED ALTERNATIVE

In accordance with the CERCLA process, the preferred alternative and the basis for its preference must be identified to allow the public an opportunity to provide input with regard to its acceptance. The preferred alternative can change in response to state or public comment or new information. This section identifies the preferred remedial alternative for the OU4 Silo 3 material based upon the detailed and comparative analysis discussion in **Sections 6.0** and **7.0**, respectively.

DOE proposes the Alternate Remedy described in **Section 6.3** of this PP as the preferred alternative for the Silo 3 material. This preferred alternative includes the removal of all material from Silo 3, treatment to stabilize characteristic metals only if required to achieve disposal facility WAC, and off-site disposal at the NTS or an appropriate PCDF. Pretreatment to reduce dispersability will be required if necessary, in combination with packaging in accordance with DOT regulations, to provide a risk to the public during routine transportation of less than $1X10^{-6}$. In addition, the preferred alternative includes decontamination and dismantlement of all structures and remediation facilities, and appropriate treatment and disposal of all secondary wastes in accordance with the all ARARs and the WAC of either the FEMP OSDF, the NTS, or an appropriate PCDF. Perched water encountered during remediation activities will be collected and directed to the FEMP OU5 water treatment facilities.

The Alternate Remedy is proposed as the preferred alternative, based on the conclusion that, as demonstrated by the evaluation documented in this PP, it best satisfies each of the statutory requirements specified by CERCLA and the NCP (40 CFR 300.430(f)(1)(ii) for an alternative selected as remedy. The basis for this conclusion is summarized below.

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As documented in Section 7.1.1.1, the preferred alternative meets the threshold criterion of overall protection of human health and the environment. The alternative removes the sources of contamination from the FEMP and disposing the material in a protective manner at an off-site facility, in accordance with acceptance criteria which have been demonstrated to be protective of human health and the environment.

As documented in Section 7.1.1.2, the preferred alternative meets the threshold criterion of compliance with ARARs. The alternative meets all ARARs for Subunit B (Silo 3) of OU4. No waivers of existing ARARs are required.

The preferred alternative is cost effective, as defined by the NCP (40 CFR 300.430(f)(ii)(D), such that the cost, short-term risk, and short-term environmental impacts of the remedy are proportional to its overall effectiveness. Based upon the evaluation of the balancing criteria documented in Section 7.1.2, DOE has concluded that the current remedy alternative, which specifies treatment not required to meet the WAC of the selected disposal facility does not provide an incremental increase in overall protectiveness proportional to the significant (greater than 20%) increase in cost. For this reason, a remedy requiring treatment not required to attain protective WAC is not cost effective, as required by the NCP. The cost of the preferred alternative, however, is proportional to its overall effectiveness.

The preferred alternative utilizes permanent solutions and alternate treatment technologies to the maximum extent practicable. As specified by the NCP (40 CFR300.430(f)(1)(ii)(E), this determination is based upon DOE's conclusion that the preferred alternative meets both threshold criteria and offers the best balance of trade-offs with respect to the five primary balancing criteria. Specifically, DOE has concluded that the advantages of the preferred remedy in **the balancing criterion of short-term effectiveness, implementability cost outweighs the nominal advantage of the other alternative considered (the current remedy) in the balancing criterion of reduction in toxicity, mobility or volume through treatment.**

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The preferred alternative does not require treatment to reduce the toxicity, mobility, or volume of contaminants, if not necessary to attain WAC demonstrated to be protective by the appropriate regulatory agency. In considering the statutory preference for remedies that include require treatment to reduce the toxicity, mobility, or volume of contaminants, DOE's has concluded that treatment not required to meet the WAC of the selected disposal facility does not provide an incremental increase in overall protectiveness proportional to the significant (greater than 20%) increase in cost. For this reason, a remedy requiring treatment not required to attain protective WAC is not cost effective, as required by the NCP.

<END OF SECTION>

9.0 COMMUNITY PARTICIPATION

9.1 Community Acceptance

Community acceptance is one of the criteria that DOE is committed to considering during the decision-making process for selecting a remedy for the Silo 3 material. The NCP specifies that the public be given the opportunity for input in selection of RAs. Specifically, the NCP [40 CFR 300.430(f)(3)] specifies that after a PP is issued, the public be provided a reasonable opportunity for submission of comments on the PP and any supporting information. This interaction with the community is a key element of the CERCLA process and is critical to making sound environmental decisions.

The public is encouraged to review and comment on both alternatives considered for remediation of the Silo 3 material. Both alternatives are discussed in detail in **Sections 6.0 and 7.0** of this PP.

The actual selection of the alternative to be implemented will be made only after comments received during the public comment period have been reviewed and responded to. The DOE and EPA will consider all public comments on this PP in preparing the ROD Amendment. Depending on comments received, the selected final remedy for the Silo 3 material presented in the ROD Amendment could be different from the preferred alternative. All written and verbal comments received during the public comment period will be summarized and responded to in the *Responsiveness Summary* section of the ROD Amendment. The ROD Amendment for Silo 3 is scheduled to be issued in the fall of 2002.

9.2 Community Participation

The community is encouraged to read and provide comments on this PP. A final remedy will be made only after hearing and considering community comments and concerns. Based upon those comments, the preferred alternative may be modified, another

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alternative presented in this PP selected, or a new alternative selected based on information gathered from the community before and during the comment period.

This PP and other supporting documents are available from the Administrative Record, located at the PEIC and at the EPA offices in Chicago, Illinois. Addresses for these Administrative Record locations are provided below.

Your comments may either be presented publicly at a community meeting or submitted by mail to:

Mr. Gary Stegner U.S. Department of Energy Fernald Area Office P.O. Box 398705 Cincinnati, Ohio 45239-8705	Mr. James A. Saric U.S. EPA, 5HRE 8J 77 W. Jackson Blvd. Chicago, Illinois 60604
513-648-3153	312-886-0992

The date, time and location of the public meeting and dates for the comment period have been announced in the local media and are posted at the Administrative Record locations. Addresses and hours for the Administrative Record locations are as follows:

Public Environmental Information Center 10995 Hamilton-Cleves Highway Harrison, Ohio 45030	U.S. EPA Region V 77 W. Jackson Blvd. Chicago, Illinois 60604
513-648-7480	312-886-0992
Monday, 7:30 a.m. to 8 p.m. Tuesday – Thursday, 7:30 a.m. to 5 p.m. Friday, 7:30 a.m. to 4:30 p.m.	Monday – Friday, 8 a.m. to 5 p.m.

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The OEPA is also participating in the RA processes at the FEMP. For additional information concerning the state's role in the cleanup process at the FEMP or regarding the specifics of the revised FS and this PP, contact:

Thomas Schneider
Ohio Environmental Protection Agency
401 E. Fifth Street
Dayton, Ohio 45402-2911

937-285-6466.

For additional information on public participation activities related to this PP, or the FEMP site, visit the DOE-FEMP website at http://www.fernald.gov/.

