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FINAL REPORT PHASE I SCRAP METAL PILES - REMOVAL ACTION NO. 15 - SEPTEMBER, 1994

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REPORT

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FINAL REPORT

PHASE I SCRAP METAL PILES

Removal Action No. 15

September 1994

U.S. DEPARTMENT OF ENERGY

FINAL REPORT

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Fernald Environmental Management Project

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirements
B69	Decontamination Building
CAM	continuous air monitor
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm^2	square centimeter
DAC	Derived Air Concentration
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
dpm	disintegrations per minute
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
HWMU	Hazardous Waste Management Unit
LANL	Los Alamos National Laboratory
LLW	low level waste
LSA	Low Specific Activity
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
OEPA	Ohio Environmental Protection Agency
OU-3	Operable Unit 3
PPE	personal protective equipment
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RA-15	Removal Action No. 15
RA-17	Removal Action No. 17
RAPP	Removal Action Project Plan
RAWP	Removal Action Work Plan
RCMSP	Radioactively Contaminated Metal Segregation Project
RCRA	Resource Conservation and Recovery Act
RSE	Removal Site Evaluation
SAM	Southern Alloys and Metals, Inc.

ACRONYMS AND ABBREVIATIONS (continued)

SCQ	Sitewide CERCLA Quality Assurance Project Plan
SEG	Scientific Ecology Group, Inc.
SOP	Standard Operating Procedure
TLD	thermoluminescence dosimeter
USEPA	U.S. Environmental Protection Agency
WEMCO	Westinghouse Environmental Management Company of Ohio

EXECUTIVE SUMMARY

The Scrap Metal Piles Removal Action No. 15 (RA-15) Work Plan (RAWP) described a two-phased approach to the removal of the recoverable scrap metal piles; ferrous and non-ferrous scrap metals removal (Phase I) from the Decontamination Building (B69) Pad and scrap copper piles removal (Phase II) from the Plant 1 Pad. Recoverable scrap metals are defined as metals ≥ ¼-inch thick. This final closeout report covers Phase I removal actions for recoverable scrap metal. Phase II removal actions for recoverable scrap copper will be discussed in a separate final closeout report. Non-recoverable refuse metal (metal < ¼-inch thick) also stored on the B69 Pad was dispositioned under Removal Action No. 9 (RA-9) - Removal of Waste Inventories, Part I - Current Low-Level Waste Management and is not a part of this removal action. Newly generated scrap metal is being managed in accordance with Removal Action No. 17 (RA-17) - Improved Storage of Soil and Debris. Therefore, no additional scrap metal was added to the recoverable scrap metal piles within the scope of this removal action.

ES.1 BACKGROUND

The scrap metal piles were located on the B69 Pad in the northeast corner of the northeast quadrant of the Production Area for Operable Unit 3 (OU-3). The scrap metal was generated at the Fernald Environmental Management Project (FEMP) as a result of past on-site demolition projects, abandoned equipment, and the upgrade of facilities and vehicles. The scrap metal on the B69 Pad was segregated as part of the Radioactively Contaminated Metal Segregation Project (RCMSP) in May 1987. The RCMSP segregated the recoverable scrap metal into ferrous and non-ferrous high-count (>200,000 disintegrations per minute [dpm]) and low-count (<200,000 dpm) radioactivity categories.

Elevated uranium concentrations in surface and subsurface soils, perched groundwater, and fugitive airborne releases were detected near the scrap metal piles. The scrap metal piles were determined to be a potential source of this contamination. Therefore, there was a potential threat of contaminant migration from the exposed scrap metal piles to previously uncontaminated areas and of exposure to human or environmental receptors. The magnitude of the potential threat was evaluated in the RA-15 Removal Site Evaluation (RSE) based on surface and subsurface soil, perched groundwater, and air

monitoring radiological data. Consistent with Title 40 Code of Federal Regulations (CFR) § 300.415 of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the U.S. Department of Energy (DOE) determined that the removal action was appropriate and issued an action memorandum. The DOE further required that the recoverable scrap metal be recycled or "beneficially reused". The U.S. Environmental Protection Agency (USEPA) approved RA-15 in April 1992 under the amended consent agreement executed between the USEPA and the DOE.

Following an extended procurement process, the Westinghouse Environmental Management Company of Ohio (WEMCO) awarded a contract to the Scientific Ecology Group (SEG) in October 1992. SEG was directed by WEMCO to recycle the contents of the scrap metal piles and to function in a "turnkey" capacity to perform all work according to a series of project-specific plans. SEG was responsible to perform metal sorting, segregation, size reduction, packaging, transportation, processing, and final recycling/disposition of the end product. In addition, SEG was responsible to characterize, process, package and disposition any secondary waste generated during the process. The Fernald Environmental Restoration Management Corporation (FERMCO) assumed cleanup responsibilities from WEMCO in December 1992, and assumed management of RA-15.

The objectives of Phase I of RA-15 were: 1) to reduce the potential for contaminant migration to previously uncontaminated areas, and minimize the potential for exposures to human or environmental receptors by eliminating the scrap metal piles; and 2) to maximize recycling of the scrap metal. These objectives were met by size reducing, packaging, and transporting the scrap metal off site for processing and recycling, thereby removing the potential threat from the FEMP. Phase I of RA-15 was considered complete when the recoverable scrap metal piles were containerized, processed, decontaminated, transported from the FEMP, and recycled for beneficial reuse or properly dispositioned as described in this report.

ES.2 SUMMARY OF FIELD ACTIONS

SEG utilized two subcontractors, Southern Alloys and Metals, Inc. (SAM) and Quadrex, to complete the removal action. SAM size-reduced and packaged the metal on site. Quadrex decontaminated non-ferrous metals (aluminum and stainless steel) at its facility at Oak Ridge. SEG provided project management, supervision, health physics,

radioactive material shipping, melting the scrap metal into shield blocks, and secondary waste handling, treatment, and transport for disposal. A total of 2,279.57 tons of scrap metal was removed from the FEMP as part of RA-15 and was recycled and/or disposed of accordingly.

Phase I of RA-15 was conducted by SEG and its subcontractors in accordance with approved project plans including a Removal Action Project Plan (RAPP), Operations and Maintenance Plan, Site Safety and Health Plan (SSHP) and Quality Assurance Project Plan (QAPP). Scrap metal removal began with on-site mobilization in January 1993. During mobilization, subcontractor personnel completed the required FEMP administrative, training, and security requirements, and received respiratory fit testing to ensure safety and to minimize the potential spread of radioactive contamination. In addition, medical surveillance examinations, and baseline urinalyses were conducted to monitor personnel for potential exposure to radioactive contamination while on site. During the final stages of mobilization, radiological control zones were established to prevent the spread of any contamination during the removal action and air monitoring stations were established around the B69 Pad to detect any possible radiation contaminants, which may migrate off site. The work area was sectioned off as a SEG controlled area.

Size reduction, when necessary, was performed using a 1,200-ton capacity shear. Non-ferrous metals were either loaded with a crane or packaged into containers via a front end loader. Ferrous metals were packaged with a crane and electromagnet.

Radiological air sampling and high volume work area and breathing zone sampling were performed throughout the sizing and packaging operations to monitor for off-site migrations and to ensure that the proper personal protective equipment was being worn in compliance with the SSHP. All site workers participated in the FEMP dosimetry and urinalysis monitoring programs. Monitoring results showed that no off-site migration of airborne radiological contaminants above the 25 percent Derived Air Concentration (DAC) occurred for depleted uranium and there were no confirmed personnel exposures exceeding administrative investigation levels. Contaminated dust migration and metal oxidation were controlled by misting the scrap metal piles. Residues from the misting were washed into a drain connected to the FEMP rainwater sewer collection system.

Containers were loaded to their volume or weight capacity, lids were secured, and each container was externally wiped down, weighed, barcoded, and staged for radiological survey prior to release from the pad. Once the contamination survey for fixed and removable contamination was performed, released containers were loaded and transported in accordance with U.S. Department of Transportation (DOT) requirements.

All the recoverable scrap metals were removed from the FEMP and on-site demobilization was completed by September 30, 1993. Upon completion of the removal of the scrap metal piles from the FEMP, items that were successfully decontaminated were free released for unrestricted use in compliance with applicable state and federal regulations as well as DOE orders and FERMCO policy. Miscellaneous items, tools, equipment and scrap that were unable to be decontaminated were packed and/or wrapped to acceptable levels and transported to the SEG Oak Ridge facility. Contaminated items received at SEG were either kept for use in radiologically controlled areas in accordance with SEG's radioactive materials licenses, or further decontaminated to meet the DOE free release criteria using more thorough techniques.

ES.3 SUMMARY OF OFF-SITE METALS PROCESSING

A total of 104 tons of low and high-count rate non-ferrous metals (primarily stainless steel and aluminum) were shipped to Quadrex in Oak Ridge for decontamination. Because of processing delays, only 27.5 tons were processed, of which 8.36 tons were successfully decontaminated, free released under Quadrex's Tennessee radioactive materials license, and sold to scrap metal dealers in the local area. The remaining stainless steel was shipped from Quadrex to the SEG Oak Ridge induction furnace and melted into shield blocks by SEG. The aluminum was volume reduced at SEG and transported to the Nevada Test Site (NTS) for disposal as low-level waste. Secondary waste from the Quadrex decontamination processes was transported to the Barnwell, South Carolina, facility since the secondary wastes could not be segregated as DOE waste.

