FINAL

RECORD OF DECISION AMENDMENT FOR OPERABLE UNIT 4 SILO 3 REMEDIAL ACTIONS

AT THE

UNITED STATES DEPARTMENT OF ENERGY FERNALD CLOSURE PROJECT FERNALD OHIO

40430-RP-0026
Revision 0

August 2003

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DECLARATION STATEMENT

SITE NAME AND LOCATION

Fernald Closure Project -- Operable Unit 4 (OU4), Silo 3, Fernald, Hamilton County, Ohio.

STATEMENT OF BASIS AND PURPOSE

This Record of Decision Amendment for Remedial Actions at Silo 3 [hereinafter called the ROD Amendment] addresses the re-evaluation of the treatment component of the selected remedy for the remediation of the OU4 Silo 3 material at the Fernald Closure Project (FCP) in Fernald, Ohio. The remedial action identified in this ROD Amendment was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) Part 300].

The decision presented herein is based on the information available in the administrative record established and maintained for OU4 in accordance with CERCLA. This decision is also based on input received from the United States Environmental Protection Agency (EPA), the Ohio Environmental Protection Agency (OEPA), and the public during review of the Proposed Plan for Silo 3. The Department of Energy (DOE) has considered all comments received during the public comment period in the preparation of this ROD Amendment.

The State of Ohio concurs with the remedy and the applicable or relevant and appropriate requirements (ARARs) put forth in this ROD Amendment for the remediation of OU4 Silo 3 material.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from OU4, if not addressed by implementing the response action selected in this ROD Amendment, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

On the basis of the evaluation documented in the Proposed Plan for Silo 3, the selected remedy addressing Silo 3, a portion of OU4 at the Fernald Closure Project, has been modified to the following:

- Removal of material from Silo 3 by pneumatic and/or mechanical processes
- Treatment to the extent practical, by addition of a chemical stabilization reagent and a reagent to reduce dispersability
- If above treatment step is deemed unimplementable, a contingency backup would be implemented to double package the waste

In addition, the remedy for Silo 3 continues to include the following components, which were not reevaluated, and remain as documented in the original OU4 ROD, and subsequent Explanation of Significant Differences (ESD) for Silo 3:

- Maintain transportation risk less than $1x10^{-6}$
- Off-site disposal of Silo 3 material at the Nevada Test Site or a permitted commercial facility
- Removal of Silo 3 structure, remediation facilities, and associated systems and components.
- Cleanup of soil in Silo 3 area to meet final remediation levels in Operable Unit 5 ROD
- Appropriate treatment and disposal of all secondary wastes at the Nevada Test Site or an appropriately licensed off-site facility.
- Collection of perched water encountered during remedial activities for treatment at OU5 water treatment facilities.
- 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.

A comparison of the revised Silo 3 remedy and the previous remedy specified in the Silo 3 ESD, using the nine criteria specified by the NCP in 40 Code of Federal Regulations (CFR) Part 300, is presented in Section 5 of this ROD Amendment. The selected remedy satisfies both of the threshold criteria specified by the NCP and represents the best balance between the alternatives with respect to the five primary balancing criteria. This remedy will achieve substantial risk reduction by removing the sources of contamination, treating the material that poses the highest risk, shipping the treated material off-site for disposal, and managing the remaining contaminated soils and debris consistent with the site-wide strategy for the Fernald Closure Project.

STATUTORY DETERMINATIONS

As documented in Section 6 of this ROD Amendment, the selected remedy satisfies all of the statutory requirements specified by the NCP [40 CFR Part 300.430(f)(5)(ii)]. The selected remedy is protective of human health and the environment, complies with all federal and state requirements that are legally applicable or relevant and appropriate to the remedial action. This remedy uses permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, is cost effective, and adequately addresses the statutory preference for remedies which include treatment as a principal element.

The selected remedy includes treatment to reduce the dispersability and mobility of contaminants, and thereby satisfies the statutory preference for treatment as a principal element. The selected remedy also provides risk reduction proportional to the cost of the remedy. If the treatment step cannot be satisfactorily implemented due to overriding technical or short-term worker risk impediments, then the formal contingency action explained in Section 4 of this ROD Amendment (additional double packaging of materials in the protective shipping containers) is also deemed to provide an appropriate balance of risk reduction, effectiveness, and cost. The contingent remedy satisfies Section 121 requirements and preferences under the site-specific circumstances giving rise to the need for the contingency action.

The Silo 3 remedy defined in this ROD Amendment has costs proportional to its overall effectiveness, and therefore meets the statutory requirement for cost-effectiveness.

This remedy will result in contaminated debris and soil being dispositioned in accordance with the EPA-approved RODs for OU3 and OU5, respectively. This remedy may result in pollutants or contaminants, as defined by CERCLA, [i.e., contaminated soil and debris in the Onsite Disposal Facility (OSDF)] remaining on-site. Therefore, a review will be conducted every five years after commencement of remedial actions to ensure that the remedy continues to provide adequate protection of human health and the environment.

The change documented in the ROD Amendment is bounded by the alternatives evaluated in the original Feasibility Study/Proposed Plan/Environmental Impact Statement (FS/PP/EIS) and the subsequent Supplemental Analyses. Therefore, it is DOE's determination that potential National Environmental Policy Act (NEPA) issues associated with the change have been adequately evaluated and that no additional NEPA documentation or evaluation is necessary.

_____ _____

Robert Warther, Manager — Date
United States Department of Energy – Ohio Field Office

_____ _____

William E. Muno, Director — Date
Superfund Division
United States Environmental Protection Agency – Region V

1 INTRODUCTION

1.1 Background

This Record of Decision Amendment addresses a change to the remedy for Silo 3 at the Fernald Closure Project in Cincinnati, Ohio, as previously described in the 1994 OU4 ROD and the 1998 ESD document for Silo 3. Other components of the selected remedy for OU4 have not been reevaluated and remain as documented in the original OU4 ROD, and its subsequent modifications.

DOE and EPA are implementing the change outlined in this ROD Amendment for Silo 3 because a revised treatment alternative that is fully compliant with applicable regulatory requirements has become available since the 1998 issuance of the Silo 3 ESD. This revised treatment alternative provides reduced cost without any meaningful reductions in either short or long-term remedy effectiveness.

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

1.2 Original OU4 Record of Decision

The decision documented by the original OU4 ROD was based on the information available in the Administrative Record for OU4 and maintained in accordance with CERCLA. The major documents prepared through the CERCLA process include the OU4 Remedial Investigation (RI), the original OU4 FS, and the original Proposed Plan PP for OU4. The original selected remedy of vitrification 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 considered the comments received both during the public comment period for the original FS/PP-Draft EIS and those following issuance of the final EIS. The original OU4 ROD was approved by DOE and EPA in December 1994.

In March 1998, DOE and EPA signed an ESD for Silo 3, which formally approved the shift from vitrification to chemical stabilization/solidification or polymer encapsulation for treating the Silo 3 residues to achieve disposal facility waste acceptance criteria and the associated quantitative Toxicity Characteristic Leachate Procedure (TCLP)-based performance standards adopted by the 1994 ROD.