<END OF SECTION>

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APPENDIX A

ARARs

FOR SILO 3 REMEDIAL ACTION

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TABLE A -1

ARARS FOR SILO 3 REMEDIAL ACTION, REMEDIAL ACTION ALTERNATIVES, CHEMICAL-SPECIFIC

Medium	Clean Air Act (CAA)	Requirement	ARAR/TBC	Rationale for Implementation
Air	Radionuclide Emissions (Except Airborne Radon-222), 40 CFR Part 61 Subpart H.	Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that might cause any member of the public to receive, in any year, an effective dose equivalent (EDE) of 10 mrem or greater per year. Monitoring is required at release points having potential to discharge radionuclides that could cause an EDE in excess of 1% of the standard (0.1 mrem/yr) to any member of the public.	Applicable	Radioactive materials within Silo 3 might contribute to the dosage to members of the public from the air pathway during implementation of remedial actions since the National Emissions Standards for Hazardous Air Pollutants (NESHAP) applies to operating units.
Air	Radon-222 Emissions, 40 CFR Part 61 Subpart Q.	No source at a DOE facility shall emit more than 20 $pCi/m^2 \cdot s$ of radon-222 as an average for the entire source during periods of storage and disposal.	Applicable	A 'source' is defined by NESHAP Subpart Q as 'any building, structure, pile, or impoundment used for interim storage or disposal that is or contains waste material containing radium in sufficient concentration to emit radon-222 in excess of this standard prior to remedial action." This standard is applicable to the facility used for disposal of the Silo 3 material.
Medium	DOE	Requirement	ARAR/TBC	Rationale for Implementation
Air	Residual Radioactive Material, DOE Order 5400.5 Chap. IV, 6.b (proposed 10 CFR Part 834).	Interim Storage The above-background concentration of radon-222 in air above an interim storage facility must not exceed: 100 pCi/L at any point, an annual average of 30 pCi/L over the facility, or an annual average of 0.5 pCi/L above background or above any location outside the site.	To be considered	Management of radium and thorium bearing waste might result in the release of radon gas to the environment.

TABLE A.1-1 (continued)

Medium	DOE (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Air	Radiation Protection of the Public and the Environment, Proposed 10 CFR Part 834.	Residual concentrations of radionuclides in the air within uncontrolled areas are limited to those listed below (for known mixtures of radionuclides, the sum of the ratios of the observed concentration of each radionuclide to its corresponding limit must not exceed 1.0.). Derived Concentration Guide (μCi/mL) Isotope — D[a] — W — Y Actinium-227 — 2×10^{-15} — 7×10^{-15} — 1×10^{-14} Lead-210 — 9×10^{-13} — ------[b] — ------ Polonium-210 — 1×10^{-12} — 1×10^{-12} — ------ Protactinium-231 — ------ — 9×10^{-15} — 1×10^{-14} Radium-224 — ------ — 4×10^{-12} — ------ Radium-226 — ------ — 1×10^{-12} — ------ Radium-228 — ------ — 3×10^{-12} — ------ Technetium-99 — 1×10^{-8} — 2×10^{-9} — ------ Strontium-90[c] — 5×10^{-11} — ------ — 9×10^{-12} Thorium-228 — ------ — 5×10^{-14} — 4×10^{-14} Thorium-230 — ------ — 4×10^{-14} — 5×10^{-14} Thorium-232 — ------ — 7×10^{-15} — 1×10^{-14} Uranium-234 — 4×10^{-12} — 2×10^{-12} — 9×10^{-14} Uranium-235 — 5×10^{-12} — 2×10^{-12} — 1×10^{-13} Uranium-236 — 5×10^{-12} — 2×10^{-12} — 1×10^{-13} Uranium-238 — 5×10^{-12} — 2×10^{-12} — 1×10^{-14} [a] D, W, and Y (days, weeks, years) represent lung retention classes; removal halftimes assigned to the compounds with classes D, W, and Y are 0.5, 50, and 500 days, respectively. Exposure conditions assume an inhalation rate of 8,400 m^3 of air per year (based on an exposure over 24 hours per day, 365 days per year). [b] A dashed line means that no limit has been established. [c] The value shown for daily derived concentration guide (DCG) is for strontium radionuclides with a f_1 value of 3×10^{-1}. The value shown for yearly DCG is for strontium radionuclides for a f_1 value of 1×10^{-2}.	To be considered	Remediation of the Silo 3 material has the potential to release radionuclides.

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TABLE A.1-1 (continued)

Medium	DOE (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Water	Radiation Protection of the Public and the Environment, Proposed 10 CFR Part 834.	Residual concentrations of radionuclides in water that may be ingested are listed below. These DCGs for the COCs are based on a committed EDE of 100 mrem/yr, assuming ingestion of 2 liters/day. Note that these DCGs apply only if ingestion is the single pathway of exposure. Ingested Water DCGs Isotope — (μCi/mL) Actinium-227 — $1x10^{-8}$ Lead-210 — $3x10^{-8}$ Polonium-210 — $8x10^{-8}$ Protactinium-231 — $1x10^{-8}$ Radium-224 — $4x10^{-7}$ Radium-226 — $1x10^{-7}$ Radium-228 — $1x10^{-7}$ Technetium-99 — $1x10^{-4}$ Strontium-90 — $1x10^{-6}$ Thorium-228 — $4x10^{-7}$ Thorium-230 — $3x10^{-7}$ Thorium-232 — $5x10^{-8}$ Uranium-234 — $5x10^{-7}$ Uranium-235 — $6x10^{-7}$ Uranium-236 — $5x10^{-7}$ Uranium-238 — $6x10^{-7}$	To be considered	Remediation of the Silo 3 material has the potential to release radionuclides.

TABLE A.1-1 (continued)

Medium	CWA	Requirement	ARAR/TBC	Rationale for Implementation
Water	Ohio Water Quality Standards, Ohio Administrative Code (OAC) 3745-1-04.	"Five Freedoms" for surface water: Surface waters of the state shall be free from: • objectionable suspended solids; • floating debris, oil and scum; • materials that create a nuisance; • toxic, harmful or lethal substances; and • nutrients that create nuisance growth.	Relevant and Appropriate	Pertains to discharges to surface waters as a result of remediation and to on-site surface waters affected by site conditions.
Water	Ohio Water Quality Standards, OAC 3745-1-07.	Use Designations and Criteria All pollutants or combinations of pollutants shall not exceed, outside the mixing zone, the Numerical and Narrative Criteria for Aquatic Life Habitat and Water Supply Use Designations listed in Tables 7-1 through 7-15 of this rule. The following constituents of concern (COCs) for Operable Unit 4 have warm water habitat criteria concentrations outside the mixing zone as follows: 30-day Criteria Constituent / average conc.[a] (ug/1) / conc. (ug/1) antimony: 650 / 190 arsenic: 360 / 190 beryllium: Tab. 7-10[b] / Tab. 7-11[c] cadmium: Tab. 7-10 / Tab. 7-11 chromium: Tab. 7-10 / Tab. 7-11 copper: Tab. 7-10 / Tab. 7-11 cyanide: 46 / 12 lead: Tab. 7-10 / Tab. 7-11 mercury: 1.1 / 0.20 nickel: Tab. 7-10 / Tab. 7-11 selenium: 20 / 5.0 silver: Tab. 7-10 / 1.3 thallium: 71 / 16	Relevant and Appropriate	Pertains to discharges to surface waters as a result of remediation and to on-site surface waters affected by site conditions.

TABLE A.1-1 (continued)

Water	Ohio Water Quality Standards, OAC 3745-1-07 (continued).				