A total of 2,271 tons of recoverable scrap metal was transported directly or indirectly (from Quadrex) to SEG's Oak Ridge facility for processing. A total of 2,254 tons of stainless and carbon steel were recycled via metal melting into shield blocks. A total of 16 tons of aluminum that was not able to be decontaminated was size reduced,

"daughtered" into compactable innerpack boxes, compacted, overpacked into containers and transported to the NTS for disposal.

Secondary waste generated at SEG included slag from the metal melt process and oxidation from the carbon steel. The SEG secondary waste will be processed, characterized, volume reduced, stabilized to meet waste acceptance criteria, and transported to the NTS or an approved commercial facility for disposal. This action is forecast to be completed by February 28, 1995. Baghouse dust generated from melting the FEMP metal was processed as SEG waste and transported to Barnwell for disposal. Complete details of off-site metals processing are provided in Attachment A.

ES.4 CONCLUSIONS

Phase I of RA-15 consisted of removal of the radioactively contaminated recoverable scrap metal piles from the B69 Pad. Following removal, the scrap metal was shipped off-site and recycled or properly dispositioned as described in this report. All objectives of Phase I of the removal action have been met. The removal action objectives for Phase I are summarized below.

> Objective 1. To reduce the potential for contaminant migration to previously uncontaminated areas, and minimize the potential for exposures to human or environmental receptors by eliminating the scrap metal piles.

The scrap metal piles, located on the B69 Pad, were successfully removed from the B69 Pad and the FEMP, eliminating the potential for further contaminant migration or exposure to human or environmental receptors.

> Objective 2. Maximize recycling of the scrap metal.

The scrap metal was shipped off site and recycled or disposed as described in this report. By recycling the scrap metal, future threats to human and environmental receptors have been reduced by limiting the required amount of restricted landfill space for disposal and reducing the amount of raw materials purchased for future use.

1.0 INTRODUCTION

The Scrap Metal Piles Removal Action is specified as Removal Action No. 15 (RA-15) in the Amended Consent Agreement signed in September 1991 by the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (USEPA). Removal of the recoverable scrap metal piles (metals $\geq$ 1/4-inch thick) was deemed appropriate by the DOE based on evidence presented in the RA-15 Removal Site Evaluation (RSE) of elevated uranium concentrations in surface and subsurface soil, perched water, and in fugitive airborne releases detected by Fernald Environmental Restoration Management Corporation (FERMCO) air monitoring Station Number 9, located in the vicinity of the scrap metal pile. Therefore, there was a potential threat of contaminant migration from the exposed scrap metal piles to previously uncontaminated areas and of exposure to human or environmental receptors. The USEPA approved the RA-15 Removal Action Work Plan (RAWP) in April 1992. The RAWP described a two-phased approach; recoverable ferrous and non-ferrous scrap metal removal (Phase I) and scrap copper removal (Phase II). This final closeout report covers Phase I actions for recoverable scrap metal. Phase II removal actions for recoverable scrap copper will be covered in a separate final closeout report. The location of the scrap metal piles on the Decontamination Building (B69) Pad at the Fernald Environmental Management Project (FEMP) is shown in Figures 1-1 and 1-2. Figure 1-3 shows aerial and close-up views of the scrap metal piles prior to their removal. Figure 1-4 shows the B69 Pad after completion of Phase I of RA-15.

The Westinghouse Environmental Management Company of Ohio (WEMCO) awarded a contract to the Scientific Ecology Group, Inc. (SEG) in October 1992 to perform Phase I of RA-15. FERMCO assumed cleanup responsibilities at the FEMP from WEMCO in December 1992, and assumed management of RA-15. Under this contract, SEG functioned in a "turnkey" capacity, performing the removal action according to a series of project-specific plans. SEG performed Phase I of RA-15 and provided off-site waste management (recycling and/or disposal) of the scrap metals.

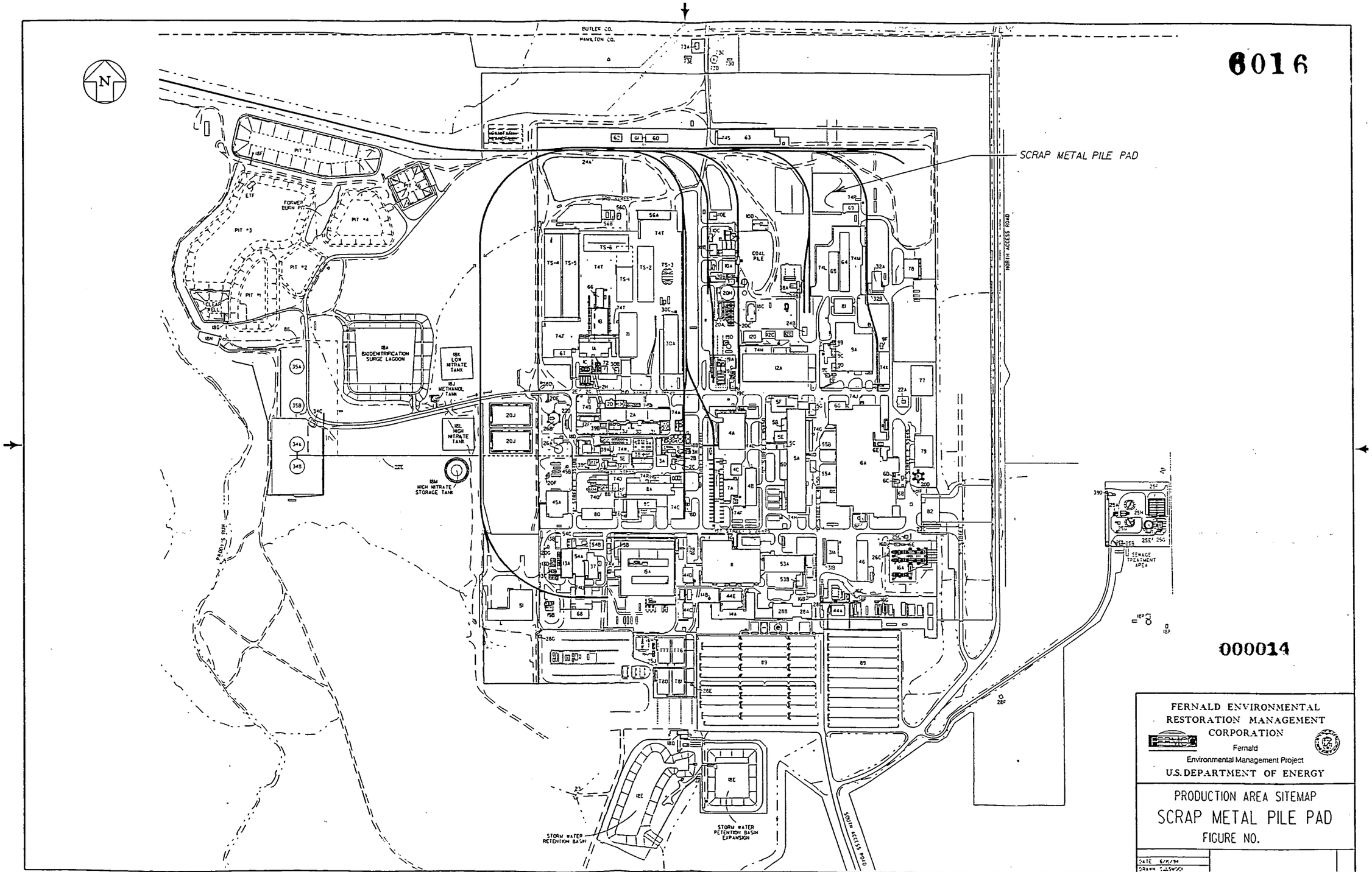

Figure 1-1. FEMP Site Perspective.

