FERNALD
Environmental Management Project

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DOE and EPA Propose an Amendment to the Cleanup Plan for Silo 3 at the Fernald Environmental Management Project

PUBLIC COMMENT PERIOD – XXX TO XXX, 2003

INTRODUCTION

This Proposed Plan summarizes a proposed amendment to the Record of Decision (ROD) for Silo 3 at the Fernald Environmental Management Project (FEMP) in Cincinnati, Ohio. It explains the Department of Energy's (DOE's) and U.S. Environmental Protection Agency's (EPA's) recommended change to the Silo 3 cleanup plan as previously described in the 1994 Operable Unit 4 ROD and the 1998 Explanation of Significant Differences (ESD) document for Silo 3. DOE and EPA will adopt a final plan for Silo 3 after all pubic comments and information submitted during the comment period have been reviewed and considered.

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

This Proposed Plan is intended to be a short summary of DOE and EPA's reasons for advocating a change to the Silo 3 cleanup plan. For those members of the public who wish to evaluate this proposal in more detail, they are encouraged to consult the documents found in the information repositories listed on the last page of this Proposed Plan. The repositories also hold copies of the original ROD, Feasibility Study, and Remedial Investigation for Operable Unit 4, of which Silo 3 is a part.

A supplement to this Proposed Plan has also been prepared that includes the key technical or regulatory information that factored into the decision. The supplement is available on request and includes backup detail for four areas:

- Letter from DOE's Nevada Test Site confirming the eligibility of Silo 3 materials for disposal at the Nevada Test Site
- A detailed compilation of applicable or relevant and appropriate regulatory requirements (ARARs) for the Silo 3 Proposed Plan
- Technical backup for the transportation risk assessment
- Cost estimate backup information.

Public input on the proposed changes and the information that supports the changes is an important contribution to the cleanup plan selection process. Both DOE and EPA encourage the public to review and comment on the proposed changes in the Silo 3 cleanup plan as presented in this Proposed Plan. Opportunities to comment include a public meeting (see side bar) and a prepaid comment form at the back of this document.

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Public Meeting

xxxxxx, 2003
xx to xx p.m.
at
the xxxxxxxxx
xxxxx, OH

40430-RP-0014, Rev. 1 Draft

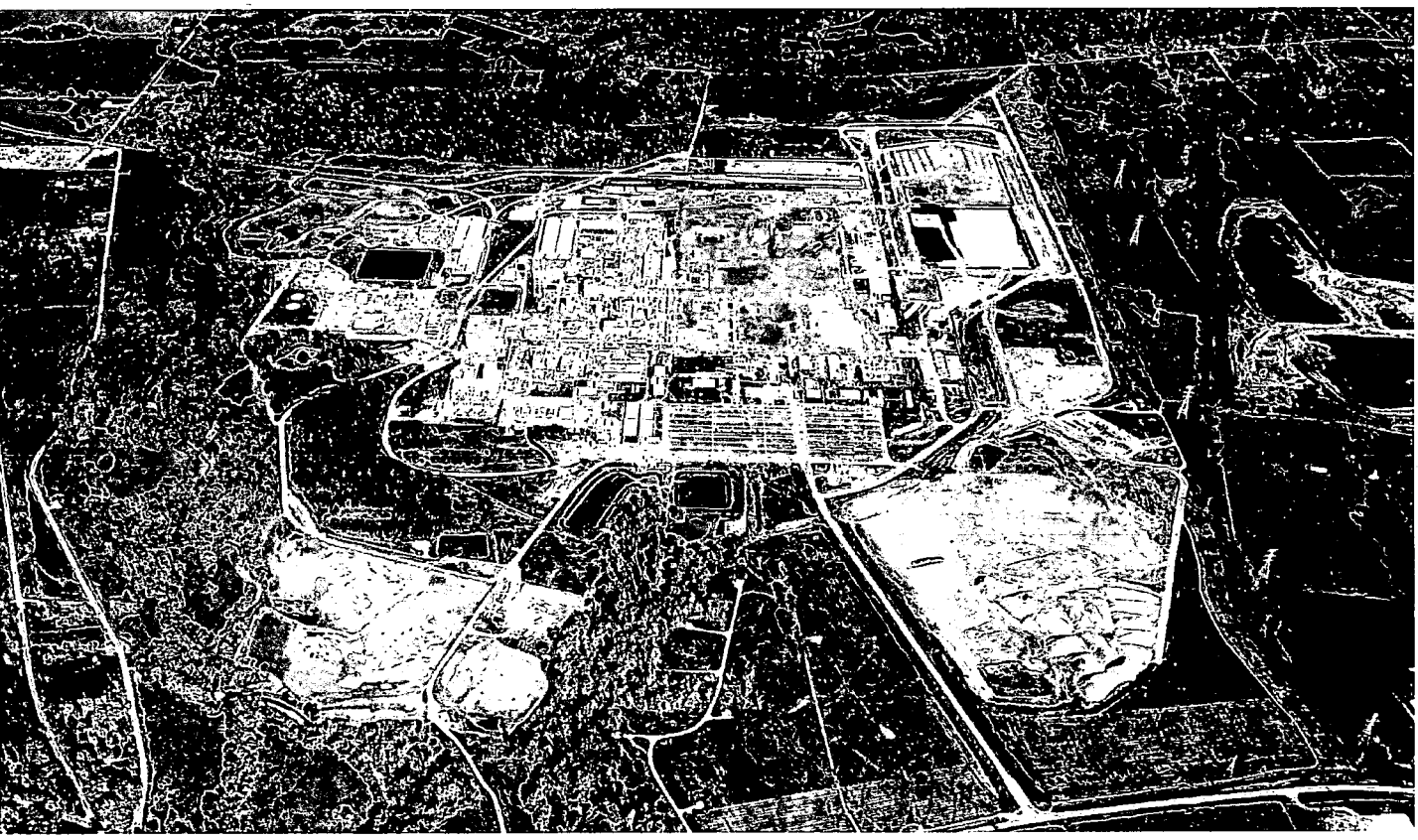
SITE BACKGROUND

The FEMP, formerly known as 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 FEMP. The FEMP 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.