1.3 Reason for Record of Decision Amendment

Since the Silo 3 ESD was issued in 1998, DOE and EPA have received new information concerning (1) the waste acceptance criteria for the Nevada Test Site disposal facility, and (2) the potential availability of other commercial facilities that can accept the Silo 3 residues for disposal as 11e.(2) regulated materials. This new information demonstrates that it is now permissible to permanently dispose of the Silo 3 residues in an untreated form at the Nevada Test Site, and that a commercial facility may also be able to accept the untreated Silo 3 material in the near future. As previously stated treatment will be applied to the degree reasonably implementable to address the dispersability and mobility of the heavy metals.

Pursuant to Section 117 of CERCLA and the NCP [40 CFR Part 300.435(c)(2)(ii)], a ROD Amendment should be processed when "differences in the remedial or enforcement action, settlement, or consent decree fundamentally alter the basic features of the selected remedy [in the original ROD] with respect to scope, performance, or cost."

DOE is issuing this ROD Amendment as part of its public participation responsibilities under Section 117(a) of CERCLA, and 40 CFR 300.430(f)(2) of the NCP. The intent of this ROD Amendment is to inform the public on the revision of the previously approved remedy for Silo 3 material.

This ROD Amendment summarizes key information that can be found in greater detail in the *Revised Proposed Plan for Silo 3*. This ROD Amendment, along with the PP for Silo 3 and other supporting documentation, will become part of the Administrative Record pursuant to 40 CFR Part 300.825(a)(2). The addresses for the Administrative Record locations are as follows:

Public Environmental Information Center 7400 Willey Road Cincinnati, OH 45013-9402 513-648-7480 Tuesday and Thursday, 7:30 a.m. to 4:30 p.m.	U.S. EPA Region V, SRF-5J 77 W. Jackson Blvd. Chicago, IL 60604 312-886-0992

Key Documents From Administrative Record File

- 1993a, *Remedial Investigation Report for Operable Unit 4*. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. (AR Index Numbers Vol. I-III: U-006-304.15 – 17)
- 1994a. *Feasibility Study for Operable Unit 4*. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. (AR Index Numbers No. U-006-405.3)
- 1994b. *Proposed Plan for Remedial Actions at Operable Unit 4*. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald OH. (AR Index Numbers Vol. I-IV: No. U-006-404.13 –16)
- 1994. *Record of Decision for Operable Unit 4*. EPA ID OH6890008976: ROD ID EPA/ROD/R05-65/287. (AR Index No. U-006-501.5) [abstract at hhtp://www.epa.gov/superfund/sites/rodsites/0504934.htm]
- 1998b. *Final Explanation of Significant Differences for Operable Unit 4 Silo 3 Remedial Action at the Fernald Environmental Management Project*. 40400-RP-0004. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. (AR Index No. U-006-503.11)

2 SITE BACKGROUND

The Fernald Closure Project, formerly known as the Fernald Environmental Management Project and the Feed Materials Production Center, is a 1050-acre DOE facility located approximately 18 miles northwest of Cincinnati. Fernald, Ohio is a small rural community located just south of the FCP. The FCP is a government-owned facility that operated from 1952 to 1989 providing in excess of 500 million pounds of high-purity uranium metal products in support of U.S. Defense initiatives. In 1992 the site was renamed the Fernald Environmental Management Project and the mission was formally changed to environmental restoration under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund. Its current name, the Fernald Closure Project, was adopted in 2003 to reflect a continuing emphasis on the completion of restoration activities and achieving the final closure end state safely and efficiently.

To facilitate restoration, the CERCLA work scope for the 1,050-acre facility was divided into five operable units: the waste pits (Operable Unit 1); other waste units (Operable Unit 2); the production area facilities and legacy-waste inventories (Operable Unit 3); Silos 1&2 and Silo 3 (Operable Unit 4); and contaminated environmental media (Operable Unit 5).

The selected remedial actions documented in the RODs for the five operable units include: production facility decontamination and dismantlement (D&D); on-site disposal of the majority of contaminated soil and D&D debris; off-site disposal of the contents of the two K-65 silos (Silos 1&2), Silo 3, waste pit material, legacy waste inventories, and limited quantities of soil and D&D debris not meeting on-site waste acceptance criteria; and treatment of contaminated groundwater to restore the affected portions of the Great Miami Aquifer underlying the FCP. Ultimately, approximately 975 acres of the 1,050-acre property will be restored to beneficial use as an undeveloped park, and approximately 75 acres will be dedicated to the footprint of the On-site Disposal Facility. Contaminated portions of the aquifer will be restored to beneficial use as a drinking water supply, and long-term stewardship actions will be put in place consistent with the final designated land use.

2.1 Overview of Silo 3

Silo 3, located adjacent to the K-65 silos (Silos 1&2) on the western periphery of the site, is an unbermed concrete silo that contains 5,088 cubic yards of cold metal oxides, a by-product material generated during Fernald's uranium processing operations. The predominant radionuclide of concern identified within the material is thorium-230, which is produced from the natural decay of uranium-238. The overall objective of the Silo 3 remedial action is to safely retrieve the residues from the concrete silo and package and transport the materials for off-site disposal in a manner compliant with regulatory requirements.

The materials contained in Silo 3 consist of relatively dry, powder-like residues that were placed in the silo over the time period 1954 to 1957. The residues consist of the metallic and non-metallic impurities that remained following the extraction of uranium from ore and ore concentrates in Fernald's refinery operations during the mid-1950s. The residues were prepared for storage following a volume reduction and concentration step known as calcining, which is a roasting process in the presence of lime that serves to remove moisture and convert the impurities to their more stable (less leachable) oxide form. Following calcining, the dry residues were pneumatically conveyed to Silo 3 for longer-term interim storage as part of DOE's ongoing custodial responsibility for the materials.

Although both residues share similar uranium processing origins and the same regulatory status, the Silo 3 residues have different engineering properties and are radiologically different from the Silos 1&2 K-65 residues. As "cold" residues (a term of engineering convenience used to reflect the residual radium-bearing content of the residues), the Silo 3 materials have a much lower radium content than the K-65 materials, and therefore Silo 3 exhibits a much lower direct radiation field and has a substantially lower radon-222 emanation rate compared to Silos 1&2. The K-65 materials in Silos 1&2 are also moisture-rich, silty, and clay-like materials, whereas the Silo 3 materials are dry and powdery. Ambient moisture contents for the materials in Silo 3 range from 3 to 10 percent by weight, which reflect their dry condition.

On an activity basis, the predominant radiological constituent in the Silo 3 material is thorium-230. The thorium contaminated Silo 3 residues do not present the same level of direct radiation exposure potential as the radium-bearing Silos 1&2 residues, and exhibit significantly lower emissions of radon gas (which forms as a radium decay product). However, the residual thorium content and the relatively dry powdery condition of the Silo 3 residues together represent a dispersability hazard and an inhalation and ingestion hazard to workers and the public if proper control and containment measures are not in place during material handling and transportation steps.

DOE has designated the residues contained in Silo 3 and Silos 1&2 as Section 11e.(2) byproduct materials under the Atomic Energy Act of 1954, as amended (AEA). This regulatory classification acknowledges the origin of the materials and identifies that they consist of tailings and wastes that were produced by the extraction and concentration of uranium from ores that were processed primarily for their source material content. As 11e.(2) byproduct materials, the residues are statutorily excluded from the definition of solid and hazardous waste under the Resource Conservation and Recovery Act (RCRA) of 1976; this statutory exclusion is described in the RCRA regulations under 40 CFR 261.4(a)(4). Specific regulatory requirements for management of the byproduct materials are defined through the AEA regulations and accompanying policies and directives.