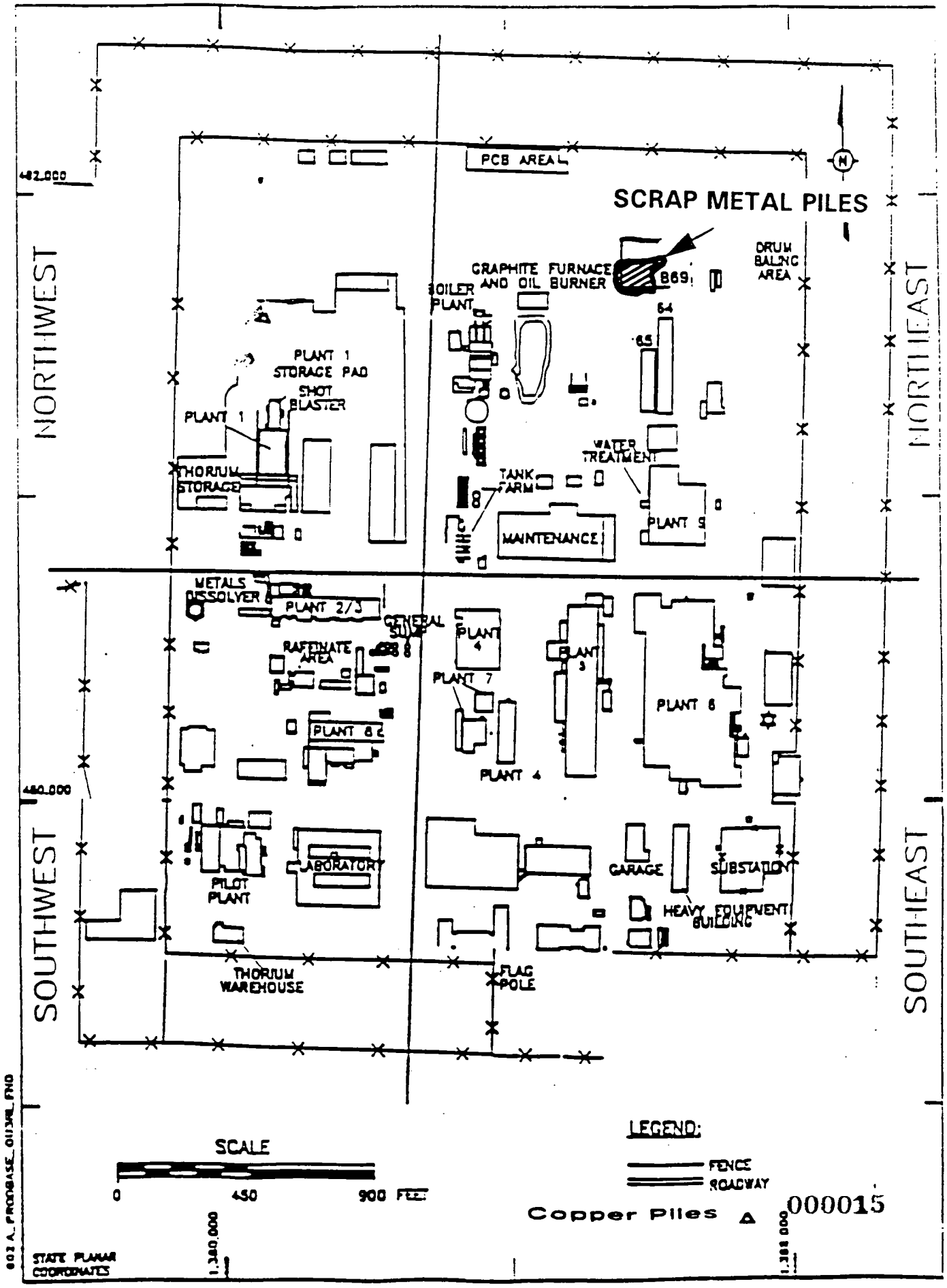

Figure 1-2. Location of Scrap Metal Piles.

Figure 1-3. Aerial and Close-Up View of Scrap Metal Piles.

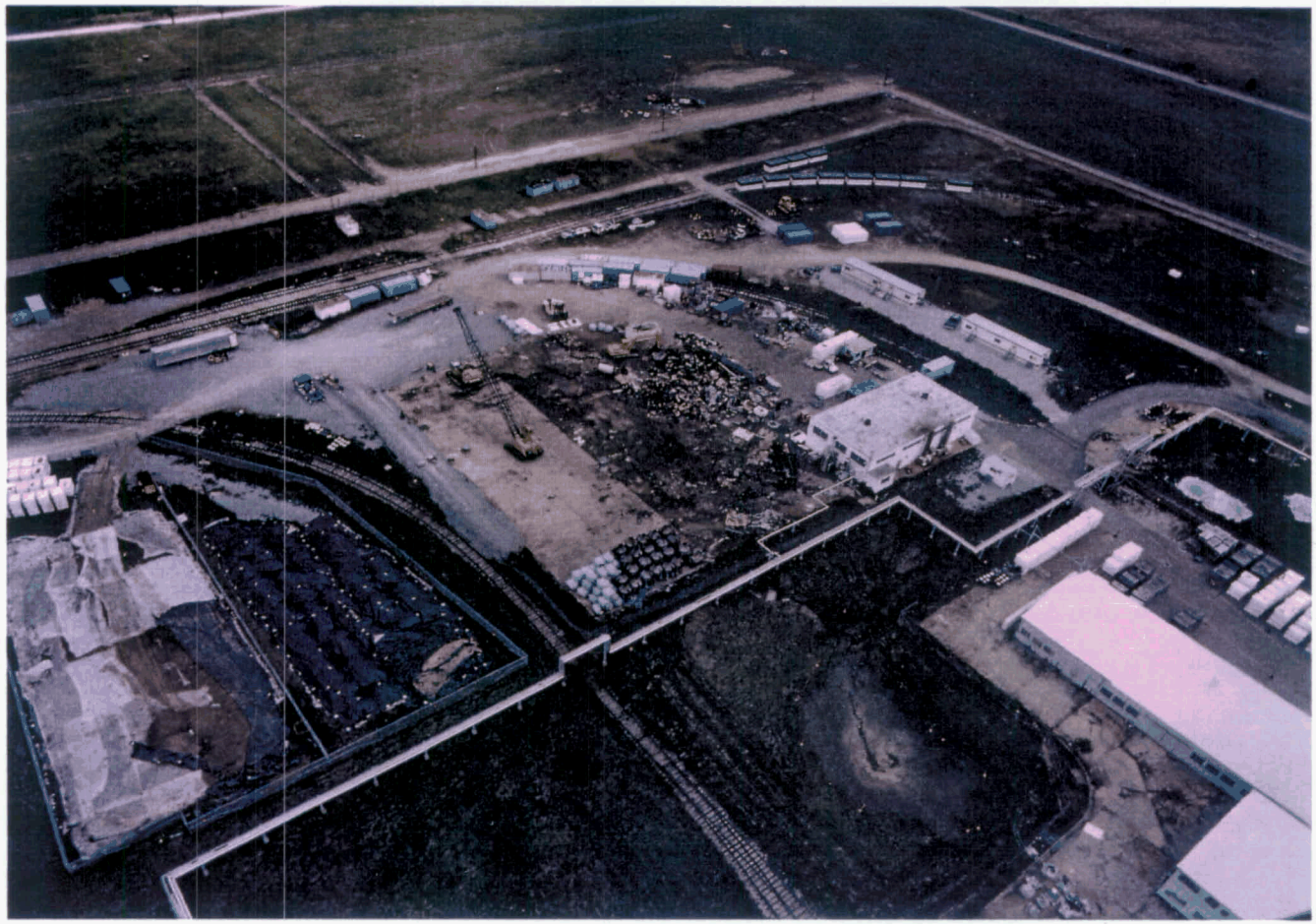

Figure 1-4. Aerial View of B69 Pad after Completion of Phase I RA-15.

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The objectives of Phase I of the removal action were to:

- reduce the potential for contaminant migration to previously uncontaminated areas, and minimize the potential for exposures of human or environmental receptors by eliminating the scrap metal piles

- maximize recycling of the scrap metal.

Section 2.0 describes the removal action and Section 3.0 discusses the results of sampling and monitoring conducted during the removal action. Section 4.0 describes health and safety issues, Section 5.0 is a discussion of how the objectives of Phase I of RA-15 were accomplished, and Section 6.0 contains references. The SEG Final Report for Phase I of RA-15 is included as Attachment A. Attachment B presents a chronological summary of the removal of the scrap metal piles.

2.0 DESCRIPTION OF PHASE I REMOVAL ACTION

Phase I of RA-15 was conducted under the direct supervision of FERMCO by SEG and two subcontractors, Southern Alloys and Metals, Inc. (SAM) and Quadrex. SAM size-reduced and packaged the metal on site. Quadrex decontaminated a portion of the non-ferrous metals at the Quadrex facility at Oak Ridge, Tennessee. SEG provided project management; supervision; health physics; radioactive material (scrap metal) shipping to Quadrex and the SEG metal melt facility in Oak Ridge; scrap metal melting into shield blocks; and secondary waste handling, treatment, and transport for disposal.

The SEG team conducted Phase I of RA-15 in accordance with the approved project plans specified in the RAWP. These plans are discussed in more detail in Section 2.1 below. The removal action was performed from January 1993 to July 1994.

The work was performed in accordance with applicable federal, state, and local environmental laws and regulations and the Amended Consent Agreement in full compliance with all Applicable or Relevant and Appropriate Requirements (ARARs) directly associated with the removal action. In addition, the work was performed in accordance with all applicable FEMP Standard Operating Procedures (SOPs) and the Sitewide Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Quality Assurance Project Plan (SCQ) (FEMP 1992) to provide consistency with other FEMP actions and compliance with applicable regulatory requirements. All sampling events included full implementation of quality assurance/quality control (QA/QC) procedures to ensure that high quality data were collected.

Removal and processing of the scrap metal piles from the B69 Pad was performed by the SEG team in nine steps:

- submittal of subcontract deliverables;
- site mobilization;
- receipt of pre-characterized scrap metal;
- size reduction and packaging;
- transportation;
- field demobilization;
- decontamination of scrap metal at Quadrex;

- metal melting and recycling at SEG; and
- waste processing, treatment, and disposition.