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).

Since 1992, Superfund remedial investigations and feasibility studies have been completed for each of the operable units, and final RODs to establish cleanup levels and document the cleanup plans have been signed for each by DOE and EPA.

As documented in the RODs for the five operable units, the selected remedial actions 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 FEMP. 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.



CERCLA cleanup actions are well underway at the 1,050-acre Fernald site.

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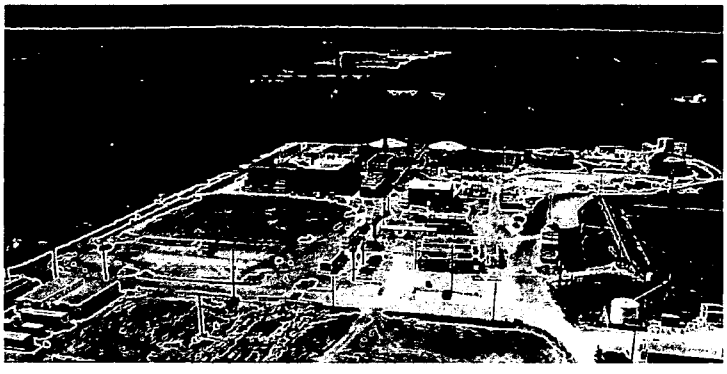
Overview of Silo 3 and the 1994 ROD

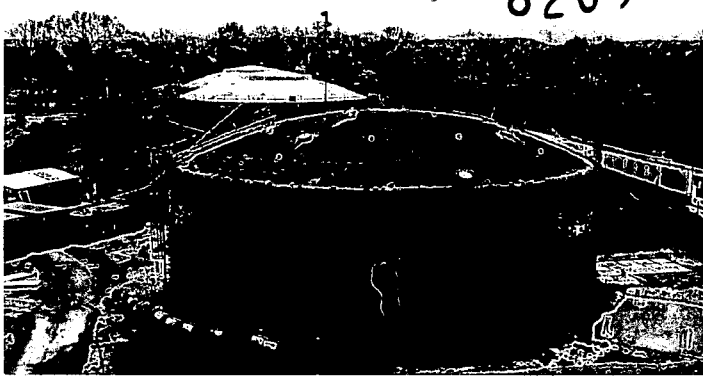
Silo 3, located adjacent to the K-65 silos (Silos 1&2) on the western periphery of the site, is an unbermed concrete silo that contains 5,088 cubic yards of cold metal oxides, a by-product material generated during Fernald's uranium processing operations. The predominant radionuclide of concern identified 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 the 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.



The Silos 1&2 and Silo 3 project area



Silo 3 contains 5,088 cy of uranium processing residues.

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 subsequent material handling and transportation steps.

The residues contained in Silo 3 and Silos 1&2 are designated as Section 11e.(2) byproduct materials under the Atomic Energy Act, which is a regulatory classification that 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 Atomic Energy Act 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 toxicity characteristic leaching procedure (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 and Silos 1&2 residues suitable for off-site disposal through treatment.

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In the 1994 Operable Unit 4 ROD, on-site vitrification and off-site disposal of both the Silo 3 and the Silos 1&2 materials was selected as the preferred remedy for the Operable Unit 4 materials as a whole. Vitrification is a treatment process that heats the materials to such temperatures that the materials fuse to a glass-like state, which in turn binds up the radioactive and non-radioactive metals in the waste to a low leachability condition. 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 Operable Unit 4 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 *relevant and appropriate* regulatory 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.

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. In the pilot scale tests, it was found that the high sulfate content of the Silo 3 residues would result in significant technical and operational difficulties and an unacceptable degree of uncertainty in the technology's ability to reliably produce a consistent vitrified material on a full-scale, continuous basis.

The ESD acknowledged that the adoption of a chemical stabilization/solidification or polymer encapsulation alternative for Silo 3 as a vitrification replacement 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 and for a cost roughly equivalent to the original remedy, and that the remedy includes disposal at a protective, appropriately permitted off-site disposal facility.

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 relevant and appropriate regulatory performance standard for designing a satisfactory treatment process to render the Silo 3 residues acceptable for off-site disposal.

The 1998 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 FEMP 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}.

In March 1998, DOE and EPA signed the 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 the quantitative TCLP-based performance standards adopted by the 1994 ROD. A policy decision was also made in the ESD to implement the Silo 3 remedy separately from the treatment of the Silos 1&2 material.

NEW INFORMATION AND REASONS FOR PROPOSED CHANGE

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 availability of other commercial facilities that can accept the Silo 3 residues for disposal as 11e.(2) regulated materials.

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 statutory 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 materials, and deemed them to be acceptable for disposal at the facility without the need for further treatment. A letter indicating the eligibility of the untreated Silo 3 materials 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 this Proposed Plan.

Emergence of a Commercial Disposal Facility to Accept DOE 11e.(2) Materials

Also since the time that the 1998 Silo 3 ESD was prepared, a commercial disposal facility that can accept 11e.(2) regulated materials for disposal is in the process of working with their regulatory agency to gain approval for accepting the Silo 3 materials untreated into their 11e.(2) disposal cell. This facility is the Envirocare commercial disposal facility in Clive, Utah. Similar to the revised waste acceptance criteria requirements at the Nevada Test Site, the facility can accept 11e.(2) materials 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 this Proposed Plan, the Envirocare facility is identified 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 executing the requirement contained in the 1998 ESD that the Silo 3 remedy include disposal at a protective, appropriately permitted off-site disposal facility. 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 this Proposed Plan, one option (the Nevada Test Site) will be selected as the representative disposal facility option to illustrate the costs and logistics of off-site disposal, and permit a fair comparison of the modified remedial action with the 1998 Silo 3 ESD remedial action.