As a point of reference, although they are statutorily excluded from formal RCRA hazardous waste definitions and administrative requirements, the Silo 3 residues do contain sufficient quantities of four RCRA regulated metals (arsenic, cadmium, chromium, and selenium) such that they can exceed RCRA thresholds for leachability as measured through the RCRA TCLP) laboratory test. As explained further below, this condition was a consideration in establishing remedy-specific quantitative performance levels in the 1994 Operable Unit 4 ROD for rendering the Silo 3 residues suitable for off-site disposal through treatment.

2.2 Purpose and Need for Decision

Facilities and environmental media at the Fernald Closure Project, 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 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.

The EPA has established a formalized risk assessment process 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 concluded in the RI that existing site conditions warrant remedial action.

2.3 Original Selected Remedy for Silo 3 Material

The major components of the selected remedy documented in the original OU4 ROD are:

- Removal of the contents of the 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 Nevada Test Site.
- 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.
- 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 contaminated debris and soils consistent with the RODs for OUs 3 and 5, respectively.

2.4 1998 Silo 3 ESD Modification to the 1994 ROD

In early 1998, an ESD was developed for Silo 3 to replace the vitrification technology with chemical stabilization/solidification or polymer encapsulation as the preferred treatment option for treating the Silo 3 wastes to achieve the TCLP-based waste acceptance limits for off-site disposal. This modification was adopted to address implementability concerns with vitrification that were revealed in pilot scale tests of the technology on surrogate materials chosen to emulate the salient engineering properties of the silos materials.

The Silo 3 ESD, which was signed by DOE and EPA in March 1998, acknowledged that the adoption of a chemical stabilization/solidification or polymer encapsulation alternative for Silo 3 (as a replacement for vitrification) would not be a fundamental change to the original remedy identified in the 1994 ROD, provided that the alternate process continued to meet all remedial objectives and performance standards of the approved ROD for a cost roughly equivalent to the original remedy, and that the remedy includes disposal at a protective, appropriately permitted off-site disposal facility.

[1] This component of the selected remedy was documented in the original Operable Unit 4 record of Decision (ROD) in 1994. However, for purposes of this ROD Amendment the reference has been updated to the most recent revision.

The Silo 3 ESD also acknowledged that the waste treatment step could be implemented either off site or on site to achieve the intended TCLP-based waste acceptance criteria requirement. If the treatment step were to be conducted off site, on-site pretreatment would be conducted at the Fernald Closure Project as necessary to reduce the dispersability of the thorium-bearing particulates and render the material acceptable for transportation. The ESD required that on-site pretreatment, in combination with packaging in accordance with Department of Transportation (DOT) regulations, must reduce the dispersability of the thorium-bearing particulates and result in a transportation risk less than 1×10^{-6} Incremental Life-time Cancer Risk.

The modified Silo 3 remedy specified by the 1998 ESD consisted of:

- Removal of the wastes From Silo 3
- Treatment, either on site or off site using chemical stabilization/solidification or a polymer-based encapsulation process, to stabilize RCRA-regulated metals to meet RCRA TCLP limits and attain disposal facility waste acceptance criteria
- If off-site treatment is employed, off-site shipment must be preceded by on-site pretreatment and/or packaging such that the risk to the public from transportation of the material to the off-site facility is less than 1×10^{-6}
- Off-site disposal at either the Nevada Test Site or a permitted commercial disposal facility
- Removal and disposal of the Silo 3 structure and the waste handling, packaging, and treatment systems
- Cleanup of the soil underlying the Silo 3 area to the final remediation levels defined in the Operable Unit 5 ROD.

2.5 Treatment Criteria for Silo 3 Material

At the time of the 1994 ROD, the Nevada Test Site was the only available disposal location that could accept the vitrified silo materials for permanent disposal. As part of its waste acceptance criteria, the Nevada Test Site required in 1994 that all treated or untreated waste accepted for disposal at the facility -- regardless of its statutory exempt or non-exempt status -- meet TCLP limits for toxicity-characteristic constituents regulated under RCRA. Based on this disposal-facility-specific requirement, the 1994 OU4 ROD adopted the TCLP limits as quantitative performance standards for treating (in this case vitrifying) the materials prior to off-site disposal.

In the 1994 ROD, the RCRA TCLP limits were adopted as performance requirements for waste treatment, due to the requirement that the material meet the Nevada Test Site's formal TCLP-based waste acceptance criteria (versus broader adoption as *applicable* requirements, since the materials continued to retain their statutorily exempt legal status). The Nevada Test Site TCLP limits therefore became the relevant and appropriate performance standard in the 1994 ROD for treating the Silo 3 wastes to achieve an acceptable disposal condition for the four RCRA metals of concern (arsenic, cadmium, chromium, and selenium) contained within the Silo 3 waste.

At the time of the 1998 ESD for Silo 3, the Nevada Test Site waste acceptance criteria limits continued to require that all treated and untreated waste accepted for disposal meet the TCLP limits for RCRA regulated constituents (again regardless of the waste's statutorily exempt or non-exempt RCRA status). The 1998 Silo 3 ESD therefore continued to adopt the facility-specific TCLP limits as a performance standard for designing a satisfactory treatment process to render the Silo 3 residues acceptable for off-site disposal.

3 BASIS FOR MODIFYING THE OU4 RECORD OF DECISION

Since the Silo 3 ESD was issued in 1998, DOE and EPA have received new information concerning (1) the waste acceptance criteria for the Nevada Test Site disposal facility, and (2) the potential availability of other commercial facilities that can accept the Silo 3 residues for disposal as 11e.(2) regulated materials.

3.1 Waste Acceptance Criteria for the Nevada Test Site

In February 2002, the Nevada Test Site, in conjunction with the state and federal regulatory agencies that oversee the facility's waste disposal operations, updated the waste acceptance criteria for the facility. As part of the February 2002 revision, the acceptance requirements for RCRA-regulated materials were clarified. In essence, the revision requires TCLP-based acceptance levels only for those wastes that are statutorily regulated under RCRA. Statutorily exempt materials, such as 11e.(2) materials, no longer need to meet TCLP-based acceptance criteria, provided the waste is otherwise disposed of in a manner that is protective of human health and environment. As part of an eligibility evaluation, a waste profile for each statutorily exempt waste must be reviewed individually to ensure that protective requirements are met for the constituents that would otherwise be regulated under RCRA.

During May 2002, Nevada Test Site regulatory personnel completed a draft waste profile review for the statutorily exempt Silo 3 material, and deemed the material to be acceptable for disposal at the facility without the need for further treatment. A letter indicating the eligibility of the untreated Silo 3 material for disposal at the Nevada Test Site was formally issued by the facility in June 2002, a copy of which is included in the technical supplement to the Proposed Plan.

3.2 Emergence of Potential Commercial Disposal Options for DOE 11e.(2) Materials

Also since the time that the 1998 Silo 3 ESD was prepared, potential commercial disposal options have been identified for disposal of untreated Silo 3 material. Similar to the revised waste acceptance criteria requirements at the Nevada Test Site, a commercial facility would be able to accept Silo 3 material in an untreated state provided the material is deemed eligible for disposal by the regulatory agency, a waste-specific profile review is conducted, and all other waste acceptance criteria requirements that are applicable to the waste are met. For purposes of comparison of alternatives in the Proposed Plan, the Envirocare facility, in Clive, Utah was assumed as a representative permitted commercial disposal facility.

