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WHAT WILL WE DO WITH 104,000,000 CUBIC FEET OF FERNALD WASTE?

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ABSTRACT

The Fernald Site, a Department of Energy (DOE) uranium metal production facility that ceased production in 1989, is now being remediated by the DOE under terms of a Consent Agreement with the United States Environmental Protection Agency (USEPA) and a Consent Decree with the State of Ohio. It is estimated that the cleanup will generate 104,000,000 cubic feet of low-level radioactive waste including construction debris, pit sludge, radium residue and a huge volume of uranium contaminated soil.

The waste handling strategy for this huge volume of waste includes minimizing remedial waste generation, recycling material when economically feasible, free-releasing clean material and volume reduction. It is anticipated that large scale radium residue vitrification and sludge drying equipment/facilities will be constructed onsite for waste treatment prior to off-site disposal. Fernald waste disposition will include both onsite disposal (if approved under CERCLA) and off-site disposal at both commercial and DOE waste disposal facilities. The waste disposition strategy selected reflects a diverse variety of technical, political, regulatory and economic factors. This presentation will describe the current views at Fernald on "what will we do with 104,000,000 cubic feet of Fernald waste."

INTRODUCTION

The Fernald Environmental Management Project (FEMP), formerly the Feed Materials Production Center (FMPC), is a Department Of Energy (DOE) site which produced high-quality uranium for military defense beginning in 1951. Production at the FEMP was halted in July 1989 and, later that year, the facility was placed on the National Priorities List (NPL). The DOE is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) and other response actions under the Amended Consent Agreement between the United States Environmental Protection Agency (USEPA) and the DOE.

In December, 1992, Fernald Environmental Restoration Management Corporation (FERMCO) assumed site remediation responsibilities as the DOE's first Environmental Restoration Management Contractor (ERMC).

The Fernald site includes five CERCLA Operable Units as follows:

Operable Unit 1 - OU1 covers approximately 37 acres and consists of a series of excavated pits containing solid and slurried wastes generated during plant operations. Specifically, OU1 includes waste pits 1 through 6, the Burn pit and the Clearwell.

Operable Unit 2 - OU2 consists of those waste units used for the storage or disposal of solid wastes from site operations. These include the inactive flyash pile, active flyash pile, south field disposal area, north and south lime sludge ponds, and solid waste landfill.

Operable Unit 3 - All plants, buildings and equipment that were involved in producing uranium metal products and in processing thorium for other DOE programs are included in OU3 remediation. The production area and production-associated facilities are generally steel framed structures covered with transite and contain a wide variety of process equipment.

Operable Unit 4 - OU4 is defined as the geographic area that includes the two K-65 silos, the metal oxide silo, the empty silo, the decant sump system, the radon treatment system, and soils and perched water that lie above the aquifer. The K-65 silos contain approximately 8,800 metric tons of residues remaining from the processing of pitchblende, a uranium-rich ore.

Operable Unit 5 - The fifth operable unit consists of environmental media that can serve as pathways for transporting contaminants. The environmental media that make up OU5 are soils, flora and fauna, surface water and sediments, and groundwater.

ESTIMATED REMEDIAL WASTE VOLUMES

The Fernald cleanup effort will generate a minimum of 104 million cubic feet of material classified as low-level radioactive waste. Fernald waste volumes are over three times greater than the total cumulative 33,000,000 cubic feet of low-level radioactive waste disposed of at the largest U.S. commercial disposal facility in Barnwell, South Carolina beginning in 1971.