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 the1994 ROD and the 1998 Silo 3 ESD as a facility-specific relevant and appropriate requirement for treatment, is no longer necessary to maintain long-term protectiveness and regulatory compliance with disposal facility waste acceptance requirements. DOE and EPA are therefore proposing to remove the quantitative TCLP performance standard as a relevant and appropriate regulatory requirement for execution of the Silo 3 remedy. This change will be formally documented in the ROD Amendment, following the completion of the public participation process.

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 unforeseen 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 cleanup plan 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 cleanup plan must continue to meet the 1×10^{-6} transportation risk threshold for the remedy adopted by the 1998 Silo 3 ESD.

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ALTERNATIVE CLEANUP PLAN BEING EVALUATED

This section describes the proposed revised Silo 3 cleanup plan, and provides a side-by-side comparison with the components of the currently approved 1998 ESD remedy for Silo 3. The following section then evaluates the revised cleanup plan 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.

For purposes of describing and evaluating the two cleanup alternatives, a representative waste transportation mode (truck transport) and disposal location (Nevada Test Site) has been adopted for both alternative cleanup plans. 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.

The currently approved and the proposed revised cleanup plans are described in the following sections, and a side-by-side comparison summary is provided in the Remedy Comparison Table below.

Currently Approved 1998 ESD Cleanup Plan

- 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.

Remedy Comparison Table

Existing Cleanup Plan	Proposed Revised Cleanup Plan
• Removal of waste from Silo by both pneumatic and mechanical processes	• Removal of waste from Silo by both pneumatic and mechanical processes
• Treatment using chemical stabilization or polymer encapsulation to meet TCLP limits	• Treatment to the extent practical, by addition of a chemical stabilization reagent and a reagent to reduce dispersability
• If off-site treatment adopted, pretreatment or packaging to reduce transportation risk to less than $1x10^{-6}$	• If above treatment step is deemed unimplementable, a contingency backup would be implemented to double package the waste
• Off-site disposal at the Nevada Test Site or permitted commercial facility	• Off-site disposal at the Nevada Test Site or a permitted commercial facility
• Removal of Silo 3 structure and waste hauling/treatment systems	• Removal of Silo 3 structure and waste hauling/treatment systems
• Cleanup of soil in Silo 3 area to meet final remediation levels in Operable Unit 5 ROD	• Cleanup of soil in Silo 3 area to meet final remediation levels in Operable Unit 5 ROD

Cost ($ Millions)		*Cost ($ Millions)*	
Capital Cost	20.0	Capital Cost	14.0
Engineering, Construction, Startup	15.0	Engineering, Construction, Startup	15.0
Operation and Maintenance	7.0	Operation and Maintenance	4.0
Transportation and Disposal	11.0	Transportation and Disposal	7.0
Facility D&D	2.0	Facility D&D	2.0
Total Estimated Cost	**55.0***	***Total Estimated Cost***	**42.0***

*Note: Does not include costs for removal of Silo 3 structure or cleanup of soil in Silo 3 area.

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Proposed Revised Cleanup Plan

- Removal of the wastes from Silo 3 (*this element remains unchanged from the currently approved plan*)
- Treatment, to the degree reasonably implementable, to address material dispersability and metals mobility (*change from the currently approved 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 currently approved 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 currently approved plan*)
- Off-site disposal at either the Nevada Test Site or a permitted commercial disposal facility (*this element remains unchanged from the currently approved plan*)
- Removal and disposal of the Silo 3 structure and the waste handling, packaging, and treatment systems (*this element remains unchanged from the currently approved 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 currently approved plan*).

Detailed Description of the Proposed Revised Cleanup Plan

Waste Removal. Under the proposed revised cleanup plan the waste would be removed from Silo 3 employing both pneumatic and mechanical systems. These waste retrieval systems remain unchanged from the currently approved cleanup plan. As a result of the relatively high concentration of thorium-230 (an alpha emitter) and the dry powdery consistency of the waste, special attention would 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 currently approved or the proposed revised cleanup plan.

To address this concern, containment structures and high efficiency air filtration systems would be employed during waste retrieval. A strict radiological control program would 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 would also be implemented to assess the effectiveness of the controls.

Waste Treatment. Under the proposed revised cleanup plan, a differing treatment approach would be implemented. Under both plans, the material would be removed from the silo in its dry form. The currently approved 1998 ESD cleanup plan envisions 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 currently approved 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 exceeds TCLP limits for the four RCRA-regulated metals (cadmium, arsenic, chromium, and selenium) that are of concern with the Silo 3 materials. Under the proposed revised cleanup plan, this chemical processing system would not be constructed; in its place a system would be designed and installed to add a liquid solution to the dry waste material as it enters the package.

As previously discussed, the acceptance criteria of the Nevada Test Site has been modified to permit receipt of the Silo 3 waste material in an untreated form, in 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}) 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 the radioactive and non-radioactive RCRA-regulated metals present in the waste.

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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. The final makeup of this solution has not as yet been selected but 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.

During the limited bench testing a dilute lignosulfonate solution (which serves as a material crusting agent) was added to the waste materials resulting in a meaningful reduction in the dispersability of the packaged materials. The addition of a dilute lignosulfonate solution was selected to represent the range of available waste additives aimed at raising the moisture content and reducing the dispersability of powdered material.

As part of earlier technology demonstration studies and proof of principle evaluations conducted on Silo 3 materials, laboratory evaluations were performed to evaluate the effectiveness of various stabilization additives aimed at reducing the mobility of the metals present in the materials. Similarly, various other stabilization-additive studies have been conducted by DOE on other waste streams at the FEMP (primarily on lead contaminated soils from the firing range) and by EPA at other CERCLA sites under the Superfund Innovative Technology Evaluation (SITE) program. These studies attest to the beneficial reduction in mobility of various metals afforded by differing waste stabilization additives. Representative examples of these stabilization additives include ferrous sulfate and triple phosphate, which each target different metals for mobility reduction. On the basis of these studies, there is a clear expectation that the addition of a chemical stabilization reagent to the waste materials will result in some beneficial reduction in the mobility of some or all of the metals present in the waste.

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 materials.