This new development may result in additional off-site disposal site options for DOE and EPA to consider in evaluating disposal at a protective, appropriately permitted off-site disposal facility as allowed by the 1998 ESD. The actual disposal facility will be selected as part of the design process and may include the Nevada Test Site, an appropriately permitted commercial facility that can accept the materials, or a combination of both. In the Proposed Plan, one option (the Nevada Test Site) was utilized to illustrate the costs and logistics of off-site disposal, and permit a fair comparison of the proposed revised remedy with the 1998 Silo 3 ESD remedy (previous remedy).

3.3 Rationale for Proposed Change

The new information summarized above demonstrates that it is now permissible to permanently dispose of the Silo 3 residues in an untreated form at the Nevada Test Site, and that a commercial facility may also be able to accept the untreated Silo 3 materials in the near future. DOE and EPA conclude based on this new information that the TCLP-based waste treatment performance standard, adopted in both the 1994 ROD and the 1998 Silo 3 ESD as a facility-specific criterion for treatment, is no longer necessary for the purposes of maintaining regulatory compliance with disposal facility waste acceptance requirements. DOE and EPA are removing the quantitative TCLP performance standard as a criterion for execution of the Silo 3 remedy.

As a result of this new development, members of the public have expressed a concern that if the primary requirement for treatment (to satisfy waste acceptance criteria obligations) is removed through the proposed ROD Amendment, other secondary benefits of waste treatment -- such as the further incremental control of the dispersability of the Silo 3 material, in the unlikely event of a severe transportation accident that subsequently damages the protective shipping containers during transit -- could be overlooked. DOE and EPA have taken these comments into consideration in the development of the modification to the Silo 3 remedy that is proposed in this document. Similarly, DOE and EPA recognize that, irrespective of the recent waste acceptance criteria revision, any new modifications to the remedy must continue to meet the 1×10^{-6} ILCR transportation risk threshold for the remedy adopted by the 1998 Silo 3 ESD.

4 DESCRIPTION OF SIGNIFICANT DIFFERENCES OR NEW ALTERNATIVES

This section describes the revised Silo 3 remedy, and provides a side-by-side comparison with the components of the previous 1998 ESD remedy for Silo 3. The following section then evaluates the revised remedy against the nine criteria specified in the National Contingency Plan. The focus of the description in this section, and the evaluation in the following section, is on that component of the plan that is proposed to be changed, specifically the treatment portion of the remedy. The previous and the revised remedies are summarized below, and compared in detail in the following sections.

Previous 1998 ESD Remedy

- Removal of the wastes From Silo 3
- Treatment, either on site or off site using chemical stabilization/solidification or a polymer-based encapsulation process, to stabilize RCRA-regulated metals to meet RCRA TCLP limits and attain disposal facility waste acceptance criteria
- If off-site treatment is employed, off-site shipment must be preceded by on-site pretreatment and/or packaging such that the risk to the public from transportation of the material to the off-site facility is less than $1x10^{-6}$
- Off-site disposal at either the Nevada Test Site or a permitted commercial disposal facility
- Removal and disposal of the Silo 3 structure and the waste handling, packaging, and treatment systems
- Cleanup of the soil underlying the Silo 3 area to the final remediation levels defined in the Operable Unit 5 ROD.

Revised Remedy

- Removal of the wastes from Silo 3 (*this element remains unchanged from the previous plan*)
- Treatment, to the degree reasonably implementable, to address material dispersability and metals mobility. Potential implementability and worker exposure concerns with this treatment are discussed under "Contingency Backup Actions in the next section (*change from the previous plan*).
- Double packaging of the untreated waste, as a contingency backup, in the event the selected treatment approach is deemed unimplementable as a result of operational difficulties which cannot be practically overcome (*change from the previous plan*)
- Requirement to maintain the transportation risk to the public of less than $1x10^{-6}$ Incremental Life-time Cancer Risk [ILCR] (*this element remains unchanged from the previous plan*)

- Off-site disposal at either the Nevada Test Site or a permitted commercial disposal facility (*this element remains unchanged from the previous plan*)
- Removal and disposal of the Silo 3 structure and the waste handling, packaging, and treatment systems (*this element remains unchanged from the previous plan*)
- Cleanup of the soil underlying the Silo 3 area to the final remediation levels defined in the Operable Unit 5 ROD (*this element remains unchanged from the previous plan*).

4.1 Detailed Description of the Revised Remedy

Waste Removal. Under the revised remedy the waste will be removed from Silo 3 employing both pneumatic and mechanical systems. These waste retrieval systems remain unchanged from the previous remedy. As a result of the relatively high concentration of thorium-230 (an alpha emitter) and the dry powdery consistency of the waste, special attention will be necessary during design to ensure the construction of waste handling systems, which would minimize the release of particulates from the waste material to the work area or the environment. This same design consideration would be necessary for either the previous or the revised remedy.

To address this concern, containment structures and high efficiency air filtration systems will be employed during waste retrieval. A strict radiological control program will be implemented during all Silo 3 operations to reduce worker exposures to As Low As Reasonably Achievable (ALARA) levels.

This control program will include engineering controls such as the filtration and containment systems, administrative controls such as project specific training and detailed operational procedures for workers, and personnel protective equipment such as protective clothing and air-supplied respirators. A thorough personnel and environmental monitoring program will also be implemented to assess the effectiveness of the controls.

Waste Treatment. As was the case with the previous remedy, the material will be removed from the silo in its dry form. The previous remedy would require the construction and operation of a chemical stabilization/solidification processing system, which includes the wetting of the material and addition of one or several chemical reagents. With the previous plan, the chemical stabilization/solidification step would involve the addition of sufficient chemical reagents and post-treatment testing to ensure the treated waste form no longer exceeded TCLP limits for the four RCRA-regulated metals (cadmium, arsenic, chromium, and selenium) that are of concern with the Silo 3 materials. Under the revised remedy, this chemical processing system will not be constructed; in its place a system will be installed to add a liquid solution to the Silo 3 material as it enters the package, in order to raise the waste's moisture content and reduce its dispersability and mobility.

As previously discussed, the acceptance criteria of the Nevada Test Site have been modified to permit receipt of the Silo 3 waste material in an untreated form. The basis for the modified WAC is recognition of the classification of the material as 11e.(2) byproduct material coupled with the material-specific waste profile review and protectiveness evaluation conducted by the Nevada Test Site regulatory personnel. Full compliance with the DOT transportation requirements, Nevada Test Site waste acceptance criteria, and 1998 Silo 3 ESD requirements pertaining to the risk during routine transportation (i.e., less than 1×10^{-6} ILCR) can be attained by the direct load out, transport, and disposal of the untreated waste material. Bench scale testing applied to Silo 3 materials has identified a potentially cost-effective and implementable approach to providing a beneficial level of treatment to the waste material prior to off-site transport. These tests yielded encouraging results indicating that a liquid solution could be successfully added to the waste as it was loaded into the packages. The results indicate that a meaningful reduction in the dispersability of the waste can be gained through the addition of the liquid to the waste as it is packaged. Considering these results, it is also anticipated that the addition of a chemical stabilization reagent to this same solution could offer some companion benefits of further reducing the mobility of radioactive and non-radioactive RCRA-regulated metals in the waste.