Based on the preferred or current leading remedial alternatives as presented in the respective draft and final Feasibility Studies, the following waste material volumes are expected to be generated by each operable unit. Note that quantities are in place volumes in cubic feet with no allowance for excavation, decontamination, treatment, bulking or containerization:

Waste Material Volume (Cubic Feet)

	OU1	OU2	OU3	OU4	OU5	TOTAL
Pit Sludge	12,781,800					12,781,800
Silo Material				377,892		377,892
Other Waste Unit Material		9,412,200				9,412,200
Concrete/ Asphalt			3,093,120			3,093,120
Metal			60,534			60,534
Transite			48,600			48,600
Equipment			2,323,782			2,323,782
GW Treatment Sludge					1,620,000	1,620,000
Soils	6,388,200		14,342,400	799,200	52,839,000	74,368,800
TOTAL	19,170,000	9,412,200	19,868,436	1,177,092	54,459,000	104,087,000

WASTE DISPOSITION CONSTRAINTS

By definition, cleanup of the Fernald Site will not be completed until every cubic foot of waste material is "dispositioned." In the authors' opinion, the disposition of this material is the single most difficult aspect of site cleanup because of the significant political, technical, legal, financial and emotional impacts of waste disposition and land use decisions. Waste disposition decisions are decisions that the site owner is frequently least able to control without the input and/or concurrence of multiple external stakeholders.

Prudence dictates that a responsible owner develop a portfolio of waste disposition options that "balance" the interests of multiple stakeholders. At Fernald, current waste disposition plans consider a number of factors which we believe to be true:

1. Nevada will not allow Ohio to bury all Fernald waste material at the Nevada Test Site. History tells us that when large volumes of waste generated in one area of the country are disposed of in another area of the country, serious political problems can arise. In the late 1970's, the closure of two Eastern U.S. low-level nuclear waste disposal facilities resulted in a large increase in the volumes of U.S.

commercial nuclear waste shipped to the Barnwell site in South Carolina. Governor Riley's declaration that "South Carolina will not become the dumping ground of the nation" lead to utility volume allocations, imposition of a cap on waste burial volumes and subsequent passage of the Low-Level Waste Policy Act (LLWPA) mandating the formation of regional disposal "compacts." In the late 1980's, similar problems arose due to the large volumes of hazardous waste disposed of at the Chemical Waste Management site in Alabama which ultimately required resolution by the U.S. Supreme Court.

Current shipments of Fernald backlog waste (not remediation waste) already account for approximately 80% of the volume of low-level waste accepted for disposal at the Nevada Test Site (NTS). In August, 1994, the State of Nevada initiated a lawsuit against DOE to prohibit continued burial of Fernald waste at NTS until a NTS Sitewide Environmental Impact Statement (EIS) is completed. Whatever the result of the lawsuit, it's clear that the huge volumes of Fernald waste to be generated in the future cannot simply be disposed of at NTS without limit.

2. The people of Ohio do not want DOE to leave all Fernald waste material onsite in Ohio. It's equally clear that all Fernald waste will not remain onsite. Fernald local stakeholders want, at a minimum, the most hazardous Fernald remedial waste, including the silo uranium residue and Operable Unit 1 pit sludge, removed from the site. In fact, several local residents prefer a return to the pristine site condition existing in 1951 when plant construction was initiated.

   The Fernald Citizen's Task Force, consisting of local Fernald stakeholders, have concluded that final site cleanup should result in a maximum risk of exposure to uranium-contaminated soils of 1 in 10000 (10^{-4}). This fact alone will require that, in the absence of developing other means to reduce risk (i.e. construction of an engineered waste management facility capable of storing the most toxic Fernald wastes), a large volume of Fernald waste material will have to be removed from the site.

3. Removing all Fernald Waste to off-site locations is not financially feasible. Even if all Fernald waste could be disposed of in Nevada, such an option is not feasible because of costs estimated in excess of $3B.

In early 1994, a table game called "FutureSite" was developed by the Fernald Citizens Task Force to evaluate Fernald land use options (commercial, industrial, residential) based on acceptable risk levels. The exercise uses stacks of different colored chips to represent varying concentrations of uranium-contaminated soil at the Fernald site. The "game board" is a map of the site that is marked with a 1000-square-foot grid. The object of the exercise is to remove chips from the site game board into either onsite or off-site disposal bins to achieve the desired site future use. In essence, players determine how much soil must be cleaned up to reach a certain land use. Finally, players tally the cost associated with the desired level of cleanup. The amount of money and number of off-site shipments required to return the site to pristine condition (i.e., remove <u>all</u> waste material from the site) was considered infeasible by virtually all game participants.