As part of this best management approach, a mock up of the Silo 3 waste packaging system will be conducted. The purpose of the mock up is to mimic full scale operating conditions in order to provide operability and maintainability data to the design process. The liquid additive delivery system will be included in this mock up testing program. Information obtained from this mock up test will be factored, to the extent practical, into the final as-built configuration of the liquid delivery system. A final formulation for the additive solutions will also be selected as part of the preparation for the mock up test, in consultation with leading industry experts with application experience in delivery of the liquid additives. It is recognized that once the final formulation for delivery is selected, the actual application of the additives defines the conclusion of the best management approach, and no further testing will be conducted on the materials during full-scale operations.

Contingency Backup Actions. As previously stated, the DOE has committed to a best effort to successfully implement the addition of the treatment solutions to the waste materials 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 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.

DOE will interact with EPA, Ohio EPA 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.

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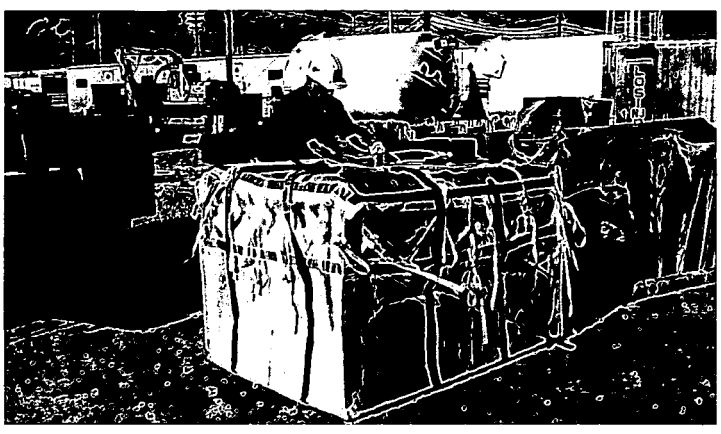
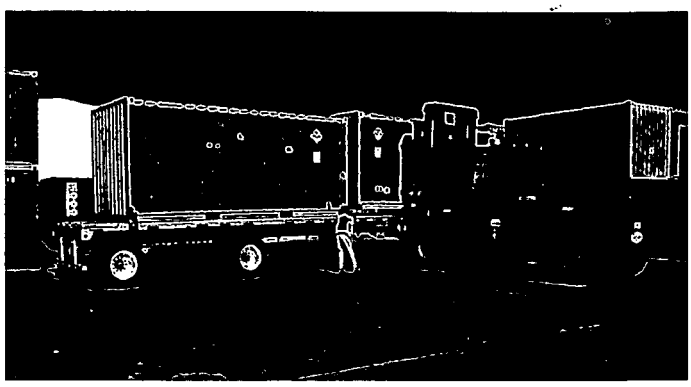
Under the conditions where the costs and/or projected worker exposures associated with the application of one or both of the additives become disproportionate with the potential benefits gained, DOE will cease efforts to apply that portion of the liquid solution to the waste that is causing the operational 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 basis and rationale for the contingency-action decisions will be documented in a formal memorandum to the administrative record file.

Waste Packaging and Shipping. Once the waste is retrieved from the silo it would be transferred by screw conveyor to a load hopper for direct delivery into the selected packaging configuration. The previously described chemical solution would be added as the waste enters the package. For purposes of evaluating the alternative, a lined soft-sided package meeting DOT-LSA-II requirements was selected to represent the range of available packaging configurations.

The packaging and mode of transportation remains unchanged from the currently approved cleanup plan. These containers would be placed into steel sealand containers and placed on trucks for off-site transport. Other modes of transportation are available for this same packaging configuration, including direct load onto rail flatbed cars with rail transport to a truck offloading station closer to the disposal facility or direct rail transport to the disposal facility. 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.



Representative DOT LSA-II lined, soft-sided package



Steel sealand cargo containers to transport DOT LSA-II soft-sided packages

Waste Disposal. This component of the remedy remains unchanged from the 1998 Silo 3 ESD remedy. The Nevada Test Site is selected as the representative option for comparison and costing in this Proposed Plan.

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.

COMPARISON OF THE REVISED SILO 3 REMEDY WITH THE 1998 ESD REMEDY

Comparative evaluations of the proposed revised Silo 3 remedy and the currently approved Silo 3 ESD 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.

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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 Operable Unit 4 Feasibility Study, Proposed Plan, ROD, and Silo 3 ESD documented a detailed evaluation of a full range of alternatives against these same criteria to arrive at the selected current cleanup plan 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 cleanup plans, aimed at those components that are different.

In addition to the nine criteria comparative analysis, Section 121 of CERCLA and the National Contingency Plan (40 CFR 300.430) requires 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. A brief discussion is presented later in this section addressing this statutory preference.

As part of the original RI/FS for Operable Unit 4, 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 Operable Unit 4 Feasibility Study 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 cleanup plan being recommended in this Proposed Plan. The proposed revised cleanup plan was developed fully considering these formal remedial action objectives.

Explanation of the CERCLA Nine Criteria

DOE and EPA use the following nine criteria from the National Contingency Plan to compare and evaluate the cleanup alternatives. The nine criteria are categorized into three groups: *Threshold Criteria*, which must be met by each alternative in order to be eligible for selection; *Primary Balancing Criteria*, which are balanced against each other to achieve the best overall solution; and *Modifying Criteria*, which are evaluated following receipt of comments on the Proposed Plan.