As a result of the test data, the DOE has committed to install the necessary process equipment to add a liquid solution to the waste materials as it is delivered into the final packages. This solution is envisioned to include both a liquid reagent to aid in reducing the dispersablity of the waste material (a material crusting agent, which also raises the moisture content of the material) in the event of an unforeseen severe accident during transport, and a second component (a chemical stabilization agent) to yield a beneficial reduction in the mobility of some, if not all, of the metals present in the Silo 3 residues.

The addition of the additives to treat the waste for dispersability and for metals mobility is being implemented to address concerns expressed by involved stakeholders, and is not a necessary prerequisite to comply with legal ARAR-driven requirements or DOT-driven transportation requirements. As such, the DOE remains committed to applying a "best management practice" effort to ensure the successful addition of the liquid additives to the waste material.

The criteria for addition of liquid additives will consist of operational criteria applied in a best management approach (utilizing the final equipment and operational configuration to apply the specified additive formulation). Given the absence of any regulatory requirement, no analytical criteria (e.g., treated waste metals analyses) are necessary as part of the best management approach to demonstrate the degree of treatment.

Contingency Backup Actions. As previously stated, the DOE has committed to a best effort to successfully implement the addition of the treatment solution to the waste material on the basis of best-available information gleaned from laboratory-scale studies. As such, significant questions remain on the ability to apply this system in a practical and reliable manner to the full-scale waste packaging system. It is believed that the mock up test program will provide more objective data on the viability of such a treatment system and may provide useful information on the means and methods to overcome any or most operational difficulties created by the addition of the liquid solution. Operability concerns associated with the liquid delivery system which have been identified to date include: (1) plugging of the liquid delivery spray nozzles and/or waste delivery chute; (2) inability to get the treated waste product to effectively fill the packages; (3) pull back of moisture laden air into the screw conveyor causing plugging; (4) difficulties created by the mixture of the two chemical additives into a single solution for delivery to the packaging system; and (5) moisture related caking or binding of filters in the air handling equipment.

In the event one or all of these concerns were to materialize during full-scale operations the on-line efficiency, capacity and cost of the remedy would be impacted. For example the plugging of the spray nozzles or the plugging of the conveyor screws would require the shutdown of operations and the performance of intrusive maintenance. Maintenance workers would be required to don fully encapsulating protective clothing and supplied air respirators and then come in direct contact with the waste material. These actions would delay operations and subject workers to potential exposures to thorium bearing material, with resultant schedule and cost increases.

DOE will interact with EPA, OEPA, and the involved stakeholders during the future mock up efforts to implement this treatment system. In the event that one or both of the waste additives cannot be practically applied, DOE will consult with the regulatory agencies and involved stakeholders on the details of the operational difficulties. The results of mock up testing, startup, and initial operations will be made available to EPA, OEPA, and other stakeholders, as will adequate opportunity for input to any decision to alter the scope of treatment or to pursue the contingency plan. Regulatory approval will be obtained prior to finalizing such a decision.

Under the conditions where the costs and/or projected worker exposures associated with the application of one or both of the additives become disproportionate with the potential benefits gained, DOE will cease efforts to apply that portion of the liquid solution to the waste that is causing the operational impediments. If the operational impediments result in the decision to discontinue all steps of the liquid treatment process, then a contingency backup action will be implemented. This contingency action will involve the use of a double packaging system as a backup means to further reduce the potential dispersability of waste material released under a hypothetical severe accident involving material transit. The contingency plan will meet all Remedial Action Objectives, ARARs, and other criteria specified for the Revised Remedy. Upon completion of the previously discussed interaction with the EPA, OEPA, and the public, and receipt of regulatory agency approval, the basis and rationale for the contingency-action decisions will be documented in a formal post-decision memorandum, and will be documented for the public in a Remedial Design Fact Sheet.

Waste Packaging and Shipping. Once the waste is retrieved from the silo it will be transferred by screw conveyor to a load hopper for direct delivery into the selected packaging configuration. The previously described chemical solution will be added as the waste enters the package.

The packaging and mode of transportation utilized remain unchanged from the previous remedy. To represent the range of available configurations, the evaluation documented in the PP assumed that soft-sided containers will be placed into steel Sea/Land containers and placed on trucks for off-site transport. Other packaging configurations and modes of transportation, including direct load onto rail flatbed cars with rail transport to a truck offloading station closer to the disposal facility (intermodal transport) or direct rail transport from the Fernald Closure Project to the disposal facility, are available that would meet transportation risk criteria and DOT regulations. The Nevada Test Site can only receive waste containers by truck, therefore only direct truck transport or intermodal transport with offloading from rail to truck is acceptable for disposal at this location. In the event rail transport were to be implemented as the mode of transportation, dedicated unit trains would be used to the maximum extent practical.

Waste Disposal This component of the remedy remains unchanged from the 1998 Silo 3 ESD remedy. Although the remedy will continue to allow disposal at either the Nevada Test Site or an appropriately permitted commercial disposal facility, a representative waste transportation mode (truck transport) and disposal location (Nevada Test Site) was utilized as the representative option for comparison and costing in the Proposed Plan.

During the design and implementation of the Silo 3 remedy, DOE will select the transportation mode(s) and compliant disposal location(s) that provide the best overall balance of reduced transportation risk and cost effectiveness. Only disposal facilities that meet the regulatory compliance requirements of the CERCLA off-site rule (40 CFR 300.440) will be considered.

Silo Demolition and Soil Cleanup. This component of the remedy remains unchanged from the 1998 Silo 3 ESD remedy. This Silo 3 structure will be demolished with the debris properly disposed of in the On-site Disposal Facility or off site at the Nevada Test Site or an appropriately permitted commercial disposal facility. Contaminated soil underlying the facility will be cleaned up to achieve the final remediation levels in the Operable Unit 5 ROD.

The excavated soil will be disposed of in the On-site Disposal Facility (or off site, as appropriate) depending on whether the On-site Disposal Facility waste acceptance criteria levels for the contaminated soil are met.

5 EVALUATION OF ALTERNATIVES

Comparative evaluations of the revised Silo 3 remedy and the Silo 3 ESD remedy (previous remedy) were conducted employing the nine evaluation criteria defined in the National Contingency Plan as the framework for identifying technical and administrative differences between the alternate plans.

The first two evaluation criteria -- overall protection of human health and the environment and compliance with ARARs -- are considered threshold criteria that must be attained by the selected remedial action. The next five criteria include short-term protectiveness, long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, implementability, and cost.

These criteria are considered primary balancing criteria, which are looked at collectively to arrive at the best overall solution that offers the best balance of tradeoffs among the criteria. The final two criteria -- state acceptance and community acceptance -- are evaluated following receipt of comments on the Proposed Plan, and are incorporated, as appropriate, into the final remedy selection in the ROD Amendment.

The OU4 FS, PP, ROD, and Silo 3 ESD documented a detailed evaluation of a full range of alternatives against these same criteria to arrive at the selected previous remedy contained in the 1998 Silo 3 ESD. The discussion in this section therefore focuses on a specific comparative analysis for the two alternative Silo 3 remedies, aimed at those components that are different.

In addition to the nine criteria comparative analysis, Section 121 of CERCLA and the NCP (40 CFR 300.430) require that the remedy selection process consider and address a statutory preference for remedies that employ treatment to permanently and significantly reduce the volume, toxicity, or mobility of hazardous constituents as a principal element.

