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FINAL REPORT FOR PLANT 7 LEAD DECONTAMINATION AND RECYCLING PROJECT

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FINAL REPORT

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Department of Energy

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Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V - SRF-5J
77 W. Jackson Blvd.
Chicago, IL 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, OH 45402-2911

Dear Mr. Saric and Mr. Schneider:

FINAL REPORT FOR PLANT 7 LEAD DECONTAMINATION AND RECYCLING PROJECT

The purpose of this letter is to transmit the final report for the Plant 7 lead decontamination and recycling project. This report documents the results and lessons learned from this recently completed lead recycling project at the Fernald Environmental Management Project (FEMP). Approximately 6.23 tons of the 7.32 tons of lead received by Scientific Ecology Group (SEG) were successfully free released for recycling.

If you have any questions, please contact John Trygier at (513) 648-3154.

Sincerely,

Johnny Reising

Johnny W. Reising
Fernald Remedial Action
Project Manager

FN:Hall

Enclosure: As Stated

Recycled and Recyclable

cc w/enc:

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J. Trygier, DOE-FN

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT (FEMP)
FINAL REPORT
FOR THE
PLANT 7 LEAD DECONTAMINATION AND RECYCLING ENGINEERING STUDY

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1.0 INTRODUCTION

Plant 7, a seven - story building measuring approximately 80' x 110' x 110', was constructed in May 1953 and was the tallest and most visible structure at the FEMP site. Plant 7 was used to convert uranium hexafluoride (UF_6) to uranium tetra fluoride (UF_4). Production operations were initiated in June 1954 and continued until 1956, after which time the Pilot Plant assumed this operation. In 1967, the uranium hexafluoride reduction process was declared obsolete and the majority of the process equipment and piping were dismantled and removed. After that time, Plant 7 was used to store equipment, empty containers and drums of UF_4.

Hazardous conditions that existed in Plant 7 prior to the start of decontamination and dismantlement (D&D) included deteriorating and friable asbestos insulation and transite siding, histoplasmosis, lead paint and flashing, and radiological contamination.

Decontamination and dismantling began in May 1993 and continued through November 1994. D&D produced several waste streams which were properly managed and dispositioned. Waste management and dispositioning of these materials included size reduction, decontamination, recycling, disposal and OU3 Engineering Studies. The OU3 Engineering Studies included the decontamination and recycling of structural steel and lead.

The lead, generated as a result of decontamination and dismantlement of Plant 7 Removal Action Number 19 (RvA 19), was in the form of roof flashing, siding flashing and window sills contaminated with natural and depleted uranium and some of the material was coated with at least one layer of lead based primer and paint. In general the contamination levels of the lead range between 20,000 dpm to 70,000 dpm total activity.

On March 13, 1995, the Scientific Ecology Group (SEG) and the Fernald Environmental Restoration Management Company (FERMCO) entered into an agreement to subcontract for decontamination, processing, radiological monitoring and unrestricted reuse of an estimated 1.64 tons of low level radioactively contaminated lead.

This subcontract was awarded to provide the services to fulfill the objectives of Removal Action Number 19, that were agreed upon between the U.S. Department of Energy (DOE) and U.S. Environmental Protection Agency (USEPA) under an Amended Consent Agreement. The subcontract was conducted in accordance with DOE's RvA 19 work plan, SEG's Offsite Processing Work Plan, Health and Safety Plan, Quality Assurance Project Plan, and Transportation Plan, other applicable, or relevant and appropriate requirements (ARARs) to the extent required by Section 120 and 121 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA) as noted in the subcontract.

The objective of this Engineering Study was to identify and execute a method for processing of the low level radioactively contaminated lead. The demonstration consisted of decontamination of the lead for unrestricted reuse, recycling the released material through a scrap metal dealer, and processing and disposing of secondary waste.

One of the requirements of RvA 19 is to submit a Final Report after final processing of the material and dispositioning of the project generated waste. This report fulfills that deliverable for a portion of the overall waste stream, provides a synopsis of the work

defined in the SEG scope of work, certifies that the work was performed, explains modifications to the subcontract and why modifications were necessary, describes the successes and problems in completing the project requirements, and provides a summary of the volumes of waste and beneficially reused metals.

2.0 SCOPE OF WORK

The FERMCO scope included audit oversight of shipments, of processing at SEG, and of return of the primary (unreleasable) waste to the FEMP.