4. <u>Much of Fernald waste material must remain onsite</u>. This is a corollary of factor #3. Resistance to leaving material onsite has always been based on the fact that the Fernald site is located over the sole-source Great Miami Aquifer (which, by the way, is already contaminated). Ohio EPA regulations explicitly prohibit the siting of waste disposal facilities over sole-source aquifers. Ohio EPA regulations, however, contain a waiver provision if the disposal facility can be shown to be protective of the acquifer. Therefore, in recognition of financial, technical and political realities, the Ohio EPA has acknowledged that a waiver may be appropriate for onsite disposal of some of Fernald's contaminated material.

   Specifically, in a letter from the Ohio EPA to the US EPA Region 5 dated April 5th, 1994, Graham Mitchell, Chief of the Office of Federal Facility Oversight, stated that:

   > *"Large volumes of contaminated construction and demolition debris, soil, flyash and bottom ash and possibly some solid waste will have to be disposed onsite at Fernald."*

5. <u>Commercial disposal relieves pressure from DOE disposal options.</u> For waste that can be disposed of via shallow land burial, the use of commercial disposal facilities in addition to DOE facilities not only adds to the portfolio of disposition options but also removes the pressure on DOE caused by electing to bury all waste at a single DOE disposal facility. The Envirocare site in Utah is a viable option for the disposition of DOE low activity radioactive waste. In fact, DOE has

already negotiated a complex-wide contract with Envirocare for certain types of mixed-waste meeting the Envirocare site's waste acceptance criteria.

6. Recycling must be an important element of the waste disposition strategy. The Presidential Order on recycling requires that DOE "promote cost effective waste reduction and recycling of usable materials in all of its operations and facilities" and that DOE integrate these programs "to assist in addressing the nations solid waste disposition problems." Notwithstanding the order, it makes good environmental and political sense to recycle. In fact, we are beginning to see competition between DOE sites in the initiation of recycling efforts.

   Cost comparisons between recycling and disposal frequently show that a cost premium must be paid for recycling. In recognition of the importance of recycling, DOE has concluded that reasonable recycling premiums can be justified.

7. Clean material should not be disposed of as low-level radioactive waste. Most DOE sites including Fernald have "controlled areas" that require dosimetry for entrance because of potential exposure to radiation or the presence of contamination. Should every object and all material in a controlled area be automatically considered contaminated and thus shipped off-site for disposal as radioactive material? The answer is, of course, "no." We have enough problems burying material that is radioactive. To avoid burying material that is clean, procedures must be put in place to deal with clean material and, in fact, "free-release" clean material from controlled areas.

8. Before we ask anyone (Ohio, Nevada or Utah) to take any Fernald waste, we must be able to state clearly that, "We have: 1) minimized the volume of waste material generated; and 2) implemented prudent volume reduction activities prior to disposal." It goes without saying that the use of best management practice is a necessary prerequisite for DOE before asking others to accept the responsibility for waste volumes generated by DOE as a legacy of the cold war.

WHAT DO WE DO WITH ALL THIS WASTE?

With this background in mind, Fernald currently plans to disposition 104 million cubic feet of waste as follows. Note that all decisions are subject to approval under the CERCLA process.

Pit Sludge (12.8 million cubic feet)

The OU1 pit sludge consists of approximately 12.8 million cubic feet of raffinate, magnesium fluoride slag and miscellaneous process debris that had been buried in pits between 1953 and 1983. This material is a major potential source of contamination of the Great Miami Aquifer and is appropriately included in the list of material that Fernald Stakeholders would like to have removed from the Fernald site.