The DOE and EPA are required to reach a finding in the proposed amendment to the ROD documenting whether the selected remedy satisfactorily fulfills this statutory preference. This statutory preference is addressed in Section 6 of this ROD Amendment.

As part of the original RI/FS for OU4, formal remedial action objectives were identified to guide the overall remedial action alternative development and evaluation process. The original remedial action objectives for the cleanup of the Silo 3 residues as defined in the OU4 FS Report are:

- 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.

These original remedial objectives remained unchanged in the 1998 Silo 3 ESD and are again being maintained as the basis for the revised remedy. The revised remedy was developed fully considering these formal remedial action objectives.

5.1 Threshold Criterion No. 1: Overall Protection of Human Health and the Environment

Both the previous and the revised remedies provide for the protection of human health and the environment by removing the high concentration waste residues from the site and properly disposing of them at the Nevada Test Site or a permitted commercial disposal facility. Off-site disposal will be conducted in accordance with the waste acceptance criteria for the receiving facility. The representative disposal facility selected for purposes of evaluating the alternate remedies is the Nevada Test Site. The Nevada Test Site incorporates engineering and institutional controls into the facility design and is situated in a climatic, demographic, and hydrogeologic setting that minimizes the potential for exposures to human or environmental receptors. The licensing process for a permitted commercial disposal facility ensures a similar level of protectiveness to the Nevada Test Site through the location, design, and acceptance criteria of the disposal facility.

The Nevada Test Site waste acceptance criteria establishes a set of requirements that must be fulfilled to permit acceptance of a waste stream for safe, protective disposal. DOE submitted a draft profile to the Nevada Test Site describing the untreated Silo 3 residues and has gained approval of the waste steam for disposal at the facility. This approval by the Nevada Test Site was in part based upon a review of the characteristics of the Silo 3 waste and a determination that the disposal of the material untreated would provide a compliant, protective, and permanent disposal solution. A final waste profile must be submitted to the Nevada Test Site prior to shipping the Silo 3 waste. A copy of the general acceptance letter from the Nevada Test Site is provided in the supplement to the Proposed Plan.

Both remedies specify that all surrounding soil will be excavated to meet the final remediation levels in the Operable Unit 5 ROD. The residual risk that will remain at the site following completion of the remedial action is consistent with that described in the original Operable Unit 4 Feasibility Study and would remain unchanged by the implementation of the revised remedy. This residual risk would be expected to be in the range of 10^{-6} to the undeveloped park user as described in the Operable Unit 5 Feasibility Study and ROD.

5.2 Threshold Criterion No. 2: Compliance with ARARs

Both the previous and the revised remedies will attain compliance with ARARs. The ARARs identified in the Operable Unit 4 Feasibility Study and 1994 ROD, and were not changed by the 1998 ESD for Silo 3, and have been maintained as the criteria for the evaluation documented in this ROD Amendment. One requirement has been revised since issuance of the Silo 3 ESD -- the selection of the RCRA TCLP limits as a quantitative performance requirement for treatment of the Silo 3 waste. As described earlier, as a result of a change in the waste acceptance criteria for the Nevada Test Site, the RCRA-regulated metals in the waste no longer need to be treated to attain TCLP levels as a necessary condition for waste acceptance. As a result of this changed condition, the application of this former requirement is no longer considered a relevant criteria for the Silo 3 remedy. With this change, the revised remedy will attain all identified ARARs, and

performance criteria. A detailed compilation of the ARARs for the revised Silo 3 remedy is provided in Appendix A of this ROD Amendment.

5.3 Balancing Criterion No. 1: Long-term Effectiveness and Permanence

The previous remedy and the revised remedy both provide a remedy that is effective in the long term and a permanent solution for the Silo 3 wastes. Both alternatives provide for the removal of the Silo 3 waste from the site and the cleanup of any contaminated soil from the silo area. The waste will be shipped from the site and disposed of at an off-site facility in full compliance with the waste acceptance criteria and any relevant licensing restrictions for the receiving facility. The design of these facilities, in concert with their waste acceptance criteria and regional climatic, demographic, and hydrogeologic setting provide a waste disposal solution that is both effective in the long term and permanent.

The previous remedy provides an incremental increase in long-term effectiveness by including treatment to the TCLP levels as a performance requirement of the remedy. The revised remedy includes the application of a binding agent and a stabilizing reagent to the waste, which is expected to provide a meaningful level of reduction in both the dispersability of the packaged waste and the leachability of the metals. It is not anticipated or expected that the application of this treatment approach will fully reduce the leachability of the four RCRA regulated metals of concern within the Silo 3 waste (arsenic, selenium, chromium, and cadmium) to below TCLP levels in all cases. The additional incremental reduction in metals leachability provided by the previous remedy over and above that anticipated by the proposed approach is not considered significant since the mobility of contaminants in the incoming waste is already a consideration in development of acceptance criteria for the receiving disposal facilities. For both the previous remedy and the revised remedy, disposal in accordance with approved disposal facility waste acceptance criteria will assure that disposal of Silo 3 material will be protective of human health and the environment. The Silo 3 waste will be disposed in the off-site facilities with other byproduct or low level radioactive wastes shipped by other generators with similar characteristics to those exhibited by the treated or untreated cold metal oxides in the silo. Adherence to the waste acceptance requirements of the receiving disposal facility ensures

full compliance with prevailing state and federal environmental and health protection regulations governing the long-term performance of these waste disposal systems.

As previously discussed, any identified contaminated soil in the area of Silo 3 will be cleaned up to attain the final remediation levels in the Operable Unit 5 ROD, consistent with other areas of the Fernald site. These cleanup levels were developed to help ensure the long-term protectiveness and permanence of the Fernald cleanup. These cleanup levels were set following a consensus building process that involved the DOE, regulatory agencies, and the community. These cleanup levels have been designed to provide a site-wide remedy that will reduce the residual risk following cleanup to the range of 10^{-6} to the undeveloped park user. The detailed exposure assumptions underlying this risk analysis can be found in the Operable Unit 5 Feasibility Study and ROD.

5.4 Balancing Criterion No. 2: Reduction of Toxicity, Mobility, or Volume Through Treatment

Both the previous and the proposed remedies provide for treatment of the waste materials prior to disposal at the Nevada Test Site or a permitted commercial disposal location. The previous plan would provide some incremental decrease in the mobility of the waste over that provided by the revised remedy.

This incremental additional decrease is not considered significant for health or environmental reasons and is not required to comply with the acceptance criteria of the receiving facility. The chemical stabilization approach envisioned under the previous plan would provide for an increase (approximately 50 percent) in volume over the revised plan due to the type and quantity of waste additives necessary to ensure attainment of the TCLP limits imposed under the previous remedy. The revised plan contemplates the addition of waste additives to the degree attainable in a practical and implementable manner. Bench scale studies demonstrated that a dilute lignosulfonate solution could be effectively added to the waste as it enters the packages to reduce the dispersability of the material. These tests were aimed at adding the lignosulfonate solution to the waste such that the moisture content of the waste was increased by up to 20 percent. These bench tests proved successful and DOE has committed to applying this system in the revised

remedy. A second chemical reagent, aimed at reducing the leachability of the nonradioactive metals, is also planned to be applied to the waste through the same delivery system. The operability of such a waste additive and liquid delivery system at full scale is not yet proven. As previously discussed, the DOE will make a best effort to ensure the success of the process. In the event the process cannot be applied at full scale, DOE will first attempt to modify or, if need be, eliminate one or both of the additives in the liquid delivery system, if that is the source of the interference. As the next step, in the event the liquid delivery system cannot be successfully operated at all (with or without additives), the contingency action will be implemented following the regulatory and stakeholder consultation process previously described. Under the contingency action, a backup double packaging requirement will be imposed as a tradeoff for elimination of the liquid delivery step.