The SEG scope of work for this project involved the transportation, receipt, necessary interim storage, decontamination, processing, radiological monitoring, and recycling of 1.64 tons of radioactively contaminated sheet lead. Additionally, the SEG scope included the processing, characterization, packaging, transport, and final disposition of secondary waste.

2.1 Contract Modifications

A modification to SEG's contract during September, 1995 increased the quantity of lead to be processed from 1.64 tons to 7.548 tons to allow FERMCO to disposition additional lead from the Plant 7 decommissioning.

3.0 SUMMARY OF WORK PERFORMED

The Plant 7 Lead Decontamination and Recycling project was performed in a seven phase effort to allow for the successful completion of the work defined in Section 2.0. The seven phases consisted of transportation from the FEMP of the radioactively contaminated sheet lead to SEG's Oak Ridge, TN facility, chemical decontamination of the lead, post decontamination survey for free release and sale to a scrap metal broker, processing secondary and tertiary waste as SEG waste for disposal at a commercial burial site, disposal of secondary and tertiary waste at a commercially licensed burial facility, return of non deconnable and primary waste to the FEMP and documentation, and evaluation of the results of the project in a final report.

3.1 Submittal of Subcontract Deliverables

In order to perform the Engineering Study in accordance with the subcontract, several project deliverables were prepared for review and approval by FERMCO. These deliverables consisted of the following:

- Offsite Processing Work Plan
- Health and Safety Plan
- Transportation Plan
- Quality Assurance Project Plan

The Offsite Processing Work Plan was submitted to FERMCO for review and approval. The plan provided a description of project integration and management, offsite activities, transportation, SEG facilities, decontamination and free release of the materials, and disposition of the waste.

The Health and Safety Plan described the safe work practices to be used and the constraints to be exercised while working. The plan also provided information on the health effects and standards for known contaminants, and procedures designed to account for the potential for exposure to radioactive contaminants and hazardous materials.

The Transportation Plan described the requirements and responsibilities for the safe and efficient loading and off-site transport of the containers of sheet lead. The purpose of this procedure was to establish guidance to properly classify, describe, package, mark, label and manifest radioactive materials for transportation from the Fernald Environmental Management Project. All shipments were conducted in accordance with the SEG State of Tennessee issued radioactive material licenses and applicable state and federal regulations. The Quality Assurance Project Plan described the Quality Assurance system for controlling work performed by SEG. This document was written as a supplement to the existing SEG Quality Assurance Program document.

3.2 Performance Audit/QA Surveillance

After review of the subcontract deliverables, FERMCO performed an audit of the SEG Bear Creek Road and Gallaher Road facilities to evaluate the preparedness to transport, receive and treat (decontaminate) the Plant 7 lead. After all audit findings, concerns, and recommendations were resolved, FERMCO instructed SEG to begin processing. The audit assured that the SEG facilities were ready to transfer, store, process, free release and package the material and waste.

FERMCO QA surveillance were performed throughout the project to assure that the disposition of waste and processing of the material met regulatory requirements, to verify subcontract requirements and to assure that the work was performed in accordance with the SEG site and project specific procedures.

3.3 Transportation and Receipt of Plant 7 Lead

Prior to shipment, all radioactive material was classified for transportation, in order to provide for the proper packaging and subsequent labeling, marking, and manifesting. The material shipped as depleted uranium and met the Low Specific Activity (LSA) criteria. The sheet lead was shipped from the FEMP to SEG on September 1, 1995. The boxes were loaded unto the transporter's truck by FERMCO.

The shipment consisted of three small white metal boxes. The FERMCO preparation of the package for shipment included: preparation and packaging of the radioactive material in accordance with Department of Transportation (DOT) requirements; labeling; marking; inspecting the package; preparation of documentation for transportation; container radiation and contamination surveys; vehicle inspection; shipment loading; vehicle placarding; vehicle contamination; and radiation survey.

Documentation used for the shipments leaving the FEMP was a straight bill of lading, a shipping manifest, a vehicle condition checklist, exclusive use instructions and a shipment release checklist.

SEG received the three boxes of sheet lead at the SEG Bear Creek Road facility in Oak Ridge, TN on September 3, 1995.