Threshold Criteria	Primary Balancing Criteria	Modifying Criteria
1. **Overall Protection of Human Health and the Environment.** Assessment of the degree to which the cleanup alternative eliminates, reduces, or controls threats to public health and the environment. 2. **Compliance with Applicable or Relevant and Appropriate Requirements.** An evaluation of whether or not the alternative attains applicable or relevant and appropriate requirements (ARARs) under federal environmental laws or state environmental or facility siting laws.	1. **Long-Term Effectiveness and Permanence.** The cleanup alternative is evaluated in terms of its ability to maintain reliable protection of human health and the environment over time. 2. **Reduction of Toxicity, Mobility, or Volume Through Treatment.** An evaluation of how well a cleanup alternative reduces the harmful nature of the contamination at the site; the ability of the contamination to move from the site into the surrounding area; and the amount of contaminated material remaining following implementation of the remedy. 3. **Short-Term Effectiveness.** The length of time needed to implement a cleanup alternative is considered. DOE and EPA also assess the risks and adverse impacts that carrying out the cleanup alternative may pose to workers and nearby residents. 4. **Implementability.** An assessment of how difficult the cleanup alternative will be to construct and operate, and whether the technology is readily available. 5. **Cost.** A comparison of the costs of each alternative. Includes capital, operation, and maintenance costs. CERCLA and the National Contingency Plan require that a selected remedy be cost effective, which is defined as a remedy that has costs that are proportionate to overall effectiveness.	1. **State Acceptance.** DOE and EPA take into account whether or not the state agrees with the recommended change, and considers state comments in the development of the Proposed Plan and the ROD Amendment. 2. **Community Acceptance.** DOE and EPA will consider the comments of local and other affected residents on the recommended alternative presented in this Proposed Plan. Responses to the comments raised during the public comment period will be provided in a document called a Responsiveness Summary, which will be attached to the ROD Amendment.

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

Both the currently approved and the proposed revised cleanup plans 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 cleanup plans 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. The Nevada Test Site does not outline specific concentration based waste acceptance criteria for individual radiological or nonradiological hazardous constituents. The Nevada Test Site requires the waste generator to submit a waste profile for approval that fully describes the physical, radiological, and chemical characteristics of the waste. 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 this Proposed Plan.

Other waste acceptance criteria for the Nevada Test Site include the requirement for the packaging configuration to fully comply with DOT regulations for shipping. In order to be received at the Nevada Test Site the waste must have as little free liquid as is reasonably achievable and in no case greater than 1percent free liquid by volume. The packaged waste will comply with these requirements under both the currently approved or proposed revised cleanup plans, even with the additional moisture that is planned to be added to the waste for dispersability control under the revised cleanup plan.

Both cleanup plans 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 proposed revised cleanup plan. 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.

Threshold Criterion No. 2: Compliance with ARARs

Both the currently approved and the proposed revised cleanup plans will attain compliance with ARARs. The ARARs were identified in the Operable Unit 4 Feasibility Study and 1994 ROD, and were not changed by the 1998 ESD for Silo 3. One requirement has been revised since issuance of the Silo 3 ESD -- the selection of the RCRA TCLP limits as a relevant and appropriate 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 and appropriate requirement for the Silo 3 cleanup plan. With this change, the proposed revised cleanup plan will attain all identified ARARs which are unchanged from the 1998 Silo 3 ESD and the 1994 Operable Unit 4 ROD. A detailed compilation of the ARARs for the revised Silo 3 remedy is provided in the supplement to this Proposed Plan.

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

The currently approved cleanup plan and the proposed revised cleanup plan 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 currently approved cleanup plan provides an incremental increase in long-term effectiveness by including treatment to the TCLP levels as a performance requirement of the remedy. The proposed revised cleanup plan includes the application of 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 currently approved remedy over and above that anticipated by the proposed approach is not considered significant relative to health-based thresholds, in that the mobility of nonradioactive metals in the incoming waste is already a consideration in the siting, design, and health-protective acceptance criteria for the receiving disposal facilities. 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.

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

Both the currently approved and the proposed cleanup plans provide for treatment of the waste materials prior to disposal at the Nevada Test Site or a permitted commercial disposal location. The currently approved plan would provide some incremental decrease in the mobility of the waste over that provided by the proposed revised cleanup plan. 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 currently approved plan would provide for an increase (approximately 50 percent) in volume over the proposed revised plan due to the type and quantity of waste additives necessary to ensure attainment of the TCLP limits imposed under the currently approved remedy. The overall increase from the in-situ volume associated with the currently approved remedy is estimated to be 63 percent, with 52 percent attributable to waste additives and 11 percent to air entrainment during waste retrieval.

The proposed 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 up to 20 percent. These bench tests proved successful and DOE has committed to applying this system in the proposed revised cleanup plan. 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.

The volume of waste under the proposed revised cleanup plan is expected to increase by approximately 11 percent from the condition of the in-situ material due to the entrainment of air during retrieval. This increase does not take into consideration any volume changes attributable to the addition of the waste treatment solution. There is an expectation that this increase may be reduced due to the introduction of the liquids to waste material as it enters the package.

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 proposed 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 must be designed into the waste handling systems of both the current and proposed revised cleanup plans.

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 (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 current cleanup plan over and above the liquid additive system contemplated by the proposed revised cleanup plan. This increased complexity results in increased uncertainty in the schedule for completion of Silo 3 remediation.

A key consideration in the analysis of the two cleanup plans is the risks attributable to the transportation of the packaged materials to the off-site disposal facility. The potential risks associated with routine (no accidents) waste transportation and to hypothetical accident scenarios have been estimated for both the currently approved and the proposed revised cleanup plans. The transportation risk analysis was completed through the use of an analytical model called RADTRAN 5. RADTRAN 5 was developed by Sandia National Lab and is used nationwide for transportation risk analysis involving radioactive materials. A more detailed discussion of the modeling input and output appears in the supplement to this Proposed Plan.

For both the current cleanup plan and the proposed revised cleanup plan, transportation risks have been evaluated for truck transport to the Nevada Test Site and the Envirocare facility in Utah (the representative commercial facility), intermodal transport to the Nevada Test Site, and rail transport to Envirocare. For each of these modes of transport both the routine (i.e., accident free) and the accident-based risks have been estimated.