30-day Criteria Constituent	average conc.[a] (ug/1)	conc. (ug/1)
zinc	Tab. 7-10	Tab. 7-11

30-day Criteria Constituent	average conc.[a] (ug/1)	conc. (ug/1)
2-butanone	160000	7100
4-nitrophenol	790	35
acentone	550000	78000
aldrin	----	0.01
bis(2-ethylhexyl) phthalate	1100	8.4
carbon tetrachloride	1800	280
DDT	----	0.001
Dieldrin	----	0.005
di-n-butyl-phthalate	350	190
diethylphthalate	2600	120
dimethylphthalate	1700	73
endosulfan[d]	----	0.003
endrin	----	0.002
fluoranthene	200	8.9
methylene chloride	9700	430
PCBs	----	0.001
phenol	5300	370
tetrachloroethene	540	73
toluene	2400	1700

[a] Criteria concentration shall be met outside mixing zone.
[b] Criteria concentration based on hardness of water. See Table 7-10 for calculation to determine maximum concentration outside the mixing zone.
[c] 30-day average criteria based on hardness of water. See Table 7-11 for calculation to determine allowable 30-day average concentration outside the mixing zone.
[d] No designation was made as to whether endosulfan referred to endosulfan I or endosulfan II or the sum total of each.

The remaining COCs for OU4 will have criteria concentration levels based on calculated acute aquatic criteria or chronic aquatic criteria.

TABLE A.1-2

ARARS FOR SILO 3
REMEDIAL ACTION ALTERNATIVES, LOCATION-SPECIFIC

NEPA/EPA	Requirement	ARAR/TBC	Rationale for Implementation
Endangered Species Protection, 50 CFR Part 402 (ORC 1518, 1513.25 and OAC 1501-18-1-01).	Federal agencies must not jeopardize the continued existence of any endangered or threatened species, or destroy or adversely modify critical habitat of such species.	Relevant and Appropriate	Although the FEMP is located within the range of the Indiana bat, a federally listed endangered species, no sighting has occurred on the FEMP. Therefore, this requirement is relevant and appropriate. Any potential impacts of the remedial actions on this species must be evaluated and appropriate action taken.
NEPA/DOE	**Requirement**	**ARAR/TBC**	**Rationale for Implementation**
Compliance with Floodplain/Wetlands Environmental Review Requirements, 10 CFR Part 1022 (Executive Order 11990).	DOE actions in a wetland must first evaluate the potential adverse effects that those actions might have on the wetland and consider the natural and beneficial values served by the wetlands.	Applicable	This requirement is applicable because the FEMP is a DOE facility. Several alternatives might result in destruction or modification of wetland areas.

TABLE A.1-3

ARARS FOR SILO 3
REMEDIAL ACTION ALTERNATIVES, ACTION-SPECIFIC

AEA/DOE	Requirement	ARAR/TBC	Rationale for Implementation
10 CFR Part 1021.2	DOE actions must be subjected to NEPA evaluation as outlined by the Council on Environmental Quality regulations in 40 CFR Part 1500-1508.	Applicable	This requirement is applicable because the FEMP is a DOE facility, and this requirement requires NEPA evaluation for specific actions at DOE facilities.
CWA	**Requirement**	**ARAR/TBC**	**Rationale for Implementation**
Nationwide Permit Program, 33 CFR Part 330.	The U.S. Corps of Engineers can issue a Nationwide Permit (NWP) as a general permit for certain classes of actions that involve dredge or fill activities in wetlands or navigable waters. Discharges of dredged or fill material into wetlands may require a wetland delineation.	Applicable	Remediation activities may require construction of access roads and utility lines resulting in minor wetland disturbances. Dredge and fill activities related to construction of these access roads and utility lines will be conducted in accordance with the substantive terms and conditions of NWP 14 (Road Crossing), and NWP 12 (Utility Line Backfill and Bedding). OEPA has been granted Section 401 State Water Quality Certification for NWPs 12 and 14.
Discharge of Stormwater Runoff; 40 CFR Part 122.26 (OAC 3745-38).	Stormwater runoff from landfills, construction sites, and industrial activities must be monitored and controlled. A Stormwater Pollution Prevention Plan is required for construction activities that result in a total land disturbance of five or more acres.	Applicable	Required of industrial waste sites and construction sites of greater than five acres that discharge stormwater runoff to the waters of the U.S. Some remedial alternatives evaluated might disturb more than five acres of land.

TABLE A.1-3 (continued)

CWA (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Discharge of Treatment System Effluent, 40 CFR Part 125.100. 40 CFR Part 125.104.	Best Management Practices (BMPs) Development and implementation of a BMP program to prevent the release of toxic or hazardous pollutants to waters of the U.S. Development and implementation of a sitewide BMP Program is also required as a condition of the FEMP National Pollution Discharge Elimination System (NPDES) Permit. The BMP program must: • Establish specific objectives for the control of toxic and hazardous pollutants, and • Include a prediction of direction, rate of flow, and total quantity of toxic and hazardous pollutants where experience indicates a reasonable potential for equipment failure.	Relevant and Appropriate	All of the proposed actions have the potential for releases and runoff from this operable unit (OU).
Safe Drinking Water Act (SDWA)	**Requirement**	**ARAR/TBC**	**Rationale for Implementation**
Ohio Water Well Standards, OAC 3745-9-10.	Abandonment of Test Holes and Wells Upon completion of testing, a test hole or well shall be either completely filled with grout or such material as will prevent contaminants from entering groundwater.	Applicable	Test borings and wells might be installed and/or closed as part of these remedial alternatives.

TABLE A.1-3 (continued)

UMTRCA	Requirement	ARAR/TBC	Rationale for Implementation
Implementation of Health and Environmental Protection Standards for Uranium Mill Tailings, 40 CFR Part 192 Subpart C.	This subpart contains guidance, criteria, and supplemental standards for compliance with Subparts A and B of 40 CFR Part 192.	Relevant and Appropriate	Radioactive materials in this OU are primarily by-product residues from uranium processing. Requirements for design of controls should be consistent with design of controls for other residual radioactive materials such as mill tailings.
RCRA Subtitle C	**Requirement**	**ARAR/TBC**	**Rationale for Implementation**
Hazardous Waste Determinations, 40 CFR Part 262.11 (OAC 3745-52-11).	Any generator of waste must determine whether or not the waste is hazardous. The procedures for determination include: • Identification of whether a particular material of concern is a "solid waste"; • Identification of whether a particular exclusion applies to the material eliminating it from definition as a "solid waste"; • Identification of whether a particular solid waste might be classified as a hazardous waste; and • Determination of whether a material otherwise classified as a "hazardous waste" might be excluded from RCRA regulation.	Relevant and Appropriate (This requirement will be applicable to non-excluded solid wastes that exhibit a hazardous characteristic.)	These procedures are established to determine whether wastes are subject to the requirements of RCRA. The materials in Silo 3 are specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate to determine whether OU4 wastes, whether excluded or not, exhibit the characteristics of hazardous waste, or are otherwise similar to RCRA hazardous waste. The material stored in the Silo are sufficiently similar to hazardous wastes based on the TCLP results. Silo 3 contain materials that must be treated, stored, and disposed in accordance with RCRA. Other wastes, such as debris generated during decontamination (e.g., concrete scabbling), will also require a hazardous waste determination.