3.4 Sorting, Cutting and Sizing

On September 8, 1995, processing was initiated by SEG at the SEG Bear Creek Road site Decon P-4 facility. The lead sheets were removed from the shipping boxes, manually flattened with hammers, cut as required to fit the chemical processing baskets and placed into B-12 containers for transfer to the chemical processing area. Pieces as long as 33 inches could be accommodated. Some sheets of lead that where badly crumpled and that could not be straightened and processed, incidental dry active waste, and water were removed from the small white metal boxes, segregated, and placed in separate containers for return to the FEMP.

3.5 Processing and Decontamination of Lead

The lead was transferred to the SEG Central Volume Reduction Facility Decon Room for chemical processing. A preliminary evaluation was made by the decontamination supervisor to determine suitability of the lead for decontamination using the SEG chemical process. After inspection, the lead pieces were loaded into the process baskets and transferred via overhead crane to the first process, a caustic bath.

In the caustic soak cycle, a sodium hydroxide solution was used to break down the oxide layer formed on the surface of the lead. The lead was pickled in the solution. The basket was removed from the caustic tank via an overhead hoist. The lead pieces were rinsed with water to remove all loose contaminants. After the oxide layer was broken down in the caustic tank and rinsed, the basket of lead was placed into a nitric acid solution. The nitric acid removed impurities on the surface, along with attacking the base lead and removing fixed radioactive contaminants. The basket was removed from the nitric acid cycle. During the post nitric rinse, a water spray wand was used to rinse each piece of lead to remove surface contaminants as well as the nitric acid. The basket was then moved to a holding area to dry.

3.6 Release for Unrestricted Reuse

The lead sheets were then taken to the lead pre-survey cubicle for surveying for free release to meet DOE Order 5400.5 and SEG's Radioactive Materials license. After passing the pre-screen survey the lead sheets were taken to a location with low background radiation levels to ensure adequate surveying. The lead sheets were smeared with muslin cloth to detect any loose surface contamination. The smears were sent to the laboratory and counted on a Tennelec System. The lead sheets were then monitored with a CM7 for beta-gamma-fixed contamination.

Pieces that did not meet the radiological criteria for free release were reprocessed using the chemical decontamination system. Pieces on which residual contamination was associated with areas covered with a tar-like substance or with a blue film of fixative previously applied by FERMCO during D&D of Plant 7, were spot cleaned with a disk sander. All lead pieces selected for processing eventually met radiological release criteria. The lead that met the free release criteria was sold to Southern Alloys, Inc., Oak Ridge, TN for unrestricted reuse.

3.7 Waste Processing, Treatment and Disposition

Secondary and tertiary wastes were designated to be dispositioned by SEG as SEG wastes. Secondary wastes were collected in 24.5 ft^3 polyethylene Enduropak containers. Chemical wastes and mixed waste comprised of chemicals from the chemical decontamination process with lead in the solution, was solidified by SEG by microencapsulation. SEG processes these wastes routinely and since there was a small amount of FERMCO lead to be processed, it was determined to be uneconomical to separate the wastes. Therefore,as previously stated, the microencapsulated wastes were designated as SEG wastes.

The chemical secondary wastes generated during the project were as follows:

Spent caustic Solution	24.5 ft^3	1 Container
Spent Nitric Acid Solution	49.0 ft^3	2 Containers
Caustic Rinse Water	24.5 ft^3	1 Containers
Nitric Acid Rinse Water	24.5 ft^3	1 Containers
Non-recirculated Rinse Water	147.0 ft^3	6 Containers
Total:	269.5 ft^3	11 Containers

Processing of secondary waste began at SEG on October 23, 1995 and was completed on January 3, 1996. After evaporation of excess water and microencapsulation of the consolidated process sludges, the final disposal volume was about 100 ft^3. Samples of the stabilized waste were taken and split for parallel analysis by SEG and an outside FEMP approved laboratory. Analysis of the secondary waste samples indicated that all constituents of TCLP analysis were well below the RCRA regulatory limits. The waste was transported and buried at a radioactive landfill.

Tertiary wastes included protective clothing, sampling supplies, air filtration products and disposable items used in the size reduction process. Tertiary wastes were collected, containerized in SEG innerpack boxes, bar coded and tracked as SEG waste. The tertiary wastes were treated either by compaction or incineration. Compacted and incinerated SEG waste was characterized, overpacked, transported and buried at a radioactive landfill (Barnwell).