For the current cleanup plan, the chemically stabilized waste is assumed to be placed into lined, soft-sided packages and loaded into steel sealand containers. For truck and intermodal transport, 7 soft-sided packages are assumed to be loaded into each sealand with one sealand placed on each truck (four sealands are assumed to be placed on each flatcar). For direct rail transport, 9 soft-sided packages are assumed to be in each sealand before loading onto the flat cars in recognition of the added weight that can be accommodated by rail over truck transport. For the currently approved remedy it has been estimated that 2810 soft-sided packages will be necessary to complete the project. This quantity includes some consideration for non-optimal packaging and a 47.9 percent waste loading rate. For the truck shipment option, 402 sealand containers have been estimated as being necessary to convey the packaged waste over the road to the Nevada Test Site. For direct rail shipment, 313 sealand containers and 79 shipments have been estimated to be necessary to transport the packaged waste to the representative commercial facility, Envirocare of Utah.

For the proposed revised cleanup plan, the previously listed assumptions regarding the quantities of packages per conveyance were also applied to this option. Under this alternative, it has been estimated that 1910 bags would be necessary to complete the project again taking some non-optimal packaging into consideration. It has been estimated that 273 sealand containers would be required to convey the material to the Nevada Test Site under the proposed revised remedy. For the direct rail option to Envirocare of Utah, it has been estimated that 213 sealand containers and 54 railcar shipments will be required.

To analyze the risks associated with the routine transportation of the waste across the road or over the rails, it was assumed that no accidents occurred that lead to loss of containment of the inner lined packages. As a result, the risk during routine transportation is limited to direct radiation from the packages the general population. The general population exposed includes those individuals living along the route, those individuals sharing the route, and those individuals that may be encountered at rest stops.

Risks to the general population were estimated for hypothetical accident scenarios for both truck and rail transport. The risks were estimated based upon the assumption that accidents of increasing severity occurred. The model utilizes available actuarial statistics to predict the frequency of an accident of a certain severity, with those of higher severity occurring at a significantly lower frequency. As the severity of the accident increases, the RADTRAN 5 model assumes an increasing quantity of the packaged material becoming released to the environment due to a breach of the outer sealand and the inner liners and packages. To ensure conservatism, for the current cleanup plan the waste was assumed to be in a monolithic form in the lined, soft-sided container with minor quantities of released materials available for resuspension by wind or fire. For the proposed revised cleanup plan, no credit is taken in the model for the planned treatment of the waste to reduce dispersability. Under these assumptions, essentially 100 percent of the waste materials are assumed to be released and available for resuspension as a result of the most severe hypothetical accident.

It should be noted that while the model is estimating the consequences of hypothetical, loss of containment accidents, the probability of such accidents actually occurring are remote. The probability of a maximum severity truck accident occurring such that all the soft-sided containers in the sealand are breached during transport to the Nevada Test Site under the proposed revised remedy has been estimated at approximately 3×10^{-5} in a rural area and approximately 9×10^{-9} in a urban area.

The probability of such a severe rail incident occurring during transport to Envirocare is estimated at approximately 9×10^{-7} in a rural area and 7×10^{-8} in an urban area. The probability of the events occurring in rural areas are calculated to be higher due the duration of time the rail or truck is in these areas and the higher speeds typically attained by both modes of transportation in rural areas. The improbability of these events occurring is supported by Fernald experience to date. Since 1985 Fernald has shipped over 16,700 individual shipments to Portsmouth and the Nevada Test Site. In all these shipments, Fernald has never had a loss of containment accident. Similarly, Fernald has shipped 72 unit trains to date and has never experienced any accident that has released or even disturbed the waste load.

The following table presents the results of the transportation risk analysis. The table presents the increased probability of experiencing a cancer event in the lifetime (termed incremental lifetime cancer risk or ILCR) of the reasonably maximum exposed individual given both routine transportation of the material and an accident-based scenario for truck transport to the Nevada Test Site and rail shipment to Envirocare. A more thorough description of the reasonable maximum exposed individual and the results of the risk analysis for the other modes of transportation to these disposal locations can be found in the supplement to this Proposed Plan. As can be seen from this data, for the currently approved remedy the incremental lifetime cancer risk during routine transportation (no accident condition) is estimated to be approximately 8.3×10^{-10} for truck transport to the Nevada Test Site and 2.9×10^{-10} for rail transport to Envirocare. For the proposed revised cleanup plan, the risk attributable to truck transportation to the Nevada Test Site is estimated at 1.3×10^{-9} and 4.4×10^{-10} for rail transport to Envirocare. These risk estimates compare favorably to the criteria of being below a risk of 1×10^{-6} for routine transportation established by the 1998 Silo 3 ESD. The calculated risk attributable to the proposed revised cleanup plan is slightly higher than the current remedy due to the increased waste loading in the shipping containers resulting in higher direct radiation levels on the outside of the package.

Results of the Transportation Risk Analysis

	Current Remedy Routine Transport ILCR	**Proposed Revised Remedy Routine Transport ILCR**
Truck to NTS	8.3×10^{-10}	1.3×10^{-9}
Rail to Ecare	2.9×10^{-10}	4.4×10^{-10}
	Current Remedy Accident Scenario ILCR	**Proposed Revised Remedy Accident Scenario ILCR**
Truck to NTS	3.1×10^{-11}	4.4×10^{-8}
Rail to Ecare	1.6×10^{-10}	2.3×10^{-7}

For the hypothetical accident scenario, the highest incremental lifetime cancer risk to the reasonably maximum exposed individual is estimated to be 3.1×10^{-11} for truck transport to the Nevada Test Site and 1.6×10^{-10} for rail transport to Envirocare for the currently approved remedy and 4.4×10^{-8} and 2.3×10^{-7} for truck to the Nevada Test Site and rail to Envirocare, respectively for the proposed revised cleanup plan. As previously stated, no consideration was given in the risk analysis for any reduction in dispersability afforded by the treatment contemplated by the proposed revised cleanup plan. As with the routine transport, the risk estimates for the hypothetical accident scenarios compare favorably to the criteria of being below a risk of 1×10^{-6} established by the 1998 Silo 3 ESD.