Each step is summarized in the following sections. A more detailed description of the removal action is contained in the SEG RA-15 Final Report included as Attachment A. A chronological summary of Phase I RA-15 activities is presented in Attachment B.

Wastes generated were processed, treated, and dispositioned as described in Section 2.9, Waste Processing, Treatment, and Disposition. Sampling and monitoring conducted during Phase I of RA-15 is discussed in Section 3.0, Analytical Results.

During the course of the removal action, four incidents occurred. These incidents involved the breaching of a UF-6 cylinder and a small gasoline spill on site, inadvertent melting of lead in the SEG furnace, and high lead levels in the slag and oxidation from melting the scrap metal at SEG. All four incidents were investigated by FERMCO, resolved according to FERMCO SOPs, and are identified and discussed in the following subsections as they apply to the individual removal action activities.

2.1 SUBMITTAL OF SUBCONTRACT DELIVERABLES

As part of its contract, SEG prepared four project-specific plans describing how Phase I of RA-15 was to be conducted. These plans are described in Attachment A and included a Removal Action Project Plan (RAPP), Operations and Maintenance Plan, Site Safety and Health Plan (SSHP), and a Quality Assurance Project Plan (QAPP). All four plans were approved by FERMCO prior to allowing SEG to proceed. The RAPP was also approved by USEPA and Ohio Environmental Protection Agency (OEPA). SEG received final approval of the RAPP on January 8, 1993.

2.2 SITE MOBILIZATION

SEG, SAM, and Quadrex arrived at the FEMP to begin mobilization the week of January 10, 1993. Mobilization was completed February 12, 1993. A typical SEG team equipment layout is presented in Figure 2-1. The SEG team consisted of a project manager, supervisors, site safety and health officer, health physics technicians, radioactive materials shipper, shear operator, front-end loader operator, crane operator, truck driver, mechanic/welder, and laborers.

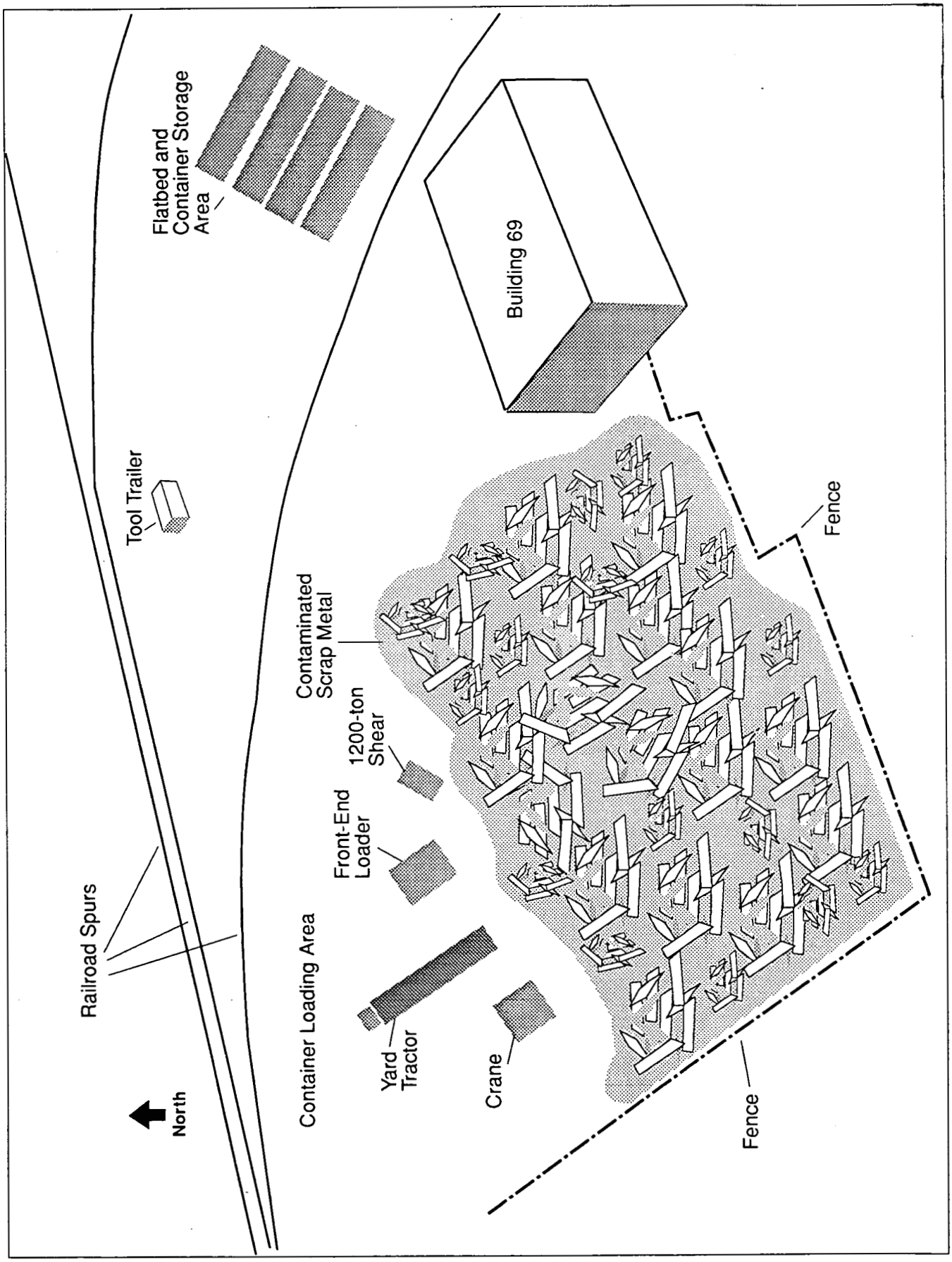

Figure 2-1. Equipment Layout.

During the mobilization period, the team members completed all required FEMP medical, training, and security requirements. This included site indoctrination training, radiological protection training, baseline medical surveillance examinations, respiratory fit testing, and baseline urinalysis.

Major equipment mobilized at the FEMP included a 1,200-ton capacity metal shear for sizing metals, 50-ton crawler crane with load block and magnet for segregating and packaging metals, front-end loader for pad cleaning, segregating, and packaging non-ferrous metals, office and equipment trailers, fuel truck, air compressor for use with power tools, electric arc welder, and a dynamometer for weighing metals and scrap suspended by the crane.

During mobilization it was recognized that the northeast corner of the FEMP, including the B69 Pad, had been recharacterized by FERMCO as a radiologically contaminated area. To provide uncontaminated access to the pad, FERMCO placed crushed rock over the contaminated soil near the pad to allow for loading filled containers of contaminated scrap metal onto flatbed trucks for shipment and to reduce the likelihood of contaminating the containers.

During the final stages of mobilization, SEG established radiological control zones around the scrap metal piles. The entire work area was restricted to authorized personnel only. SEG also established air monitoring stations around the B69 Pad, as described in Section 3.0.

2.3 RECEIPT OF PRE-CHARACTERIZED SCRAP METAL

The scrap metal was segregated, categorized, and characterized by FERMCO as part of the Radioactively Contaminated Metal Segregation Project (RCMSP) in May 1987. FERMCO provided assay value data necessary for performing radioactivity calculations to SEG. Assay values provided by FERMCO were 0.01 percent by weight for total uranium and 0.5 percent by weight for isotopes for all metals associated with the contract.

2.4 SIZE REDUCTION AND PACKAGING

Size reduction and packaging of non-ferrous metals began February 15, 1993 and was completed April 12, 1993. Size reduction and packaging of ferrous metals began April 13, 1993, and was completed July 19, 1993. The project was remobilized in August 1993 to process an additional 300 tons of scrap metal, including vehicles and heavy equipment. Final on-site demobilization was completed September 30, 1993. A total of 2,279.57 tons of scrap metal was removed from the FEMP during Phase I of RA-15 and processed for recycling and/or disposal.

The 1,200-ton capacity shear was used to size-reduce oversized pieces of metal (Figure 2-2). Only scrap metal destined for metal melting was size reduced since contaminants would be locked into the sheared edges of metal selected for decontamination. Steel up to 6 inches thick was sized into pieces no larger than 2 feet by 2 feet to accommodate melting and recycling. Metals requiring size reduction that were greater than 6 inches thick were packaged and transported whole for size reduction at the SEG Metal Melt Facility in Oak Ridge.

Non-ferrous metals, depending on size, were either loaded with the crane and load block (Figure 2-3) or were placed into Quadrex containers via the front-end loader. The Quadrex metal boxes measured 6 feet x 6 feet x 24 feet. Ferrous metals were primarily packaged with the crane and electromagnet; non-sized ferrous metals were placed in SEG boxes with the crane and load block. SEG metal boxes measured 6 feet x 6 feet x 6 feet 11 inches. A dynamometer was placed between the load block and large pieces of metal during loading to weigh the metal and ensure the containers would not exceed weight limitations.