5.5 Balancing Criterion No. 3: Short-term Effectiveness

The National Contingency Plan identifies the considerations for which the short-term effectiveness criterion should be evaluated as risks to the community during implementation of the alternative, potential impacts to workers during remedial actions, potential environmental impacts during implementation, and time until protection is achieved. Overall, this criterion favors the revised remedy due to its advantages in worker risk and implementation schedule.

Due to the dispersible nature and high thorium-230 content of the Silo 3 material, a primary short-term effectiveness issue is the potential for worker exposures due to Silo 3 material becoming airborne during retrieval, 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. These considerations would be designed into the waste handling systems of both the current and revised remedies.

A key consideration in the analysis of the short-term effectiveness of the two remedies is the risks attributable to the transportation of the packaged materials to the off-site disposal facility.

A detailed transportation risk analysis was completed evaluating the potential risks associated with routine (no accidents) waste transportation and to hypothetical accident scenarios for both the previous and the revised remedies. The following table presents the results of the transportation risk analysis.

RESULTS OF THE TRANSPORTATION RISK ANALYSIS

	Previous Remedy Routine Transport ILCR	**Revised Remedy Routine Transport ILCR**
Truck to NTS	8.3×10^{-10}	1.8×10^{-9}
Rail to Envirocare	2.9×10^{-10}	4.4×10^{-10}
	PreviousRemedy Accident Scenario ILCR	**Revised Remedy Accident Scenario ILCR**
Truck to NTS	3.1×10^{-11}	4.4×10^{-8}
Rail to Envirocare	1.6×10^{-10}	2.3×10^{-7}

Additional details concerning the assumptions, methodology, and results of the analysis are documented in the Silo 3 Proposed Plan.

These risk estimates compare favorably to the criteria of being below a risk of 1×10^{-6} ILCR for routine transportation established by the 1998 Silo 3 ESD. The calculated risk attributable to the revised remedy is slightly higher than the previous remedy due to the increased waste loading in the shipping containers resulting in higher direct radiation levels on the outside of the package.

Operation and maintenance of the additional equipment required for chemical stabilization of leachable metals to meet TCLP levels under the current plan results in increased non-radiological risk (worker injury), and the potential for increased radiological exposures to workers. In addition, operation of the chemical stabilization process results in an incremental increase in short-term environmental impacts attributable to increased generation of secondary waste (e.g. wastewater and solid waste) derived from increased material handling and processing steps.

As will be discussed under the implementability criterion, the chemical stabilization operation in addition to the retrieval and packaging, transportation and disposal operations, increases the operational complexity of the previous remedy over and above the liquid additive system contemplated by the revised remedy. This increased complexity results in increased uncertainty in the schedule for completion of Silo 3 remediation.

5.6 Balancing Criterion No. 4: Implementability

This criterion favors the revised remedy due to less complex 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 cleanup alternatives. Chemical stabilization of the leachable metals for the previous remedy requires additional equipment and unit operations over and above those envisioned to support the proposed remedy. In addition, assuring that the process accomplishes adequate chemical stabilization to meet the TCLP 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 TCLP limits, and the ability to reprocess treated waste failing to meet the limits is also required.

As documented in the 1998 Silo 3 ESD, a primary factor in the selection of the previous 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 thorium-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 the chemical stabilization process included in the ESD remedy, further increases the complexity of the design, operation, process control, and maintenance aspects of the remedy.

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 plan, than those that would be expected by the revised remedy. Some operational challenges are expected during the implementation of the liquid addition system for the revised remedy. As previously stated, DOE expects that these will be overcome during the mock up testing.

The administrative feasibility associated with obtaining the necessary approvals for acceptance at the Nevada Test Site is equivalent for either remedy. The licensing process for the acceptance of the treated waste material at the representative commercial facility (Envirocare) is considered to be more complex.

The schedule for implementation of the previous remedy including design, construction, operations and post-treatment system cleanout and demolition has been estimated at 43 months. The schedule duration to implement the same scope for the revised remedy is estimated at 35 months. The differences are attributable to the added design engineering for the more complex treatment process, and to the added schedule duration to execute the operations and shipping program associated with previous remedy.

5.7 Balancing Criterion No. 5: Cost

A detailed cost evaluation of the previous and revised remedies is documented in the Proposed Plan for Silo 3 and detailed in the Supplement to the Proposed Plan. The accuracy of both estimates is considered +50/-30 percent, consistent with CERCLA guidance. For purposes of comparative analysis, treated waste is assumed to be shipped by truck to the Nevada Test Site for each alternative. The following summarizes the major cost elements for the previous plan and the revised remedy alternatives. Costs associated with the D&D of the Silo 3 structure have not been included. Similarly, the costs for addressing any contaminated soil in the Silo 3 area have been excluded from both options.

Summary Cost Data ($ Million)		
Alternative	**Previous Cleanup Plan**	**Revised Cleanup Plan**
Capital Cost	20.0	14.0
Engineering, Proj. Mgmt., Const. Mgmt. and Startup Cost	15.0	15.0
Operation and Maintenance Cost	7.0	4.0
Transportation and Disposal Cost	11.0	7.0
D&D Cost	2.0	2.0
Total Cost	**55.0**	**42.0**

Due to the incremental life-cycle costs of providing treatment to stabilize arsenic, cadmium, chromium, and selenium to achieve TCLP limits, the estimated cost for the previous remedy is estimated at $13 million greater than the revised plan. These incremental costs include additional capital costs to support the installation of the chemical stabilization system, increased operational costs attributable to additional staff and analytical demand, and increased shipping costs due to the almost 50 percent increase in volume to be shipped under the previous remedy.

It should be noted that the difference between the two alternatives ($13 million) is within the errors expected from estimating (plus 50 percent, minus 30 percent), and therefore should not be heavily relied upon in decision making. While a more precise estimate of the cost differences between the two alternate remedies cannot be made without the benefit of more detailed engineering, it can be reasonably expected that the cost to implement the previous remedy will be higher than that to implement the revised plan. These added costs would be attributable to the added design, construction, operation and demolition scope associated with the more complex treatment approach dictated by the previous remedy.

5.8 Modifying Criterion No. 1: State Acceptance

The OEPA has had an opportunity to review and participate in the revision of the Silo 3 remedy and concurs with the revised remedy.

5.9 Modifying Criterion No. 2: Community Acceptance

DOE's recommendation to implement the revised remedy for Silo 3 was documented in the Proposed Plan for Silo 3, which was made available for public comment from April 30, 2003 through May 30, 2003. A public hearing was held in the vicinity of the Fernald Closure Project on May 13, 2003. DOE and EPA have considered comments provided by the community in making the final alternative selection documented in this ROD Amendment. Comments received during the public comment period are addressed in the Responsiveness Summary, contained in Appendix B of this ROD Amendment.