To minimize the potential risks associated with the hypothetical accident scenario, the FEMP employs certain controls as part of every truck and rail shipment from the site. It is envisioned that these or similar measures would be used on the shipments of Silo 3 waste materials. For truck shipments to the Nevada Test Site, the controls that Fernald applies to each shipment include: (1) a rigorous quality control and assurance program to ensure the quality of the packages and the conveyances and their compliance with DOT and Nevada Test Site requirements; (2) affixing a global positioning system transponder to each conveyance to track the progress of each vehicle and/or ensuring each driver has a working cellular phone or two-way radio; (3) employing screening criteria for the selection of drivers; (4) training of the driver on what actions to take in the event of accidents; and (5) the briefing of interested emergency response personnel along the transportation route.

Similarly, for rail transportation the control measures that are routinely applied to waste shipments include: (1) application of a rigorous quality assurance and control program to ensure the quality of the package, cars, liners (where applicable) and lids; (2) utilizing the commercial rail car tracking system to watch the progress of Fernald waste shipments; (3) working with the commercial rail carrier to ensure the availability of adequate emergency response plans; and (4) the briefing and training (if requested) of emergency response personnel along the transportation route.

In the event of an accident, the truck driver has been directed to immediately contact the appropriate response authority, the carrier company representative, and the Fernald communications center. The truck driver is briefed on emergency response techniques and is equipped with a spill kit.

The Fernald emergency response center makes the necessary contacts to the DOE and local stakeholders and provides any necessary support to the on scene event coordinator. For rail incidents, the rail carrier company personnel are trained in emergency response techniques. The rail carrier will perform the necessary notification to local response authorities and provide assistance to the response as appropriate. The rail carrier will contact the Fernald communications center following the incident. The Fernald communications center will again provide necessary notifications and any necessary support to the on scene event coordinator.

Balancing Criterion No. 4: Implementability

This criterion favors the proposed revised cleanup plan 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 cleanup alternatives. Chemical stabilization of the leachable metals for the current cleanup plan 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 currently approved 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 a the chemical stabilization process contemplated by the current cleanup plan, 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 proposed revised cleanup plan. Some operational challenges are expected during the implementation of the liquid addition system for the Proposed Plan. As previously stated, DOE expects that these will be overcome during the mock up testing.

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

Both alternatives include off-site disposal of the Silo 3 materials at either the Nevada Test Site or a permitted commercial disposal facility. The administrative feasibility associated with obtaining the necessary approvals for acceptance at the Nevada Test Site is equivalent for either cleanup plan. The licensing process for the acceptance of the treated waste material at the representative commercial facility (Envirocare) under the proposed revised cleanup plan is considered to be more complex that that contemplated for the current plan.

The schedule for implementation of the currently approved 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 proposed 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 currently approved remedy.

Balancing Criterion No. 5: Cost

The cost evaluation is based on estimates documented in the supplement to this Proposed Plan. The cost estimates were developed for (1) capital costs; (2) engineering, project management, construction management and startup costs; (3) operations and maintenance (O&M) and system shutdown costs; (4) transportation and disposal costs; and (5) decontamination & demolition (D&D) costs. 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.

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.

The following summarizes the major cost elements for the currently approved plan and the proposed revised cleanup plan alternatives. A more detailed basis for the cost estimate is provided in the supplement to this Proposed Plan.

Summary Cost Data ($ Million)

Alternative	Current Cleanup Plan	Proposed 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**

The cost estimate for the currently approved remedy varies from the rough order of magnitude value provided in the 1998 Silo 3 ESD as a result of more detailed conceptual engineering performed to describe and estimate the remedy. The error band (+50/-30 percent) around the estimated cost for the currently approved remedy presented in the table overlaps with the band around the estimate for the chemical stabilization and off-site shipment alternative presented in the original Operable Unit 4 Feasibility Study.

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 current cleanup plan is estimated at $13 million greater than the proposed 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 current cleanup plan.

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 decisionmaking. 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 currently approved remedy will be higher than that to implement the proposed 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 currently approved remedy.

As previously discussed, it is estimated to require 43 months to implement the currently approved remedy and 35 months to implement the proposed revised remedy. The driving difference between these two schedules is the increased operation and shipping duration for the currently approved remedy attributable to the added complexities of the treatment process and the added volume for shipment.

Modifying Criterion No. 1: State Acceptance

The Ohio EPA has had an opportunity to review and participate in the proposed change to the Silo 3 remedy and concurs with the recommendation.

Modifying Criterion No. 2: Community Acceptance

During the public comment period, interested persons or organizations may comment on the two alternatives and the recommended implementation strategy for the Silo 3 Proposed Plan. DOE and EPA will consider comments provided by the community in making the final alternative selection. The comments will be addressed in a document called a Responsiveness Summary, which will then be part of the ROD Amendment for Silo 3.

Statutory Preference For Treatment As Principal Element

Under Section 121 of CERCLA, DOE and EPA are required to reach a finding for the proposed amendment to the ROD 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 contained in Section 300.430 of the National Contingency Plan.

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. The treatment step cannot be satisfactorily implemented due to overriding technical or short-term worker risk impediments, then the formal contingency action explained above (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.

FINDINGS AND CONCLUSIONS

DOE and EPA are proposing a change to the remedy for Silo 3 to a revised plan that offers cost and schedule benefits while still maintaining a health-protective, compliant remedy. This change is being considered as a result of a recent revision to the waste acceptance criteria at the Nevada Test Site. As a result of the change in criteria, the disposal facility at the Nevada Test Site can now receive the Silo 3 waste untreated and still meet health-protective disposal requirements for the facility. On this basis, DOE and EPA have developed a new proposed cleanup plan for Silo 3 that takes advantage of the revised disposal facility acceptance criteria, but also seeks to address key concerns of involved stakeholders. This revised approach eliminates the RCRA TCLP test as a required performance measure for the treatment of the Silo 3 waste, and in its place adopts a best-management approach involving the addition of waste treatment reagents to the waste prior to final packaging. The treatment reagents are designed to meaningfully reduce both the dispersability and leachability of the Silo 3 materials to best-management-practice performance levels.