On May 27, 1993, a container of UF-6 was sheared, resulting in the formation of an airborne cloud of uranium hexafluoride. Work was immediately stopped and the work site evacuated. FERMCO emergency response personnel contained the breached cylinder and investigated the cause of the incident in accordance with FERMCO SOPs. It was determined that the cylinder had recessed ends and appeared to be a pipe from the vantage point of the shear operator. The cylinder had been inadvertently missed by the FEMP operating contractor when removing similar type containers during the 1987 Radioactively Contaminated Metal Segregation Project (RCMSP). Post incident meetings were held and critiques derived to ensure that similar incidents did not occur.

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Figure 2-2. Size Reduction of Scrap Metals with the 1,200-Ton Capacity Shear.

Figure 2-3. Crane Loading Non-Ferrous Metals.

While size-reducing a fire fighting vehicle with the shear on August 16, 1993 the fuel tank was cut open resulting in a small fuel spill of 20 to 30 gallons of gasoline. FERMCO personnel excavated the fuel contaminated soil. Post incident meetings determined that a checklist had not been completed by FERMCO decontamination personnel that would have confirmed that all fluids had been drained prior to releasing the vehicle to SEG for processing. SEG continued size reduction activities once the affected soil was removed and all remaining vehicles and equipment included in the SEG subcontract were confirmed as having all fluids drained.

2.5 TRANSPORTATION

Loaded containers of scrap metal were not released from the B69 Pad until radiation surveys documented that the exterior surfaces of the containers exhibited <200 dpm/100 square centimeters (cm^2) alpha and <1000 dpm/cm^2 beta/gamma in conformance with U.S. Department of Transportation (DOT) regulations 49 CFR § 173. Radiation surveys of the containers were conducted by SEG (see Section 3.4), but were approved for release by FERMCO radiation technicians. Containers were loaded with the crane onto flatbed trucks (Figure 2-4); maximum allowable net weight was 42,000 pounds. Shipments were transported as Low Specific Activity (LSA) in accordance with DOT requirements and SEG transportation procedures.

2.6 FIELD DEMOBILIZATION

Field demobilization began once all scrap metal was removed from the B69 Pad. Final demobilization was completed by the end of September 1993.

Heavy equipment was radiologically surveyed and contaminated areas were decontaminated using either foaming cleanser, Massilin, high pressure wash, wire brushing, or grinding. All items leaving the FEMP were radiologically surveyed and were not free released (released as decontaminated) until DOE/Nuclear Regulatory Commission (NRC) free release limits were met as determined by FERMCO radiation technicians. Items or equipment unable to be decontaminated to free release limits were packaged and/or wrapped and transported to the SEG Oak Ridge facility for use in radiologically controlled areas in accordance with SEG's radioactive materials license or further decontaminated to meet DOE/NRC free release criteria. Radiological boundaries

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Figure 2-4. Loading SEG Containers onto Flatbed Trucks.

established around the B69 Pad during the removal action remained in effect to accommodate future activities.

2.7 DECONTAMINATION OF SCRAP METAL

A material balance showing how the scrap metals were processed at Quadrex and SEG is presented in Figure 2-5. Only non-ferrous scrap metal (stainless steel and aluminum) was decontaminated at the Quadrex-Oak Ridge facility. A total of 1 ton of carbon steel was also received by Quadrex but was not decontaminated. Quadrex was able to receive and process radioactive materials under their State of Tennessee Radioactive Materials License and Industrial and Commercial User Waste Discharge Permit. The Quadrex decontamination process involved a series of chemical baths using both caustics and acids. A more detailed description of the process may be found in the RAPP.

Stainless steel and aluminum were determined to be successfully decontaminated at Quadrex if the metals met the State of Tennessee free release requirements of <20 dpm alpha (removable), <200 dpm alpha (fixed), <1,000 dpm beta/gamma (removable), and <4,000 dpm beta/gamma (fixed). Materials meeting the above criteria were free released and recycled.

Efforts to decontaminate low and high count stainless steel and aluminum by Quadrex were only partially successful due to scheduling delays at Quadrex (see Attachment A). Out of a total of 104 tons of contaminated stainless steel, aluminum, and carbon steel shipped from the FEMP to Quadrex, decontamination techniques were only applied to 27 tons of stainless steel and aluminum (Figure 2-5). Of the 27 tons attempted, 8 tons or approximately 30 percent was successfully decontaminated to State of Tennessee free release levels. The remaining stainless steel, aluminum, and carbon steel that were not decontaminated were shipped from Quadrex to SEG's facilities in Oak Ridge, Tennessee. At SEG, the remaining stainless and carbon steel was recycled by melting it into shield blocks (see Section 2.8). The remaining aluminum was significantly volume reduced at SEG and transported to the Nevada Test Site (NTS) for disposal.

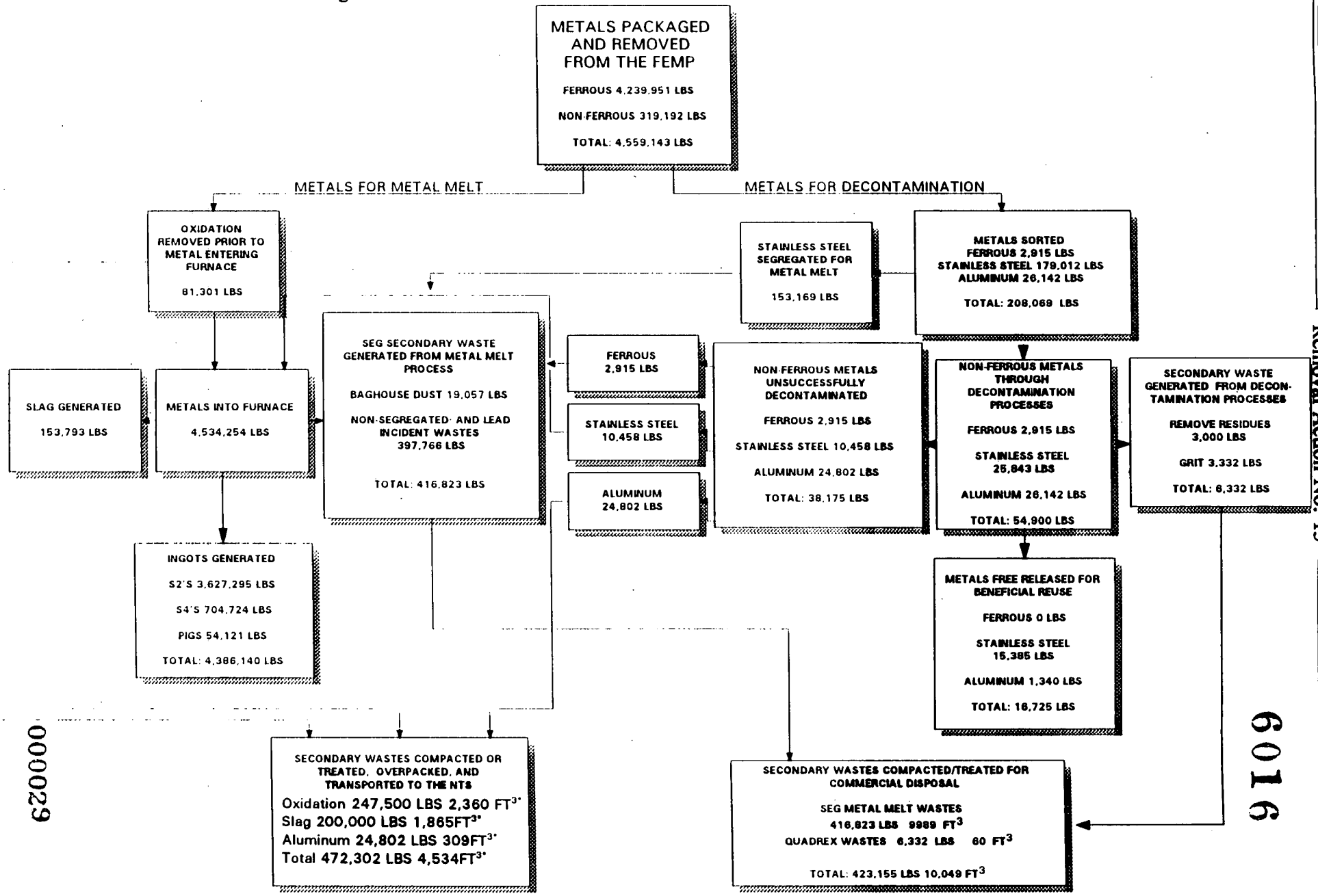
2.8 METAL MELTING AND RECYCLING

Ferrous metals (carbon steel) and stainless steel removed from the B69 Pad during Phase I of RA-15 were melted at the SEG-Oak Ridge melting/casting facility. The facility was

SEG

MATERIA. ALANCE OF
FERROUS AND NON-FERROUS METALS
REMOVED FROM THE FEMP

Figure 2-5 Material Balance of Scrap Metals Removed from the FEMP



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designed to convert ferrous and miscellaneous scrap metal into usable, slightly contaminated shield blocks by melting the material in a 20-ton induction furnace (Figure 2-6). Ferrous metal and stainless steel from RA-15 was processed into shield blocks for use by the Los Alamos National Laboratory's (LANL's) High Energy Physics Program (Figure 2-7). SEG received and processed radioactive materials under a variety of licenses and permits which are listed in the RAPP.