TABLE A.1-3 (continued)

RCRA Subtitle C	Requirement	ARAR/TBC	Rationale for Implementation
Empty Containers, 40 CFR Part 261.7 (OAC 3745-51-7).	Containers that have held hazardous wastes are "empty" and exempt from further RCRA regulations if one or more of the following are met: • No more than 2.5 cm (1 inch) of residue remains on the bottom of their inner liner; • Less than 3% by weight of total capacity remains (less than or equal to 110 gallon container); and • Less than 0.3% by weight of total capacity remains (greater than 110 gallon container). Containers that have held acutely hazardous ("P" listed) wastes are "empty" and exempt from further RCRA regulation if: • They or their inner liners have been triple rinsed with an adequate solvent or the inner liner has been removed from the container.	Relevant and Appropriate (This requirement will be applicable to non-excluded solid wastes that exhibit a hazardous characteristic.)	Containers used to treat or store the contents of Silo 3 might contain residues that exhibit hazardous waste characteristics which must be removed before the containers might be reused or disposed.
Generators Who Transport Hazardous Waste for Off-site Treatment, Storage, or Disposal; 40 CFR Parts 262.20 - 33 and 263.20 - 31 (OAC 3745-52-20 through 33 and OAC 3745-53-20 through 31).	Any generator who transports hazardous waste for off-site treatment, storage or disposal must originate and follow-up the manifest for off-site shipments.	Applicable	Any residues determined to be RCRA hazardous waste removed from this OU for off-site treatment, storage, or disposal might be subject to the manifest requirements.

TABLE A.1-3 (continued)

RCRA Subtitle C (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Treatment, Storage, or Disposal Facility Standards; 40 CFR Part 264 Subpart B (OAC 3745-54-13 through 16).	General Standards • Waste Analysis - OAC 3745-54-13: Operators of a facility must obtain a detailed chemical and physical analysis of a representative sample of each hazardous waste to be treated, stored, or disposed of at the facility prior to treatment, storage, or disposal. • Security - OAC 3745-54-14: Operators of a facility must prevent the unknowing or unauthorized entry of persons or livestock into the active portions of the facility, maintain a 24-hour surveillance system, or surround the facility with a controlled access barrier and maintain appropriate warning signs at facility approaches. • Inspections - OAC 3745-54-15: Operators of a facility must: (1) develop a schedule and regularly inspect monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment that are important to preventing, detecting or responding to environmental or human health hazards; (2) promptly or immediately remedy defects; and (3) maintain an inspection log. • Training - OAC 3745-54-16: Operators must train personnel, within six months of their assumption of duties at a facility, in hazardous waste management procedures relevant to their positions, including emergency response training.	Relevant and Appropriate (This requirement will be applicable to non-excluded solid wastes that exhibit a hazardous characteristic.)	Residues that exhibit a characteristic similar to RCRA hazardous waste, removed from this OU, might be treated, stored, and disposed in accordance with TSD facility standards. These requirements are relevant and appropriate because the residues are sufficiently similar to hazardous waste.

TABLE A.1-3 (continued)

RCRA Subtitle C (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Treatment, Storage, or Disposal Facility Preparedness and Prevention; 40 CFR Part 264 Subpart C and 40 CFR Part 264.31 (OAC 3745-54-31).	Treatment, storage, and disposal facility (TSDF) operators must design, construct, maintain and operate facilities to minimize the possibility of a fire, explosion, or any unplanned sudden or nonsudden release of hazardous waste to air, soil, or surface water which might threaten human health or the environment.	Relevant and Appropriate (This requirement will be applicable to non-excluded solid wastes that exhibit a hazardous characteristic.)	Residues removed from this OU might be treated, stored, and disposed in accordance with TSD facility standards. These requirements are relevant and appropriate because the residues are sufficiently similar to hazardous waste.
40 CFR Part 264.32 (OAC 3745-54-32).	Facilities must be equipped with an internal communication or alarm system, a telephone, or a two-way radio for calling outside to emergency assistance, fire control, and spill control. Decontamination equipment and water must be at an adequate volume and pressure to supply water hose streams, foam producing equipment, automatic sprinklers, or water spray systems.		
40 CFR Part 264.33 (OAC 3745-54-33).	Fire protection, spill-control and decontamination equipment, and communication and alarm systems must be tested and maintained, as necessary, to ensure proper emergency operation.		
40 CFR Part 264.34 (OAC 3745-54-34).	Personnel must have immediate access to emergency communication or alarm systems whenever hazardous waste is being handled at the facility.		
40 CFR Part 264.35 (OAC 3745-54-35).	Aisle space must be sufficient to allow unobstructed movement of personnel, fire and spill control, and decontamination equipment.		
40 CFR Part 264.37 (OAC 3745-54-37).	Operators must attempt to make arrangements, appropriate to the waste handled, for emergency response by local and state fire, police and medical personnel.		

TABLE A.1-3 (continued)

RCRA Subtitle C (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Treatment, Storage, or Disposal Facility Contingency Plan and Emergency Procedures; 40 CFR Part 264 Subpart D and 40 Part CFR 264.51 (OAC 3745-54-51).	Each facility operator must have a contingency plan designed to minimize hazards to human health or the environment due to fires, explosions, or any unplanned releases of hazardous waste constituents to the air, soil, or surface/groundwater.	Relevant and Appropriate (This requirement will be applicable to non-excluded solid wastes that exhibit a hazardous characteristic.)	Residues removed from this OU might be treated, stored, and disposed in accordance with TSD facility standards. These requirements are relevant and appropriate because the materials in Silo 3 are sufficiently similar to hazardous waste.
40 CFR Part 264.52 (OAC 3745-54-52).	Contingency plans should address procedures to implement a response to incidents involving hazardous waste, and provide for: internal and external communications, arrangements with local emergency authorities, an emergency coordinator list, a facility emergency equipment list indicating equipment descriptions and locations, and a facility personnel evacuation plan.		
40 CFR Part 264.55, .56 (OAC 3745-54-55 through 56).	Each facility must have an emergency coordinator who: (1) has responsibility for coordinating emergency response measures; (2) is on the premises or on call at all times; (3) is thoroughly familiar with all aspects of the contingency plan, facility operations, location and characteristics of waste handled, location of pertinent records, and facility layout; and (4) has the authority to commit the resources necessary to implement the contingency plan in the event of an emergency.		

TABLE A.1-3 (continued)

RCRA Subtitle C (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Closure, 40 CFR Part 264 Subpart G. 40 CFR Part 264.111 (OAC 3745-55-11). 40 CFR Part 264.114 (OAC 3745-55-14). 40 CFR Part 264.116 (OAC 3745-55-16).	An operator must close facilities in a manner that: • Minimizes the need for further maintenance; • Minimizes post-closure escape of hazardous constituents; and • Complies with specific, unit-type closure requirements. Contaminated equipment, structures and soils must be properly disposed or decontaminated. Following closure, a survey plot showing the location of hazardous waste disposal units, with respect to surveyed benchmarks, must be filed with the legal total zoning authority.	Relevant and Appropriate (This requirement will be applicable to non-excluded solid wastes that exhibit a hazardous characteristic.)	These requirements are relevant and appropriate because the residues are sufficiently similar to hazardous waste and some remedial alternatives might require closure as outlined in this standard.