6 STATUTORY DETERMINATIONS

The NCP [40 CFR Section 300.430(f)(5)(ii)] specifies that a ROD shall describe the following statutory requirements as they relate to the scope and objectives of the action:

- How the selected remedy is protective of human health and the environment;
- How the remedy will comply with all ARARs established under federal and state environmental laws (or justify a waiver);
- How the remedy is cost-effective (i.e., provides overall effectiveness proportional to its costs);
- How the remedy will use permanent solutions and alternative technologies or recovery technologies to the maximum extent practicable; and
- How the remedy will satisfy the statutory preference for remedies that employ treatment that permanently and significantly reduces the toxicity, mobility, or volume of the hazardous substances, pollutants, or contaminants as a principle element, or if it is not satisfied, explain why a remedy providing reductions in toxicity, mobility, or volume was not selected.

In addition, CERCLA requires five year reviews to determine if adequate protection of human health and the environment is being maintained where RAs result in hazardous substances remaining on-site. A discussion is provided below of how the revised remedy for Silo 3 satisfies these statutory requirements.

6.1 Protection of Human Health and the Environment

The revised remedy achieves the requirement of being protective of human health and the environment by: (1) removing the sources of contamination, (2) treating, to the extent reasonably technically feasible, the materials giving rise to the principle threats from Silo 3 (3) disposing of treated materials at an off-site location that provides the appropriate level of protectiveness; and (4) remediating contaminated soils and debris to protective levels. The contents of Silo will be removed, treated to the extent reasonably implementable to reduce the dispersability and mobility of contaminants, and transported in a protective manner to an offsite facility for disposal. The location, design, and waste acceptance criteria of the offsite disposal facility will assure that the disposal of the Silo 3 material

provides long-term protection of human health and the environment. Concrete from the Silo 3 structure and the associated remediation facilities will be removed from OU4 and disposed of in a manner consistent with the approved OU3 ROD. Contaminated soil will also be removed and disposed in a manner consistent with the approved OU5 ROD.

Baseline cancer risks from current conditions exceed the 10^{-4} to 10^{-6} acceptable risk range. Under the future land use scenario of continued federal ownership, the residual cancer risk from Silo 3 will be reduced to less than 1×10^{-6}. There are no short-term threats associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the remedy.

6.2 Compliance with ARARs

The revised remedy for Silo 3 will comply with all ARARs. As described earlier, as a result of a change in the waste acceptance criteria for the Nevada Test Site, the RCRA-regulated metals in the waste no longer need to be treated to attain TCLP levels as a necessary condition for waste acceptance. As a result of this changed condition, the application of this former requirement is no longer considered a relevant criteria for the Silo 3 remedy. With this change, the revised remedy will attain all ARARs and performance criteria identified for the Silo 3 remedy. A detailed compilation of the ARARs for the revised Silo 3 remedy is provided in Appendix A of this ROD Amendment.

6.3 Cost Effectiveness

DOE has determined that the revised remedy for Silo 3 has costs that are proportional to the overall effectiveness of the remedy. Therefore, the revised remedy meets the statutory requirement for cost effectiveness, as defined by the NCP [40 CFR 300.430(f)(1)(ii)(D)].

6.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

DOE has determined, with the concurrence of the EPA and the OEPA, that the revised remedy for Silo 3 represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner. Of the alternatives that are protective of human health and the environment and comply with ARARs, DOE has determined that this selected remedy provides the best balance of tradeoffs among the alternatives in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost. As documented in the next section, the revised remedy also meets the statutory preference for treatment as a principle element.

6.5 Preference for Treatment as a Principal Element

Under Section 121 of CERCLA, DOE and EPA are required to reach a finding that the selected remedial alternative satisfies a statutory preference for remedies that employ treatment to permanently and significantly reduce the volume, toxicity, or mobility of hazardous constituents as a principal element. The finding is to be made through the detailed comparison of the two alternatives, considering site-specific factors and the five primary balancing criteria specified by the NCP (40 CFR 300.430).

On the basis of the detailed comparisons described above, DOE and EPA conclude that the modified Silo 3 treatment process satisfactorily achieves the statutory preference for treatment as a principal element and provides sufficient additional risk reduction in relation to cost. If the treatment step cannot be satisfactorily implemented due to overriding technical or short-term worker risk impediments, then the formal contingency action (additional double packaging of materials in the protective shipping containers) is also deemed to provide an appropriate balance of risk reduction, effectiveness, and cost to satisfy Section 121 requirements and preferences under the site-specific circumstances giving rise to the need for the contingency action.

6.6 National Environmental Policy Act

In the original ROD for OU4 DOE chose to complete an integrated CERCLA/NEPA process. This decision was based on the longstanding interest on the part of local stakeholders to prepare an Environmental Impact Statement (EIS) on the restoration activities at the FEMP and on the recognition that the draft document was issued and public comments received. Therefore, the document served as DOE's ROD for OU4 under both CERCLA and NEPA; however, it is not the intent of the DOE to make a statement on the legal applicability of NEPA to CERCLA actions.

Four Supplemental Analyses have been prepared evaluating changes to the original OU4 FS/PP EIS:

- January 9, 1996, evaluating shipping material for disposal via truck as opposed to the combination of rail/truck evaluated in the OU4 FS/PP-EIS.
- August 20, 1996 evaluating the Silo 3 remediation alternatives, including on-site treatment with disposal at the NTS or a PCDF, and transportation of untreated Silo 3 material to an off-site facility.
- March 3, 1998 evaluating Accelerated Waste Retrieval of the Silos 1 and 2 material.
- March 13, 2000 considering of alternatives for the remediation of the Silos 1 and 2 material.

No additional impacts were identified as a result of these reevaluations, and in each case, DOE determined that no additional NEPA evaluation or documentation was required.

The change documented in the ROD Amendment is bounded by the alternatives evaluated in the original FS/PP/EIS and the subsequent Supplemental Analyses. Therefore, it is DOE's determination that potential NEPA issues associated with the change have been adequately evaluated and that no additional NEPA documentation or evaluation is necessary.

7 COMMUNITY PARTICIPATION

Compliance with the public participation requirements specified by the NCP (40 CFR 300.435(c)(2)) for revision of the Silo 3 remedy have been met through the following actions:

- The Proposed Plan, and information supporting DOE's selection of the revised remedy for Silo 3 has been made available at two Administrative Record locations: the Public Environmental Information Center at the Fernald Closure Project, and at the EPA offices in Chicago, Illinois.

- The Fernald Citizens Advisory Board, the Fernald Residents for Environmental Safety and Health, OEPA, and other stakeholders have been informed during the evaluation and development of the revised remedy through periodic briefings and communications.

- DOE's recommendation for the revised Silo 3 remedy and the supporting rationale were documented in a Proposed Plan, which was placed into the Administrative Record on April 29, 2003.

- A thirty-day public comment period was established from April 30, 2003 through May 30, 2003. A public hearing was held in the vicinity of the Fernald Closure Project on May 13, 2003. The availability of the Proposed Plan, and the schedule for the comment period and hearing were advertised in local newspapers on April 30, 2003.

- No oral nor written comments were received at the public hearing on May 13, 2003. A transcript of the public hearing is contained in the Responsiveness Summary (Appendix B). All comments received during the public comment period, as well as DOE's response to each comment, are documented in the Responsiveness Summary.

APPENDIX A

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

AND TO BE CONSIDERED REQUIREMENTS

FOR SILO 3 REMEDIAL ACTION