A total of 2,279 tons of scrap metal was removed from the B69 Pad during Phase I of RA-15 (Figure 2-6). A total of 2,271 tons of scrap metal were directly or indirectly (via Quadrex) processed at SEG. A total of 2,254 tons of stainless and carbon steel were beneficially reused as shield blocks. A total 16 tons of aluminum received by SEG from Quadrex was volume reduced and shipped to NTS for disposal. In addition, the carbon steel received from the FEMP produced a total of 41 tons of oxidation. The oxidation was secondary waste and is discussed further in Section 2.9.

Lead was inadvertently introduced into the SEG metal melt furnace, resulting in a furnace shutdown on September 19, 1993. A small piece of lead, present within the scrap metals being melted at the time, had migrated through the furnace well and shorted out one of the heating coils. An investigation report was written by FERMCO and the incident was investigated according to FERMCO SOPs. Although the specific source of the lead was not able to be identified, it is believed by FERMCO that the lead may have originated from a fork lift counter weight.

Final disposition of the lead and resulting lead waste to the Envirocare facility will be completed by November 30, 1994.

2.9 WASTE PROCESSING, TREATMENT, AND DISPOSITION

2.9.1 On Site

Good housekeeping activities by SEG and its subcontractors included trash collection and litter control, and securing loose light weight items. Contaminated dust, dirt, and metal oxides generated during removal of the scrap metal from the B69 Pad were controlled by misting. Wash water drained into an existing FEMP drain southeast of the pad. The drain is connected to the FEMP rainwater sewer collection system. Residues

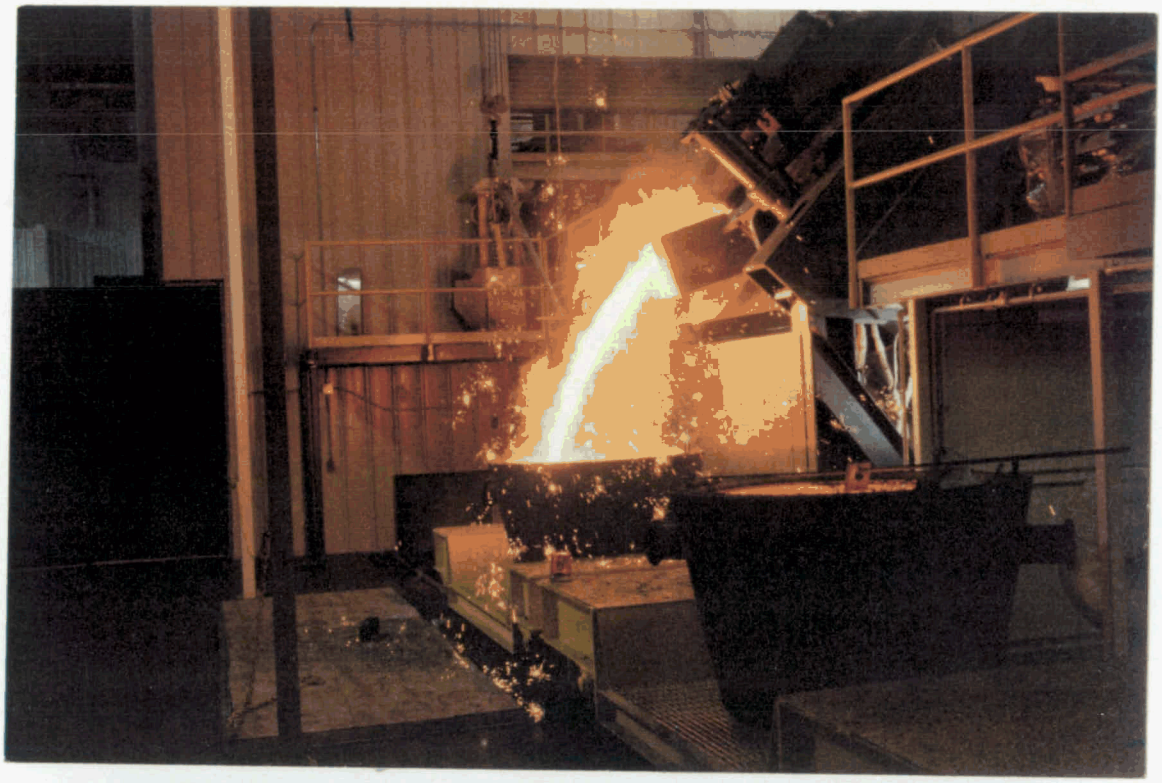

Figure 2-6. Casting and Processing Shield Blocks.

Figure 2-7. Staging Shield Blocks for Shipment to Los Alamos National Laboratory.

and materials were removed from the surface of B69 Pad and drummed. These residues and materials were collected during separation of the scrap metal and did not go down the sump. Residues consisted of approximately 200 pounds of residue believed to be black oxide (U_3O_8) with a small quantity of green salt (UF_4), yellow cake (UO_3), black tar and dirt, plastic, paper and metal fragments. Discarded personal protective equipment (PPE) and other solid waste generated during the removal action were disposed as low level waste (LLW) according to the SSHP.

2.9.2 Off Site

Secondary waste from the decontamination processes at Quadrex-Oak Ridge was stabilized and characterized by Quadrex and transported to the Barnwell, South Carolina, disposal facility. The Barnwell facility was used rather than NTS because the secondary waste generated by Quadrex could not be segregated as DOE waste only. A total of 6,332 pounds of secondary waste was generated during the decontamination of stainless steel and aluminum from Phase I of RA-15.

Secondary wastes generated during the metal melt process at SEG-Oak Ridge included slag, oxidation, and baghouse dust. Forty-one tons of oxidation are being characterized by SEG for possible stabilization to meet NTS waste acceptance criteria. The stabilization of the oxide wastes, if required, will be solidified with sulfur cement. Levels of lead above the RCRA action level (> 5 mg/l) were found in some secondary slag and oxidation wastes. The probable source of the lead was from lead-based paint coating some of the scrap metal. After the presence of lead was identified, SEG initiated a FERMCO generated sampling and analysis program to ensure that the wastes were properly characterized prior to final dispositioning. This sampling program is discussed further in Section 3.5.

The Baghouse dust generated during the metal melt process was disposed as SEG waste and transported to Barnwell for disposal. The 77 tons of slag waste have been stabilized and, pending final characterization, will be disposed by November 30, 1994. The stabilization of the slag with sulfur cement has reduced the volume from 2060 cubic feet (cf) to 1865 cf. In addition, final disposition of the oxidation wastes will be completed by February 28, 1995.

2.10 COMMUNITY RELATIONS

A 45-day public comment period for RA-15 was held from November 4 to December 18, 1992. The announcement ran in three local newspapers. There were no oral or written comments submitted. The following activities were implemented to maintain an active effort to keep interested community members informed throughout the implementation of RA-15:

- Preparation of fact sheets or updates for distribution at quarterly public meetings,
- Devotion of some portion of the public meetings to discussion of RA-15,
- Inclusion of coverage of RA-15 in the Fernald Project Cleanup Report as needed during RA-15, and
- Additions to the Administrative Record and publicizing their availability at the Public Environmental Information Center (JAMTECK Building).

3.0 SAMPLING AND ANALYSES

This section summarizes the results of sampling and monitoring performed by SEG and FERMCO during Phase I of RA-15. FERMCO's responsibility for all sampling and monitoring performed by SEG during Phase I of RA-15 consisted of auditing and spot checking SEG's work. All radiation surveys conducted by SEG were reviewed and deemed acceptable by FERMCO radiation technicians. A more detailed description of the sampling and monitoring results can be found in Attachment A.

3.1 AREA RADIATION AND AIR MONITORING

SEG performed area radiation monitoring inside the site radiological control zones and airborne radiation monitoring at the perimeter of the FEMP during metal sizing and packaging operations to monitor for off-site migration of radiological contaminants. Continuous air monitors (CAMs) were used and positioned downwind according to FERMCO daily wind readings. Results from CAMs did not reveal any airborne radiological contaminants above 25 percent of the Derived Air Concentration (DAC) for depleted uranium during the removal action.

3.2 PERSONNEL MONITORING

SEG performed on-site high volume work area and breathing zone airborne radiation surveys as described in the SEG SSHP. In addition, thermoluminescence dosimeters (TLDs) were issued to all employees by FERMCO to measure radiation dose received by the workers while on site. Badges were read monthly and a record provided by FERMCO to SEG. Urine samples were collected and analyzed for each worker initially (baseline), monthly, and at exit from the job by FERMCO for uranium to detect ingested radionuclides and to determine if exposure occurred. Personnel breathing zone monitoring, TLDs, and urinalysis performed during the removal action showed no confirmed radiation exposure exceeding administrative investigation levels while at the FEMP.

3.3 FIXED AND REMOVABLE CONTAMINATION SURVEYS

Under the supervision of FERMCO radiation technicians, SEG performed contamination surveys (100-cm^2 smears) to identify and control contaminated areas and items within the B69 Pad radiological contamination zone. All personnel and equipment were surveyed for removable contamination prior to leaving the contamination zone to prevent the spread of contamination outside the project site.