TABLE A.1-3 (continued)

RCRA Subtitle C (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Container Storage, 40 CFR Part 264 Subpart I 40 CFR Part 264.171 - 178 (OAC 3745-55-71 through -78).	Containers of RCRA hazardous waste must be: • Maintained in good condition; • Compatible with hazardous waste to be stored; • Closed during storage (except to add or remove waste); and • Managed in a manner that will not cause the container to rupture or leak. Storage areas must be inspected weekly for leaking and deteriorated containers and containment systems. Containers must be placed on a sloped, crack-free base, and protected from contact with accumulated liquid. A containment system with a capacity of 10 percent of the volume of the largest container of free liquids must be provided. Spilled or leaked waste must be removed in a timely manner to prevent overflow of the containment system. Incompatible materials must be separated. Incompatible materials stored near each other must be separated by a dike or other barrier. At closure, hazardous waste and residue from the containment system must be removed, and containers, liners, bases, and soils must be removed or decontaminated.	Relevant and Appropriate (This requirement will be applicable to non-excluded solid wastes that exhibit a hazardous characteristic.)	These requirements are relevant and appropriate for alternatives utilizing containers for temporary storage or storage before disposal. These requirements are relevant and appropriate because the residues in the Silo are sufficiently similar to hazardous waste.

TABLE A.1-3 (continued)

RCRA Subtitle C (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Tank Systems, 40 CFR Part 264 Subpart J (OAC 3745-55-91 through 96).	Design, operating standards, and inspection requirements for tank units within which hazardous waste is stored or treated. Includes the following: • Tank design must be compatible with the material being stored. • Tank must be designed and have sufficient strength to store or treat waste in order to ensure that it will not rupture or collapse. • Tank must have secondary containment that is capable of detecting and collecting releases to prevent migration of wastes or accumulated liquids to the environment.	Relevant and Appropriate (This requirement will be applicable to non-excluded solid wastes that exhibit a hazardous characteristic.)	Design criteria, operating standards, and inspections for tank treatment units might be relevant and appropriate for alternatives utilizing treatment or storage in a tank prior to disposal. These requirements are relevant and appropriate because the residues in the Silo are sufficiently similar to hazardous waste.
Closure Requirements for Tanks, 40 CFR Part 264.197 (OAC 3745-55-97).	At closure, the facility owner must do the following: • Remove waste residues; • Remove or decontaminate tank system components; • Remove or decontaminate contaminated soils and structures; • Manage all of the above as hazardous wastes; and • If all contaminated soils cannot be removed, meet the landfill requirements of 40 CFR Part 264.310.	Relevant and Appropriate (This requirement will be applicable to non-excluded solid wastes that exhibit a hazardous characteristic.)	Silo 3 is a tank, according to the definitions of 40 CFR Part 264.10, which contains wastes sufficiently similar to hazardous waste. These requirements are relevant and appropriate because the circumstances and wastes subject to potential release are similar to the releases that RCRA is designed to address. These standards will also pertain to closure of any tanks and appurtenances used to store or treat these residues during remediation.

TABLE A.1-3 (continued)

RCRA Subtitle C (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Miscellaneous Units, 40 CFR Part 264 Subpart X (40 CFR 264.601, .602 and OAC 3745-57-91 and 92).	Environmental performance standard, monitoring, inspection, and post-closure care for treatment in miscellaneous units as defined in 40 CFR Part 260.10.	Relevant and Appropriate (This requirement will be applicable to non-excluded solid wastes that exhibit a hazardous characteristic.)	Miscellaneous units might be utilized under various alternatives to remediate waste that is sufficiently similar to hazardous wastes.
Corrective Action for Solid Waste Management Units (SWMUs), 40 CFR Part 264 Subpart S and 40 CFR Part 264.552,.553.	Corrective action management units (CAMUs) might be designated at the site as areas where remediation wastes (solid, hazardous, or contaminated media and debris) might be placed during the process of remediation. Temporary units consisting of tanks and container storage units might be used to store and treat hazardous waste during the process of corrective action.	Relevant and Appropriate (This requirement will be applicable to non-excluded solid wastes that exhibit a hazardous characteristic.)	During the process of remediation, waste materials might require temporary management in containment buildings, temporary units, stockpiles, or other land based units for the purpose of staging, treating or disposing the material. Materials generated from remediation of the Silo 3 material are considered remediation wastes. Some of the waste material might exhibit a RCRA characteristic, or otherwise be sufficiently similar to hazardous waste to make this requirement relevant and appropriate.

TABLE A.1-3 (continued)

RCRA Subtitle C (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Radiation Dose Limit (All Pathways), Proposed 10 CFR Part 834.	The exposure of members of the public to radiation sources as a consequence of all routine DOE activities shall not cause, in a year, an EDE greater than 100 mrem from all exposure pathways.	To be considered	Radiation sources from this OU (i.e., a DOE-owned facility) might contribute to the total dosage to members of the public.
CAA	Requirement	ARAR/TBC	Rationale for Implementation
Control of Fugitive Dust, OAC 3745-17-08.	Visible emissions of fugitive dust generated during grading, loading, or construction operations and other practices that emit fugitive dust shall be minimized or eliminated.	Relevant and Appropriate	The implementation of remedial action alternatives will require the movement of dirt and other material likely to result in fugitive dust emissions. This requirement is relevant and appropriate because the FEMP is not located in an area subject to this regulation.
Prevention of Air Pollution Nuisance, ORC 3704.01-.05 and OAC 3745-15-07.	Measures shall be taken to adopt and maintain a program for the prevention, control, and abatement of air pollution in order to protect and enhance the quality of the state's air resource so as to promote the public health, welfare, and economic vitality of the people of the state. The emission or escape into open air from any source whatsoever of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, odors, and combinations of the above in such a manner or in such amounts as to endanger the health, safety, or welfare of the public or to cause unreasonable injury or damage to property shall be declared a public nuisance and is prohibited.	Applicable	During the remediation process, some potential exists for emissions of radionuclides and toxic chemicals to the air, which might endanger individuals or damage property.

TABLE A.1-3 (continued)

CAA (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Control of Visible Particulate Emissions from Stationary Sources, OAC 3745-17-07.	Discharge of particulate emissions of a shade or density greater than 20 percent opacity into ambient air from any stack is prohibited. Transient limits are included in this regulation.	Applicable	Treatment operations for various alternatives might result in the release of particulate material.
Permit to Install, OAC 3745-31-05(A)(3).	The director shall issue a permit to install if he/she determines that the installation or modification and operation of the air contaminant source will employ the best available technology.	Relevant and Appropriate	Although an administrative permit to install is not required for alternatives involving treatment, the substantive requirements of this section must be met by employing Best Available Technology (BAT) for treating particulate and other off-gas emissions.

TABLE A.1-3 (continued)

CAA (continued)	Requirement	ARAR/TBC	Rationale for Implementation
Restrictions on Particulate Emissions from Industrial Processes, OAC 3745-17-11.	This requirement establishes numerical emission release limits for particulate material from industrial sources. Any source (operation, process, or activity) shall be operated so that particulate emissions do not exceed allowable emission rates specified in this regulation [based on processing weights (Table 1) or uncontrolled mass rate of emissions (Figure II) of OAC 3745-17-11]. A source complies with Table 1 requirements if its rate of particulate emission is always equal to or less than the allowable rate of particulate emission based on the maximum capacity of the source: Process Rate at Maximum Capacity (lb/hr) — Allowable Rate of Particulate Emission (lb/hr)[1] 100 — 0.551 200 — 0.877 400 — 1.40 600 — 1.83 800 — 2.22 1000 — 2.58 [1] Excerpted from Table 1 of OAC 3745-17-11.	Applicable	Treatment operations for various alternatives might result in release of particulate material that might exceed these standards.