In the event that the delivery systems designed to add the reagents cannot be made operationally viable and/or result in unacceptable worker health and safety exposure conditions, a contingent approach will be implemented to double package the material before off-site transport. Both the primary action (treatment reagents) and the contingency action (double packaging) have been developed to respond to stakeholder concerns regarding the potential for re-suspension and dispersion of the Silo 3 materials in the event of a catastrophic transportation accident involving the breach of the shipping containers en-route to final disposal.

DOE and EPA evaluated the proposed revised cleanup plan against the nine remedy selection criteria in the CERCLA National Contingency Plan, and compared the results to those for the currently approved 1998 Silo 3 ESD cleanup plan. The comparison shows that both remedies meet the threshold criteria established by the National Contingency Plan for overall protection of human health and the environment, and compliance with ARARs.

When comparing the five primary balancing criteria for the two alternatives, DOE and EPA find that the two alternatives are essentially equivalent with respect to long-term protectiveness and permanence. Under both options the waste will be shipped off site to an appropriate disposal facility in full conformance with health-protective waste acceptance criteria. While the currently approved remedy envisions a more involved treatment approach, the incremental benefits provided by this approach are judged not to be significant to the long-term protectiveness of the remedy. Both alternatives are implementable, although DOE and EPA conclude that the proposed revised remedy would be easier to implement overall due to the elimination of the more elaborate treatment system contemplated by the currently approved remedy to satisfy RCRA TCLP performance requirements.

The schedules for implementing the two alternatives are comparable (both satisfy enforceable milestone requirements for Operable Unit 4); the proposed revised remedy, however, offers meaningful schedule improvements attributable to a shorter operations and shipping duration. In terms of short-term effectiveness, both remedies are comparable. Fewer shipments would be expected under the proposed revised remedy, with the calculated risks during transportation associated with the proposed revised remedy being slightly higher but still within the acceptable range established for the remedy by the 1998 Silo 3 ESD. The proposed revised remedy will be less costly to implement than the currently approved cleanup plan due to the adoption of a more straightforward treatment approach that results in fewer packages to ship. Ohio EPA supports the proposed changes to the remedy, and the final criterion (community acceptance) will be evaluated after DOE and EPA receive public comments on this Proposed Plan.

In summary, DOE and EPA conclude that the proposed revised cleanup plan for Silo 3 represents the best overall balance of the evaluation criteria; provides effectiveness proportionate to its cost; and meets the CERCLA statutory preference for remedies that employ treatment as a principal element. As a result, DOE and EPA are recommending the implementation of the proposed revised remedy as the final remedy for Silo 3.

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PUBLIC INVOLVEMENT ACTIVITIES

The community is encouraged to read and provide comments on the revised cleanup plan for Silo 3 at the Fernald Environmental Management Project. A final remedy selection will be made only after hearing and considering community comments and concerns. Based on those comments, the preferred plan may be modified, based on information gathered from the community during the comment period.

DOE and EPA will consider public comments received during a 30-day comment period from XXXXX to XXXXX, 2003. A public meeting will be held during the comment period to explain the Proposed Plan and accept oral and written comments.

Additional copies of the Proposed Plan and the supporting documents are available from the Administrative Record locations both at the Fernald Public Environmental Information Center and at the EPA offices in Chicago, Illinois. Addresses for these two Administrative Record locations are provided below. In addition to the prepaid comment form attached to this Proposed Plan, your comments may also be submitted electronically or by mail to:

Mr. Gary Stegner	Mr. Jim Saric
U.S. Department of Energy Fernald Area Office P.O. Box 538705 Cincinnati, OH 45239-8705 Email: gary.stegner@fernald.gov 513-648-3131	U.S. EPA, SRF-5J 77 W. Jackson Blvd. Chicago, IL 60604-3590 Email: saric.james@epamail.epa.gov 312-886-0992

The date, time, and location of the public meeting and the dates for the comment period will be 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	U.S. EPA Region V
P.O. Box 538705 Cincinnati, OH 45253-8704 513-648-5051 Monday and Thursday, 9 a.m. to 7 p.m. Tuesday, Wednesday and Friday, 9 a.m. to 4:30 p.m. Saturday, 9 a.m. to 1 p.m.	U.S. EPA, SRF-5J 77 W. Jackson Blvd. Chicago, IL 60604 312-886-0992

OHIO EPA INVOLVEMENT

The **OHIO EPA** is participating in the RI/FS and remedial action processes at the FEMP. For additional information concerning the state's role in the cleanup process at the FEMP or regarding g the specifics of this Proposed Plan contact:

Tom Schneider
Fernald Project Manager
Ohio Environmental Protection Agency
401 E. Fifth St.
Dayton, OH 45402-2911

513-285-6466

Key Documents From Administrative Record File

Fernald Environmental Management Project (FEMP):

- 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)

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COMMENT FORM

Your input on the Proposed Plan for amending the Operable Unit 4 ROD to accommodate the revised cleanup plan for Silo 3 is important. Public comments assist DOE and EPA in selecting the final cleanup plan.

You may use the space below to write your comments about both of the alternatives described in this Proposed Plan. After making your comments, please fold, tape (no staples), and mail this prepaid form. We must receive your comments on or before the close of the public comment period on XXXXX, 2003. If you have questions about the comment period or the upcoming public meeting, contact Gary Stegner in DOE's Public Information Office at (513) 648-3153. Those with electronic capabilities may submit their comments to DOE via E-mail to: gary.stegner@fernald.gov.

(BELOW INFORMATION IS OPTIONAL)

Name: _____

Address: _____

City: _____

Phone: _____

MAILING LIST ADDITIONS

Please add my name to the Fernald Mailing List to receive additional information on the cleanup progress at the Fernald Environmental Management Project.

Yes _____ **No** _____

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FERNALD AREA OFFICE
US DEPARTMENT OF ENERGY
PO BOX 538705
CINCINNATI OH 45253-9985

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For More Information

Additional information or related cleanup documents are available to the public at the following location:

Public Environmental Information Center
JAMTEK Building
10845 Hamilton-cleves Highway
Harrison, OH 45030
513-638-0164