3.4 RADIATION SURVEYS OF TRAILERS, TRUCKS, AND CONTAINERS

Incoming shipments were surveyed for radiation levels and removable contamination by SEG. Trucks were also surveyed. Outgoing shipments were surveyed for contamination to assure SEG compliance with federal and state shipping regulations. Each loaded truck was surveyed externally to determine if dose levels and contamination levels met FERMCO and 49 CFR Part 173 requirements. All surveys were reviewed by FERMCO radiation technicians and approved prior to acceptance of incoming shipments or release of outgoing shipments.

3.5 SECONDARY WASTE SAMPLING

Levels of lead above the RCRA action level (>5 mg/l) were found in some of the slag and oxidation wastes generated during the SEG metal melt process. The origin of the lead was believed to be from processing scrap metal coated with lead based paint. After the presence of lead was identified, SEG collected slag and oxidation samples from waste boxes according to a FERMCO specific sampling and analysis plan. The plan was prepared in accordance with NVO-325, Rev. 1 and the FERMCO Waste Certification Program. Waste boxes containing lead in excess of the regulatory limit were held for particle size reduction (if necessary) and stabilization. The disposition of wastes is forecast to be completed by February 28, 1995. If circumstances arise that affect the planned completion date, USEPA will be notified.

4.0 HEALTH AND SAFETY CONTROLS

Health and safety controls and monitoring were conducted in accordance with the SEG RAPP and the SEG project-specific SSHP. Monitoring of materials, work spaces, and personnel were conducted as specified and no action levels were exceeded.

5.0 CONCLUSIONS

Phase I of RA-15 consisted of removal and recycling or dispositioning of the radioactively contaminated ferrous and non-ferrous recoverable scrap metal piles from the B69 Pad. Phase I of RA-15 was considered complete when all of the scrap metal was removed from the FEMP and recycled or properly dispositioned as described in this report. Completion of Phase I of this Removal Action has accomplished the objectives as described below.

- **Objective 1.** Reduce the potential for contaminant migration to previously uncontaminated areas, and minimize the potential for exposure to human or environmental receptors.

The scrap metal piles were successfully removed from the B69 Pad and the FEMP, eliminating the potential for further contamination or exposure to human or environmental receptors.

- **Objective 2.** Maximize recycling of the scrap metal.

The scrap metal was shipped off site, received, recycled, or disposed of accordingly as described in this report. By recycling the scrap metal, future threats to human and environmental receptors have been reduced by reducing the amount of restricted landfill space required for disposal and reducing the amount of raw materials purchased for future use.

6.0 REFERENCES

FEMP. 1992. FEMP Sitewide CERCLA Quality Assurance Project Plan.

Parsons. 1992. Safety Assessment Number 92-1046, Processing and Disposal of an Estimated 2,210 Tons of Non-RCRA Scrap Metal, Removal Action 15. FERMCO Subcontract No. 2-21487, December 1992.

Parsons. 1992. Removal Site Evaluation, Scrap Metal Piles. WEMCO Subcontract No. 2-21487, April 1992.

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ATTACHMENT A

SEG PHASE I RA-15
FINAL REPORT

6016

FINAL REPORT

for the

FEMP SCRAP METAL PROJECT

Submitted to: FERMCO
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Submitted by: Scientific Ecology Group, Inc.
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Date: August 1, 1994

SCIENTIFIC ECOLOGY GROUP, INC.

FINAL REPORT
FOR THE
REMOVAL OF NON-RCRA SCRAP METAL FROM THE
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT (FEMP)

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ATTACHMENTS:

Attachment I - Material Balance
Attachment II - Summary Progress Table

1.0 INTRODUCTION

On August 3, 1992, the Scientific Ecology Group (SEG) and Westinghouse Environmental Management Company of Ohio (WEMCO) agreed upon a subcontract (subcontract no. 2-21486) for processing and disposal of an estimated 2,210 tons of non-RCRA scrap metal. On December 1, 1992, the Fernald Environmental Restoration Management Corporation (FERMCO) replaced WEMCO as the operating contractor of the Fernald Environmental Management Project (FEMP) and assumed the SEG subcontract. This subcontract was awarded to provide the services to fulfill the objectives of Phase I of Removal Action Number 15 (RA 15), that was 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 RA 15 Work Plan, Phase I, SEG's Removal Action Project Plan (RAPP), other applicable, or relevant and appropriate requirements (ARARs) to the extent required by Sections 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 requirements of this removal action was completed on July 31, 1994.

The scrap metal piles, located at the northeast corner of the FEMP, were generated as a result of years of equipment replacements and plant upgrades. Until 1987, the accumulated metal (ferrous and non-ferrous) was mixed into one large pile on the B69 pad adjacent to the original FEMP decontamination facility. In 1987, through a Radioactively Contaminated Metal Segregation Project the metal was grossly segregated into recoverable and refuse scrap piles. Only the recoverable metals were part of this subcontract, the refuse metals were removed by others under Removal Action Number 9. Recoverable scrap metal was defined as having a minimum thickness of one-quarter inch. The recoverable scrap pile was further segregated, during the 1987 project, into four distinct piles consisting of low-count ferrous, high-count ferrous, low-count non-ferrous, and high-count non-ferrous.

The objective of this removal action was to remove the potential threat to human health and the environment from the radioactively contaminated scrap metal pile. By size reducing, packaging, and transporting the scrap metal off site for processing and beneficial reuse, the potential threat was removed from the FEMP. In addition, by beneficially reusing the scrap metal, the future threat to human health and the environment has been greatly reduced by limiting the amount of restricted landfill space used. By melting the contaminated metal into 4,000 pound and 20,000 pound shield blocks for use by the DOE's High Energy Physics Program and decontaminating a portion of the non-ferrous metals for unrestricted reuse this objective was met.

The scrap metal associated with this subcontract was segregated, categorized, and characterized at the Decontamination Building Pad (B69) by the FEMP's operating contractor in May of 1987. Specifics of this evolution follow in this report.

SEG utilized two subcontractors (Southern Alloys and Metals, Inc., [SAM] and Quadrex) to formulate the team that completed this removal action. SAM provided the personnel, equipment, and expertise for size reducing and packaging the scrap metal at the FEMP. Quadrex provided personnel to select and oversee the loading of non-ferrous metals destined to their facility in Oak Ridge, Tennessee for decontamination, and subsequent secondary waste handling. SEG provided the personnel and equipment required for project management, supervision, health physics, radioactive material shipping, melting the scrap metal into shield blocks, and secondary waste handling, treatment, and transport for disposal. In total, 2,279.57 tons of scrap metal were removed from the FEMP as part of this removal action and processed for beneficial reuse or disposal.

One of the subcontract deliverables is to submit a Final Project Report after final processing and dispositioning of project generated waste. This report fulfils that deliverable and provides a synopsis of the work defined in the subcontract Scope of Work, certifies that the work was performed, explains modifications to the subcontract and why the modifications were necessary, describes the successes and problems in completing the project requirements, provides a summary of the volumes of waste and beneficially reused metals and provides a summary progress table.

2.0 SCOPE OF WORK

The Scope of Work for this project involved the receipt, transportation, necessary interim storage, processing, packing, and disposition or beneficial reuse of an estimated 2,210 tons of low level radioactive scrap metal located at the FEMP consistent with the Record of Decisions (RODs) resulting from the CERCLA process.

3.0 SYNOPSIS OF WORK PERFORMED

The scrap metal project was performed in a nine phase effort to allow for the successful completion of the work defined in the subcontract Scope of Work. The nine phases consisted of submitting the required subcontract deliverables for approval or information, mobilizing the necessary equipment and personnel at the FEMP for performance of the work, receipt of the pre-characterized scrap metal, size reduction (if necessary) and packaging of the metal, radioactive material transport, demobilization, decontamination of metal for free release, melting of metal for beneficial reuse, and secondary waste processing, treatment, and waste disposition.

3.1 Submittal of Subcontract Deliverables

In order to perform this removal action in accordance with the subcontract several project deliverables were prepared for review and approval by WEMCO/FERMCO. These deliverables consisted of the following:

- RAPP
- Operations and Maintenance Plan
- Site Safety and Health Plan (SSHP)
- Quality Assurance Project Plan (QAPP)

Of these deliverables, the RAPP was additionally submitted, by FERMCO, to the DOE, USEPA, and Ohio EPA (OEPA) for review and approval. The RAPP provided a description of project integration and management, on-site (FEMP) activities, transportation, SEG and Quadrex facilities, and decontamination and melting for beneficial reuse.

The Operations and Maintenance Plan provided an outline of the types of equipment for the scrap metal sizing and loading activities and the times that scheduled maintenance would be required.

The SSHP, written specifically for the FEMP scrap metal project, described the safe work practices to be used and the constraints to be exercised while working around the scrap metal pile. The SSHP 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 QAPP (QAP-114) describes the Quality Assurance system for controlling work performed by SEG for FERMCO. This work included all activities necessary to remove, decontaminate, or process the scrap metal from the FEMP. This document was written as a supplement to the existing SEG Quality Assurance Program document (SEG/QA-100), and the RAPP.