TABLE A.1-4

OTHER REQUIREMENTS FOR SILO 3 REMEDIAL ACTION ALTERNATIVES

Title	Requirement	Rationale for Implementation
OSHA Worker Protection Requirements, 29 CFR Parts 1904 and 1910.	Establishes requirements to protect workers who could be exposed to radiation, noise, hazardous wastes, or other contaminants or hazards at the remediation site.	This OU is a remediation site under CERCLA. Compliance with 29 CFR Part 1910.120 is required for sites undergoing remediation by 40 CFR Part 300.150.
DOT Requirements for Transportation of Hazardous Materials, 49 CFR Parts 171-173, 177, 178.	Hazardous materials may not be transported on public highways except in accordance with these regulations: • Part 171, General Requirements. • Part 172, this part establishes shipping papers, marking, labeling, placarding, and emergency response information requirements. • Part 173, this part establishes packaging and other shipping requirements for hazardous materials, including radioactive materials. • Part 177, Requirements of the Transporter. • Part 178, Specifications for Shipping Containers.	Applicable to those alternatives which involve transportation of the waste materials off-site. Radioactive materials and materials sufficiently similar to hazardous wastes might be shipped off-site.
Highway Improvement Act of 1982, 23 USC 127.	Establishes vehicle weight limits for interstate highways.	Applicable to those alternatives which involve transportation of the waste materials off-site.
Hazardous Materials Transportation Act, 49 USC 1801-1812.	Establishes requirements for minimizing environmental impacts of spills or releases of hazardous materials.	Applicable to those alternatives which involve transportation of the waste materials off-site. Radioactive materials and materials sufficiently similar to hazardous wastes might be shipped off-site.

TABLE A.1-4 (continued)

Title	Requirement	Rationale for Implementation
NTS Waste Acceptance Criteria.	Establishes which wastes may be disposed at a facility.	The NTS waste acceptance criteria would be applicable to disposals at the NTS. NTS operates under DOE Order 435.1, "Radioactive Waste Management."
National Historic Preservation Act, 16 USC 470 et seq.	Protects sites listed or eligible for listing in the National Register of Historic Places.	Required by law for the alternatives affected.
Archaeological and Historic Preservation Act, 16 USC 469.	Preserves artifacts and data associated with archaeological finds.	Required by law for the alternatives affected.
American Indian Religious Freedom Act, 42 USC 1996.	Provides for tribal access by native peoples to grave sites and sites of cultural, symbolic, or religious significance.	Required by law for the alternatives affected.
Native American Graves Protection and Repatriation Act, 25 USC 3001.	Provides for return of human remains and cultural objects from Native American graves to affiliated tribes.	Required by law for the alternatives affected.
Protection and Enhancement of Cultural Environment, Executive Order 11593.	Requires inventory of site for potential historic places for eligibility in the National Register of Historic Places.	Required by law for the alternatives affected.
Fish and Wildlife Coordination Act, 16 USC 66 et seq.	Requires consultation with other state agencies on activities that might affect any body of water for the conservation of fish and wildlife resources.	Required by law for the alternatives affected.

TABLE A.1-4 (continued)

Title	Requirement	Rationale for Implementation
Archaeological Resources Protection Act, 16 USC 470 (a).	Requires permit for removal of any archaeological resources from federal lands.	Required by law for the alternatives affected.
Antiquities Act and Historic Sites Act, 16 USC 431-433 and 16 USC 461-467.	Requires identification and preservation of cultural resources on federal lands; includes natural landmarks.	Required by law for the alternatives affected.
Farmland Protection Policy Act, 7 USC 4201 et. Seq.	Requires protection and maintenance of farmland for its beneficial use as a national resource.	Required by law for the alternatives affected.
Occupational Radiation Protection, 10 CFR Part 835.	Provides standards for occupational radiation protection of workers at DOE facilities.	Required by law for safety and worker protection at DOE facilities (replaces former DOE Order 5480.11).
DOE Order	**Title**	**Rationale for Implementation**
5400.3	Hazardous and Mixed Waste Program	Contractual obligation for activities at DOE facilities.
5400.5	Radiation Protection of the Public and the Environment	Contractual obligation for activities at DOE facilities.
451.1A	NEPA Compliance Program	Contractual obligation for activities at DOE facilities.
5480.1B	Environmental, Safety, and Health Program for DOE Operations	Contractual obligation for activities at DOE facilities.
460.1A	Packaging and Transportation Safety	Contractual obligation for activities at DOE facilities.
460.2	Departmental Materials Transportation and Packaging Management	Contractual obligation for activities at DOE facilities.

TABLE A.1-4 (continued)

DOE Order	Title	Rationale for Implementation
5480.4	Environmental Protection, Safety, and Health Protection Standards	Contractual obligation for activities at DOE facilities.
440.1A	Worker Protection for DOE Federal and Contractor Employees	Contractual obligation for activities at DOE facilities.
435.1	Radioactive Waste Management	Contractual obligation for activities at DOE facilities.
414.1	Quality Assurance	Contractual obligation for activities at DOE facilities.
430.1A	Life Cycle Asset Management	Contractual obligation for activities at DOE facilities.

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APPENDIX B

TRANSPORTATION RISK EVALUATION FOR SILO 3 REMEDIAL ACTION

APPENDIX B
SILO 3 RADTRAN5® EVALUATION

This section evaluates the radiological risk posed to the general public and workers by the routes proposed for transporting untreated Silo 3 material from the FEMP to an offsite disposal facility. For the purpose of the evaluation, Envirocare of Utah, Inc. (Envirocare) was used as a representative permitted commercial disposal facility (PCDF) . Fluor Fernald, Inc. (Fluor Fernald) evaluated one direct rail route to Envirocare and one direct truck route to Envirocare. A discussion of these routes is presented below. For both transportation options, Silo 3 material will be loaded into soft-sided containers that will be overpacked into cargo containers or sea/lands for ease of handling and shipping operations. The evaluation assumed that no pretreatment was provided prior to packaging

TRANSPORTATION OPTIONS

Direct Rail Shipments to Envirocare of Utah, a representative PCDF

For direct rail shipments, nine soft-sided containers will be placed into an overpack container (cargo container or sea/land). Each railcar shipment will consist of four overpack containers per flatbed railcar. Retrieval and shipping operations will result in the need for an estimated 1,700 soft-sided containers. With nine soft-sided containers per overpack container, 189 overpack containers and 48 railcar shipments will be required to transport Silo 3 material to Envirocare.

Railcar shipments of Silo 3 material will follow the same route as the unit trains used for shipment of OU1 WPRAP material.

Direct Truck Shipments to Envirocare of Utah a representative PCDF

For direct truck shipments, eight soft-sided containers will be placed into an overpack container (cargo container or sea/land). Each truck shipment will consist of one overpack container. Retrieval and shipping operations will result in the need for an estimated 1,700 soft-sided containers. With eight soft-sided containers per overpack container, 213 truck shipments will be required to transport Silo 3 material to Envirocare.