In addition, approximately 30 gallons of water were found in one of the boxes during the unloading operations at SEG. Laboratory analysis of samples of the water showed significant lead levels (1,100 ppm) and barium (800 ppm). The tramp water was transferred to a collection drum and returned to the FEMP as primary waste for treatment.

4.0 MATERIAL BALANCE AND WASTE TRACKING INVENTORY

Weights of materials received at SEG, processed, and dispositioned are depicted on the attached flow chart (Attachment I). Data are tabulated as follows:

Net Weight Material Received:	7.320 tons
Lead free-released for recycled:	6.230 tons
Lead not compatible with process (Excessively crumpled):	0.320 tons
Water:	0.150 tons
Incidental concrete, insulation, etc.:	0.100 tons
Fines, dust, and sweepings:	0.080 tons
Airborne losses to HEPA (estimated):	0.005 tons
Losses to chemical process:	0.429 tons

5.0 LESSONS LEARNED

The major success was that all lead processed was cleaned to the required level of unrestricted release for recycling. The decontamination activities were completed on schedule.

One problem was that the shipment from the FEMP contained some materials other than lead sheets. The corrective action will be to ensure future material segregation functions are implemented more thoroughly with oversight performed in the field as verification.

Processing of some of the lead was complicated by severe deformation. This deformation was a result of bending, folding, and compaction of the lead sheets during containerization at the FEMP. Virtually every piece was crumpled and required manual straightening before it could be cut to size. Straightening was accomplished by repetitive pounding with hammers. The most crumpled sheets, 641 lbs., were determined to be too deformed for such flattening and processing and were set aside. The crumpled lead sheets were returned to the FEMP as primary waste. Future projects for recycling of lead should implement a plan that considers packaging to preserve the integrity of the material so that optimum recycling may occur. Due to the "soft" nature of the metal, the deformation problem could exist unless significant efforts are taken to carefully store and containerize the metal.

A tar-like substance and a blue fixative film were countered on many of the sheets which were not removed during the chemical decon process and apparently attracted and/or held particulate contaminates. Contamination associated with these materials was successfully removed with a hand held disk sander in a lead preparation room of the P-4 Decon Facility. Fixative should not be applied to materials destined for recycle if avoidable, since additional efforts are required to remove the fixative.