The preferred alternative for disposition of OU1 pit sludge material is excavation, drying and shipment by rail to a commercial disposal site in the arid west. Envirocare of Utah is the only disposal site currently known to meet this criteria. Envirocare offers a number of advantages over the DOE Nevada Test Site (NTS) including; 1) direct rail access; 2) ability to bury waste material in bulk rather than containerized form; and 3) location in Tooele County, an area zoned for hazardous waste management operations. The Envirocare facility already contains 75 million cubic feet of DOE uranium mill tailings relocated from the Vitro Company in Salt Lake City. Shipping OU1 pit contents to Envirocare eliminates the need to ship the material to NTS.

Silo Material (378,000 cubic feet)

The contents of the Operable Unit 4 K-65 silos includes residues rich in uranium content and classified as 11(e)2 by-product material. The material contains radium and thorium which contribute to elevated radiation fields in the vicinity of the silos and the emission of radon gas. Like the Operable Unit 1 pit material, Fernald stakeholders have a strong desire to have this material removed from site. As a result, the preferred remedy for Operable Unit 4 is to vitrify the material in an onsite facility and ship the material off-site to the Nevada Test Site for disposal.

OU2 Other Waste Unit Material (9.4 million cubic feet)

OU2 includes other waste unit material, specifically solid waste, lime sludge, flyash and contaminated construction debris. This material has activity levels far below the pit materials included in OU1. As a result, the leading remedial alterative for OU2 is to excavate the material and place it in an onsite disposal cell.

OU2 is especially important to Fernald cleanup plans since it is the first Operable Unit to propose construction of an onsite disposal cell and leaving waste material onsite. If such approval is granted in the OU2 Record of Decision, the facility design will have to be approved by EPA/OEPA and will be

subject to public review and comment. It is anticipated that the cell size would ultimately be expanded to accept larger volumes of OU3 demolition debris and soils generated from OU's 1, 3, 4 and 5 provided that these materials meet the cell waste acceptance criteria (WAC).

Concrete/Asphalt (3.1 million cubic feet)

Demolition of buildings and structures within the OU3 production area will generate approximately 3 million cubic feet of concrete and asphalt debris. The OU3 interim record of decision permits up to 10% of total OU3 material to be shipped off-site for disposal at the Nevada Test Site prior to the final record of decision. The final Record of Decision is expected to call for the disposition of most OU3 remediation materials, including concrete and asphalt, within the property boundary in an on-site disposal cell.

Metal (61,000 cubic feet)

Operable Unit 3 building demolition will generate 61,000 cubic feet of metal. As demonstrated on the recent dismantlement of Plant 7, the vast majority of Fernald metal generated before the final OU3 record of decision will be recycled. Recycling is applicable to two general classes of material, 1) material that can be reasonably decontaminated and "free-released" to the economy and 2) material that cannot be reasonably decontaminated but can be melted and "beneficially reused" within the controlled DOE environment. Plant 7 structural steel will be decontaminated for "free-release" and sold into the commercial scrap metal market. The former Fernald scrap metal pile was melted for "beneficial reuse" and fabricated into shield blocks for use in physics experiments at Los Alamos National Laboratory.

If onsite disposal is approved in the final OU3 record of decision, metal recycling would be re-examined in light of the economics of the onsite disposal option.

Transite (49,000 cubic feet)

Transite, a building material consisting of cement and asbestos, was used as siding and roofing material on many of the Operable Unit 3 buildings. Since the asbestos material is non-friable, transite will be shipped for burial at the Nevada Test Site at least until the final OU3 record of decision. After the final ROD, it is anticipated that transite meeting the onsite cell waste acceptance criteria will be disposed of in the onsite cell.

Equipment (2.3 million cubic feet)

The approximate 160 buildings in Operable Unit 3 contain numerous components of contaminated equipment, estimated to have a total collective volume of approximately 2.3 million cubic feet. With the exception of a small amount of equipment that might be excessed and made available to other U.S. government facilities, this equipment will either be recycled or disposed of in the onsite cell if approved in the Operable Unit 3 Record of Decision.