The proposed truck route to Envirocare consists of traveling I-74 and I-275 through Ohio and Indiana to I-75/I-71 in Kentucky to I-64 through Indiana and Illinois to I-70 through Missouri to I-29 up through Iowa to I-80 through Nebraska, Wyoming, and Utah to Envirocare.

This route passes through the following major cities: Louisville, Kentucky when transferring from I-71 to I-64; St. Louis, Missouri when transferring from I-64 to I-70; Columbia on I-70 through Missouri; Kansas City, Missouri when transferring from I-70 to I-29; St. Joseph on I-29 through Missouri; Omaha, Nebraska when transferring from I-29 to I-80; Lincoln on I-80 through Nebraska; Cheyenne on I-80 through Wyoming; and Salt Lake City on I-80 through Utah.

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 1 presents the user-defined package-specific and vehicle-specific parameters associated with the proposed transportation routes.

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TABLE 1
PACKAGE-SPECIFIC AND VEHICLE-SPECIFIC PARAMETERS
FOR RADTRAN5® ANALYSIS

Parameter	DIRECT TRUCK	DIRECT RAIL
Number of Shipments	213	48
Number of Overpack Containers per Shipment	1	4
Dose Rate 1 m from Package (mrem/hr)	2.5	2.5
Characteristic Package Dimension (m)	7.08	7.08
Dose Rate 1 m from Vehicle (mrem/hr)	2.5	2.5
Characteristic Vehicle Dimension (m)	7.08	28.32
Number of Crew Members	2	2
Average Distance from Package to Crew Members (m)	7.62	100
Crew View Package Dimension (m)	3.56	3.56

Table 2 presents the radionuclide content for each shipping alternative. For truck transportation, it is assumed that eight - 3 yd^3 soft-sided containers are placed in an overpack container, such as a cargo container or sea/land, for a total of 24 yd^3 of Silo 3 material per overpack container. For rail transportation, nine - 3 yd^3 soft-sided containers are placed in an overpack container for a total of 27 yd^3 of Silo 3 material per overpack container.

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 3 and 4 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.

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TABLE 2
RADIONULCIDE CONTENTS FOR TRANSPORTATION OPTIONS

Radionuclide	Raw Material pCi/g	Curies per Overpack Container	
		Truck	Rail
Ac-227	925	1.36E-02	1.53E-02
Ac-228	842	1.24E-02	1.39E-02
B-210	3,480	5.11E-02	5.75E-02
B-211	925	1.36E-02	1.53E-02
Bi-212	367	5.39E-03	6.07E-03
Bi-214	3,870	5.69E-02	6.40E-02
Fr-223	13	1.91E-04	2.15E-04
Pa-231	627	9.21E-03	1.04E-02
Pa-234	3	4.41E-05	4.96E-05
Pa-234m	1,780	2.62E-02	2.94E-02
Pb-210	3,480	5.11E-02	5.75E-02
Pb-211	925	1.36E-02	1.53E-02
Pb-212	367	5.39E-03	6.07E-03
Pb-214	3,870	5.69E-02	6.40E-02
Po-210	3,480	5.11E-02	5.75E-02
Po-211	3	4.41E-05	4.96E-05
Po-212	85	1.25E-03	1.41E-03
Po-214	3,870	5.69E-02	6.40E-02
Po-215	925	1.36E-02	1.53E-02
Po-216	367	5.39E-03	6.07E-03
Po-218	3,870	5.69E-02	6.40E-02
Ra-223	925	1.36E-02	1.53E-02
Ra-224	367	5.39E-03	6.07E-03
Ra-226	3,870	5.69E-02	6.40E-02
Ra-228	406	5.97E-03	6.71E-03
Rn-219	925	1.36E-02	1.53E-02
Rn-220	367	5.39E-03	6.07E-03
Rn-222	3,870	5.69E-02	6.40E-02
Th-227	912	1.34E-02	1.51E-02
Th-228	747	1.10E-02	1.24E-02
Th-230	60,200	8.85E-01	9.95E-01
Th-231	117	1.72E-03	1.93E-03
Th-232	842	1.24E-02	1.39E-02
Th-234	1,780	2.62E-02	2.94E-02
Tl-207	922	1.36E-02	1.52E-02
Tl-208	132	1.94E-03	2.18E-03
Tl-210	1	1.47E-05	1.65E-05
U-234	1,730	2.54E-02	2.86E-02
U-235	117	1.72E-03	1.93E-03
U-238	1,780	2.62E-02	2.94E-02

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TABLE 3
REGIONAL FRACTION OF ACCIDENT SEVERITY OCCURENCES – TRUCK

Severity Category	Rural	Suburban	Urban
1	0.462	0.435	0.583
2	0.302	0.285	0.382
3	0.176	0.221	0.0278
4	0.0403	0.0506	0.00636
5	0.0118	0.00664	0.000742
6	0.00647	0.00174	0.000146
7	0.000571	0.0000672	0.0000113
8	0.000113	0.00000593	0.000000994

TABLE 4
REGIONAL FRACTION OF ACCIDENT SEVERITY OCCURENCES – RAIL

Severity Category	Rural	Suburban	Urban
1	0.356	0.313	0.572
2	0.214	0.188	0.343
3	0.385	0.451	0.0772
4	0.0385	0.0451	0.00772
5	0.00641	0.00338	0.000514
6	0.000648	0.000163	0.0000186
7	0.000342	0.0000376	0.00000857
8	0.0000641	0.00000313	0.000000715

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 airborne, and the fraction of airborne material that can become respirable. The accident release fractions for untreated Silo 3 material is presented in Tables 5 and 6 for rail and truck, respectively.

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TABLE 5
ACCIDENT RELEASE FRACTIONS - RAIL

Severity Category	Release Fraction	Airborne Fraction	Respirable Fraction
1	0.0	N/A	N/A
2	0.01	4.94E-06	1
3	0.1	1.98E-05	1
4	1	5.21E-05	1
5	1	1.26E-04	1
6	1	2.50E-04	1
7	1	4.04E-04	1
8	1	4.93E-04	1

TABLE 6
ACCIDENT RELEASE FRACTIONS - TRUCK

Severity Category	Release Fraction	Airborne Fraction	Respirable Fraction
1	0.0	N/A	N/A
2	0.01	6.0E-06	1
3	0.1	2.0E-05	1
4	1	8.0E-05	1
5	1	2.0E-04	1
6	1	4.0E-04	1
7	1	1.0E-03	1
8	1	2.0E-03	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.

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Table 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.

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TABLE 7
ESTIMATED NON-RADIOLOGICAL FATALITIES

	Estimated Non-Radiological Fatalities	
Route	Non-Occupational	Occupational
Direct Truck	0.0624	0.0177
Direct Rail	0.00782	0.000536

Table 8 presents data on the estimated dose received by the maximally exposed individual resulting from incident-free transport of Silo 3 material and the estimated dose of the maximally exposed individual resulting from a hypothetical accident. The estimated dose from incident-free transport is the sum of the individual doses received by each shipment of Silo 3 material. The estimated dose resulting from a hypothetical accident is based on an evacuation time of 24-hours for an individual originally standing 33 meters away from a Severity Class 8 accident that results in a total release of material.

TABLE 8
ESTIMATED DOSE - MAXIMALLY EXPOSED INDIVIDUAL

Route	Incident-Free Transport (REM)	Hypothetical Accident (REM)
Direct Truck	2.99E-05	0.826
Direct Rail	3.24E-05	0.916

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.

$$LCF = H_E \bullet CRF \quad \text{(Eq. 1)}$$

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 members of the public is 5×10^{-4} per rem. These values are used in the RADTRAN5® computer model and are from the latest edition of ICRP-30.