6.0 CONCLUSIONS AND RECOMMENDATIONS

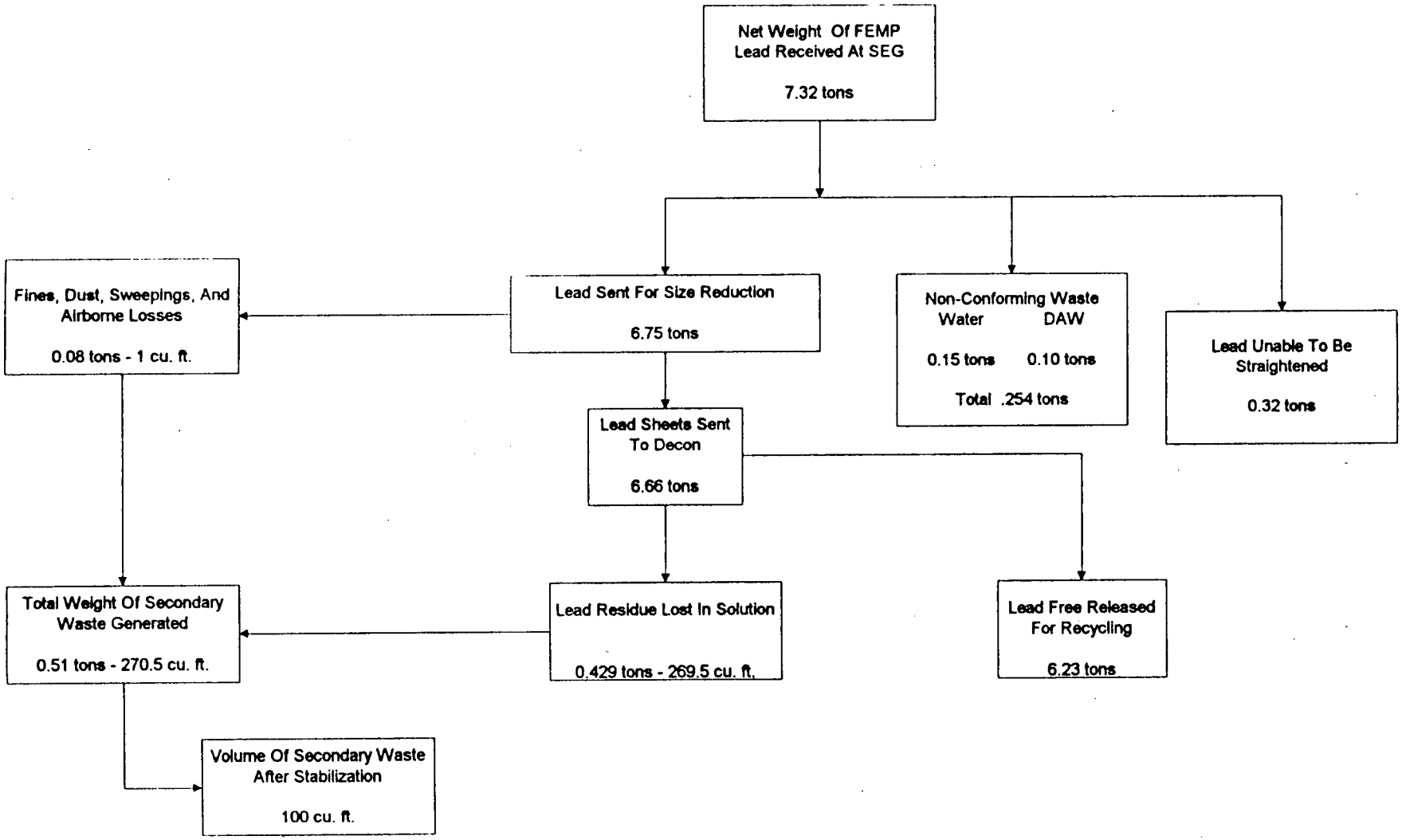
This engineering study provides several important recommendations and conclusions which the FEMP must consider during OU3 remedial actions. Due to the soft nature of lead, additional care should be taken when dismantling this material for recycle. Also, the contaminant fixative should not be applied to lead destined for recycle. Lastly, the costs for

alternate treatment technologies for lead, such as macroencapsulation, should be further developed for comparison to lead recycling costs.

This engineering study has demonstrated a technology that can be implemented on a larger scale. The cost to decontaminate and recycle the 7.548 tons or 15,096 lbs of lead was $76,257. The salvage value credited for sale of the scrap lead to a scrap metal dealer was $2,565. It is anticipated that the unit costs for this technology would be reduced if applied to larger volumes and less crumpled lead.

Attachment II provides additional information about the cost. It is currently estimated that there is 17.5 tons of lead flashing that will be generated during D&D at the FEMP. The lessons learned in this study will be beneficial to the FEMP in future recycling efforts.

MATERIAL BALANCE OF SHEET LEAD REMOVED FROM THE FEMP



Attachment I

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ATTACHMENT II
PLANT 7 LEAD RECYCLING
COST ANALYSIS

JAN. 95-SEP 96	COST	COST/15,096 LBS	COST/707.7LBS/CF
FERMCO	$27,451	1.82	$1,286.97
SEG	48,806	3.23	2,288.14
TOTAL COST	$76,257	5.05	$3,575.11

NOTE: 7.548 tons
or 15,096 lbs

The FERMCO scope included audit oversight of shipments, of processing at SEG, and of return of the primary (unreleasable) waste to the FEMP. The scope also included sampling, analysis, repackaging and shipment of waste for final disposition.

The SEG scope of work included the transportation, receipt, necessary interim storage, decontamination, processing, radiological monitoring, and recycling of the radioactively contaminated sheet lead. Additionally, the SEG scope included the processing, characterization, packaging, transport, and final disposition of secondary waste.

ESTIMATE TO COMPLETE is a proration of the project close out cost. Project close out includes preparation and issuance of the final report, final payments, records management and cease charge notice.

NOTE: One charge number was used for both the recycling of the Plant 7 lead and the steel. All cost have been prorated at 3% of the total project cost. The 3% used to prorate the cost is a ratio between the time/cost to decontaminate the lead and the combined time/cost to decontaminate the lead and steel as charged to the Plant 7 dismantling engineering and waste control accounts.