Ground Water Treatment Sludge (1.6 million cubic feet)

Operable Unit 5 includes the uranium contaminated groundwater under the Fernald site plus contaminated water expected to be generated during the remediation of other operable units. This water will be treated and released in an Advanced Waste Water Treatment system prior to release. The Advanced Waste Water Treatment system is expected to operate for 30 years, generating a total of 1.62 million cubic feet of sludge. It is expected that this water treatment sludge will either be shipped off-site for disposal or disposed of in the onsite cell.

Soils (74.4 million cubic feet)

Contaminated soil contributed by four operable units is the largest single source of Fernald waste requiring disposition. This total soil volume includes not only the site surface soil volume of OU5 but also contaminated soil impacted by pit and silo excavation and building removal. It is estimated that the Fernald cleanup will generate approximately 74 million cubic feet of contaminated soil exceeding the anticipated cleanup action level of 50 ppm uranium. Total uranium contamination levels of on-site soils range from background (3.7 ppm) up to a maximum of 10,000 ppm.

At one point, it was anticipated that soil washing would be used to clean uranium contaminated soil to designated site cleanup levels. The "clean" fraction (approximately 80%) would remain onsite while the "dirty" fraction (approximately 20%) plus secondary waste would be shipped off-site for disposal. In support of this initial plan, the Fernald site was designated as the lead site for the Uranium In Soils Integrated Demonstration sponsored by DOE EM-50.

The initial plan to wash Fernald Uranium contaminated soil was modified based upon a recognition of the following:

1. Soil washing would necessitate the construction of substantial capital facilities—something to be avoided, if possible, on a superfund site.

2. Soil washing tests at Fernald using an acid based leaching treatment generally yielded results achieving preliminary clean up goals (50 ppm Total U). However, the leachability of the U remaining in the soil increased which had the effect of lowering the clean up goal to below 20 ppm. Additionally, higher volumes of secondary waste were generated due to the decomposition of the soil itself. Although clean up goals were partially achieved, the generation of a difficult secondary waste made soil washing in this manner an expensive proposition.

   Additional testing performed by the Uranium Soils ID used a Carbonate based extraction process. The treated soil fraction was generally higher and less secondary process wastes were generated. However, results indicated that decontamination levels achieved were only in the 120-150 ppm Total U range, values well above the preliminary clean up goal.

3. With construction of an onsite cell anticipated, huge volumes of fill material would be required to fill the voids between the components of demolition debris. Since the anticipated waste acceptance criteria (WAC) of the onsite cell is higher than the activity of over 99% of total site soil volume, it turns out that virtually all contaminated site soils can be placed in the onsite cell as fill material with no need for soil washing.

The current plan therefore, is to dispose of contaminated soil in the onsite cell containing OU2 pit material and OU3 demolition debris.

It should be noted that the volume of contaminated soil requiring disposition in an onsite cell is a function of the distribution of soil contamination, the final cleanup action level (estimated to be 50 ppm) and the final cell waste acceptance criteria (estimated to be 1080 ppm). Figure 1 illustrates the impact of these factors on the volume of contaminated soil to be placed in an on-site disposal cell.

SUMMARY

It is expected that approximately 25% of anticipated remedial waste volume will be removed from the Fernald site with the balance placed in an onsite disposal cell. The disposition of 104 million cubic feet of Fernald waste is a difficult technical undertaking complicated by many factors

frequently beyond the control of the Department of Energy. It is our belief that the timely disposition of waste material (and therefore the success of Fernald's remediation) will be successful only if a portfolio of prudent disposition options are made available and then selected based on input from the broadly-defined universe of Fernald stakeholders.

(FIGURE 1 IS IN FREELANCE GRAPHICS FOR WINDOWS - UNDER THE FILE NAME PLANT 7A)