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Table 9 presents the estimated ILCRs calculated for the maximally exposed individual resulting from the dose received during incident-free transportation and a hypothetical accident. The hypothetical accident assumes a worst case (low probability, high consequence) accident with full release of Silo 3 material from packaging. The probability of this accident occurring is $9.54X10^{-7}$ during rail transportation and $2.03X10^{-5}$ during truck transportation. Using as an example the estimated dose of 0.826 rem for a hypothetical accident involving shipment of the Silo 3 material by direct truck to Envirocare of Utah, the ILCR for the hypothetical accident, *without considering the low probability of the accident occurring,* is calculated to be 4.13×10^{-4}. This equates to an additional 1 in 2,420 chance of the maximally exposed individual developing cancer over a lifetime.

TABLE 9
INCREMENTAL LIFETIME CANCER RISK - MAXIMALLY EXPOSED INDIVIDUAL

Route	Incident-Free Transport		Hypothetical Accident	
	Dose (REM)	ILCR	Dose (REM)	ILCR
Direct Truck	2.99E-05	1.5E-08	0.826	4.13E-04
Direct Rail	3.24E-05	1.62E-08	0.916	4.58E-04

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APPENDIX C

COST ANALYSIS
FOR SILO 3 REMEDIAL ACTION

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PROPOSED PLAN COST COMPARISON

The prices identified below include inflation

CURRENT REMEDY (Treatment Off-Site):

Capital Costs:	$13,321,280
Engineering and Project Management:	$8,003,753
Construction Management and Startup:	$2,843,809
Operations and Maintenance (O&M):	$3,116,123
Transportation and Disposal:	$10,386,412
Shutdown:	$144,617
Total	**$37,815,994**

ALTERNATE REMEDY (Non-Treatment)

Capital Costs:	$13,321,280
Engineering and Project Management:	$8,003,753
Construction Management and Startup:	$2,843,809
Operations and Maintenance (O&M):	$3,123,880
Transportation and Disposal:	$3,353,161
Shutdown:	$144,617
Total	**$30,790,500**

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GENERAL ASSUMPTIONS:

- The Alternate Remedy cost summary is based on the May 2002 baseline.
- The Current Remedy cost summary is based on the May 2002 baseline, with exception of sampling and disposal costs. Sampling costs have been deleted for this remedy, since sampling is not required to approve the material for transport. Disposal costs are based on a November 2001 unsolicited proposal from a PCDF for off-site treatment and disposal of the Silo 3 material.
- Silo 3 facility design and processes (retrieval, conveyance, packaging, etc.) do not change from the current baseline.
- 5,088 yd^3 Silo 3 material in-situ.

CAPITAL COSTS

- Capital Costs include long-lead procurements and the Silo 3 construction subcontract costs (including equipment and labor). Note: Construction management costs are not included.
- Silo 3 facilities include the silo enclosure, the retrieval facility (excavator room), packaging facility, and cargo containment.

ENGINEERING AND PROJECT MANAGEMENT

- Project Management costs include Fluor Fernald project management activities and Jacobs Engineering Group project closeout.
- Engineering costs include both Jacobs Engineering Group (Designer of Record) and Fluor Fernald scope.
- Jacobs scope includes the development of conceptual, preliminary and final design, safety basis documentation and Title III (construction support) documentation.
- Fluor Fernald scope includes oversight of the Jacobs design effort, conduct of design data development laboratory testing, development of the Remedial Design Package and Health and Safety Plan, and preparation of long-lead procurement documentation.

CONSTRUCTION MANAGEMENT AND STARTUP

- Construction Management includes construction management activities, such as infrastructure coordination, planning and bidding support, subcontract oversight and acceptance testing.

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- Startup includes startup management activities, development of operating procedures, maintenance plans, operations training, and system operability test (SOT) procedures, conduct of training, SOTs, and the readiness review.

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OPERATIONS AND MAINTENANCE

- Includes the access and retrieval of the Silo 3 material, packaging and preparation of the material for shipment.
- Pneumatic retrieval through the existing manways on the Silo 3 dome.
- Installation of a reinforced concrete framework around the silo wall and removal of a silo wall section to allow access for mechanical excavation.
- Excavator deployed through silo wall opening to mechanically excavate remaining material.
- Packaging of Silo 3 material in 3 yd^3 IP-2 soft-sided containers (1700 soft-sided containers required; assume purchase of 25 extra containers = 1725 soft-sided containers)
- Inner liner/bag used inside the soft-sided package to allow cinching around the fill spout to reduce the spread of contamination (vendor minimum- 2500 bags)
- Loading frames used to give soft-sided container shape during filling. Assuming rent two frames during Startup and an additional ten during Operations (twelve frames total during Operations).
- Lifting frames used to lift soft-sided containers and load into cargo containers.
- Operations for the Alternate Remedy also includes sampling of the material to meet the disposal facility waste acceptance criteria (WAC).

Costs

Soft-sided containers (1725 containers @ $355/container) = $612,375

Inner Liners/Bag (2500 bags @ $6.25/bag) = $15,625

Loading Frames (2 frames rented for 3 months; 12 frames rented for 7 months @ $200/frame per month) = $18,000

Lifting Frames (2 frames @ $5,200/frame) = $10,400

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TRANSPORTATION AND DISPOSAL

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Transportation

- Shipping of soft-sided containers in cargo containers. Top loading/side loading cargo containers with removable header used to allow loading in the Silo 3 facility.
- Nine (9) soft-sided containers per cargo container
- Four (4) cargo containers per rail flatcar
- Minimum cargo container fleet (70) leased, allowing containers to be recycled through Envirocare and sent back to Fernald for filling
- Fleet of railcars supplied by railroad
- 48 railcar shipments. Shipped on WPRAP unit train (one train shipped every two weeks)
- Administration of shipment program remains WPRAP scope

Costs

Cargo containers (lease 70 containers @ $7,000/container) = $490,000

Use of railcars (48 railcar shipments at rate of $0.20/mile, with an avg. roundtrip of 4,000 miles/railcar) = $38,400

Shipping (189 cargo containers shipped @ $2,965/container) = $560,385

Disposal

Current Remedy

- Treated Silo 3 material disposed in the Envirocare mixed waste cell.
- Disposal costs include costs to treat and dispose of the material.

Alternate Remedy

- Untreated Silo 3 material disposed in soft-sided containers as over-sized debris at Envirocare.

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Costs

Current Remedy

Disposal [5,088 yd^3 material @ $405.00/ yd^3 ($15.00/ft^3)] = $2,060,640

Alternate Remedy

Treatment and Disposal [5,088 yd^3 material @ $1,688.58/ yd^3 ($62.54/ft^3)] = $8,591,495

SHUTDOWN

- Shutdown includes those activities necessary to place the Silo 3 facilities in a controlled state ready for dismantlement. This includes isolation of utilities to the facilities, removal of gross quantities of hold-up material in equipment and gross decontamination of the equipment and facilities.

- The Operations and Maintenance craft required for shutdown are not included in the costs. These personnel are planned by another Silos subproject, but will support the Silo 3 shutdown activities as needed.

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