3.2 Site Mobilization

SEG, SAM, and Quadrex mobilized a team of personnel and the necessary equipment at the FEMP for the safe and efficient size reduction, loading, and off-site transport of the scrap metal. The SEG team consisted of the following job functions:

- Project Manager
- Supervisors
- Site Safety and Health Officer
- Health Physics Technicians
- Radioactive Materials Shipper
- Shear Operator

- Front End Loader Operator
- Crane Operator
- Truck Driver
- Mechanic/Welder
- Laborers

During the mobilization period, the team members completed all of the necessary administrative and security requirements, indoctrination training, radiological protection training, medical surveillance examinations, respiratory fit testing, and baseline urinalysis.

During the final stages of mobilization the radiological control zones and real time air monitoring stations were established around the scrap metal pad. The entire work area was sectioned off as a construction area and isolated to authorized personnel only.

A list of the major equipment mobilized at the FEMP is as follows:

- 1,200 ton shear for sizing metals
- 50 ton crawler crane with load block and magnet for segregating and packaging metals
- Front End Loader for pad cleaning, segregating, and packaging non-ferrous metals
- Tool Trailer for small equipment and tool storage
- Fuel Truck
- Two (2) office trailers
- Air Compressor for use with power tools
- Electric Arc Welder for equipment repairs
- Dynamometer for weighing metals and equipment suspended by the crane

3.3 Receipt of Scrap Metal

Once mobilization was complete, SEG took control of the scrap metal piles on the belief and understanding that the scrap metal was pre-segregated, categorized, and characterized as described in the subcontract. The FERMCO MC&A group provided the assay value data necessary for performing radiological activity calculations for the shipments off-site. The values of 0.01% by weight for total uranium and 0.5% by weight for isotopic was provided for all metal associated with the

subcontract.

3.4 Size Reduction and Packaging

Size reduction (when necessary) was achieved with the 1,200 ton shear. Only scrap metal destined for metal melting was sized since contaminates would be locked into the sheared edges of metal selected for decontamination. Steel up to six inches thick were sized with the shear into pieces no larger than 24 inches by 24 inches to accommodate the opening of the SEG furnace pre-heater. Metals requiring size reduction that were greater than six inches thick were packaged and transported whole for sizing at the SEG Metal Melt facility.

Packaging of the metals was performed three different ways. Non-ferrous metals, depending on size, were either loaded with the crane and load block or were dumped in the containers via the front end loader. Ferrous metals were primarily packaged with the crane and electromagnet; non-sized ferrous metals were placed in containers with the crane and load block. A dynamometer was placed between the load block and large pieces of steel during loading to ensure the containers would not be overweight.

Throughout the sizing and packaging operation, real time and delayed radiological air sampling was performed to ensure that the proper personal protective equipment was being worn and to monitor for offsite migrations. Mobile real time air sampling equipment (Continuous Air Monitors [CAMs]) were located at the predominate down wind locations. Wind direction was confirmed twice daily with FEMP Control. The CAMs did not reveal any offsite migration of airborne radiological contaminates above 25% of the Derived Air Concentration (DAC) for depleted uranium.

High volume work area and breathing zone sampling pumps and low volume lapel sampling pumps provided the delayed air sampling data to ensure the workers were being properly protected against airborne radiological contaminates. All of the team members participated in the FEMP invivo and invitro monitoring programs. Monitoring results showed that none of the personnel received an uptake of radioactive material while at the FEMP.

General housekeeping practices, such as trash collection and securing loose light weight items, prevented potentially contaminated items from being blown off of the radiologically controlled work pad. As scrap metal was removed from the pad, contaminated dust, dirt, and oxidation were controlled by wetting and washing down the pad with a FERMCO supplied fire hose. Residues and waste water drained into the pre-established FEMP sump southeast of the pad.

Once the containers were loaded to their volume or weight capacity, the lids were secured, externally wiped down, weighed, barcoded, and staged to be radiologically surveyed off of the pad.

3.5 Transportation

Loaded containers were removed from the pad after radiation survey for fixed and removable contamination was performed. Radiation limits used to remove the containers from the pad were as follows:

- <200 disintegrations per minute per 100 centimeters square (dpm/100cm^2) alpha
- <1000 disintegrations per minute per 100 centimeters square (dpm/100cm^2) beta/gamma

Flatbed trucks were loaded with containers that had compatible weights so that the net weight of the shipments were less than 44,000 pounds and/or the gross vehicle weight was less than 80,000 pounds. The containers were shored at the base and chained or strapped down to prevent movement during transit.

All scrap metal shipments were transported as Low Specific Activity (LSA), exclusive use, in accordance with and defined in 49 CFR and the SEG transportation procedure. The SEG team prepared the following shipping papers that accompanied each shipment:

- Radioactive Material Shipping Manifest
- Bill of Lading
- Exclusive Use Instruction
- Radiation and Contamination Release Survey
- Shipment Release Checklist
- Vehicle Condition Checklist

Shipment activity and weight data from each shipment were provided to FERMCO MC&A personnel so that a Shipping Order for Nuclear Material and Nuclear Material Transaction Report (DOE/NRC Form 741) could be prepared. The Shipping Order for Nuclear Material accompanied the shipment. The Nuclear Material Transaction Reports were mailed to SEG rather than accompanying the shipment since the scrap metal was characterized as depleted material.

3.6 Demobilization

After the scrap metal was removed from the FEMP the demobilization phase began. Heavy equipment used in the handling of radioactive material was disassembled as necessary to access surface areas susceptible to contamination.

Contamination was removed as much as practicable using one of the following methods:

- Foaming cleaner and paper towels
- Wipe down with Massilin
- High pressure water (1,200 psi) and detergent
- Wire brushing
- Grinding

Items that were successfully decontaminated to the FEMP site release limits were free released for unrestricted use. Items or equipment that were unable to be decontaminated, even after several cleaning attempts, were packaged and/or wrapped and transported to the SEG-Oak Ridge facility. Contaminated items received at SEG were either kept for use in radiologically controlled areas, in accordance with our radioactive materials licenses, or further decontaminated to meet the free release criteria using more thorough techniques.

The leases on the two office trailers were transferred to FERMCO at their request for future use. Area radiological boundaries that had been established during project mobilization also remained to accommodate future activities with radioactive materials.

3.7 Decontamination of Scrap Metal

Primarily low-count and high-count non-ferrous metals were selected by Quadrex for decontamination. A total of one hundred four tons of contaminated scrap metal, that included 1.5 tons of carbon steel, was selected by Quadrex as having a high probability of meeting their criteria for successful decontamination.

After an extensive delay by Quadrex (see Table 6-1) to respond to audit findings, seventeen Quadrex "QC" containers were transported to the Quadrex Recycle Center in Oak Ridge, Tennessee. Once at the Quadrex facility, due to an over commitment of the facility, financial capabilities and remaining project schedule after the audit response delay, decontamination techniques were only applied to 27.5 tons of scrap metal. Of the 27.5 tons attempted, 8.35 tons (30%) were successful in being decontaminated to free releasable levels. It is believed that if additional grit blasting and/or chemical bath decontamination attempts had been applied to the metal, the percentage of success would have been much greater.

Because of the above mentioned difficulties Quadrex encountered while processing the metals, an SEG/Quadrex and SEG/FERMCO agreement was reached. The Scope of Work change allowed the remaining stainless steel to be beneficially reused by melting it into shield blocks. The remaining

aluminum was significantly volume reduced via the SEG Ultracompactor and transported to the Nevada Test Site (NTS) for disposal.

Secondary waste that consisted of used grit and chemical line sludge from the decontamination processes were stabilized and characterized by Quadrex and transported to the Barnwell, South Carolina disposal facility. The Barnwell Facility was selected over the NTS since the secondary wastes generated by the Quadrex decontamination processes could not be segregated as DOE waste only. A total of 6,332 pounds of secondary waste were attributed to the decontamination of the DOE metals.

3.8 Metal Melting

Of the total 2,279.57 tons of scrap metal subsequent to this subcontract, 2,271.21 tons were directly or indirectly (from Quadrex) transported to SEG for processing. The remaining 8.36 tons of metal were decontaminated and free released by Quadrex. Of the metal transported to SEG, 2,254.29 tons of stainless and carbon steel were beneficially reused by way of metal melting via the 20 ton SEG induction furnace. 16.92 tons of aluminum that Quadrex was unable to decontaminate was size reduced, "daughtered" into compactable innerpack boxes, compacted, overpacked into NTS approved containers and transported to the NTS for disposal.

Normally, SEG's Metal Melt facility only produces slag and baghouse dust as secondary waste streams. However, the carbon steel received from the FEMP additionally produced a large amount of oxidation due to the amount of time and environmental conditions that the metal sustained while piled on the B69 pad. A total of 40.65 tons of oxidation was collected as a result of melting the carbon steel. In the early stages of melting the FEMP metal the oxidation was only collected from where the boxes were emptied and had separated from the metal during transport or the dumping process. The remaining loose oxidation that still adhered to the metal was processed through the furnace. This approach effected the furnace efficiency, generated a large amount of slag, and produced lower grade ingots. To rectify this situation, a vibrating shaker table was brought into the metal melt facility and placed in the process line. By using this shaker table, loose oxidation was removed from the metal and collected prior to entering the furnace.

3.9 Waste Processing, Treatment, and Disposition

Slag is generated as a result of the melting process. Impurities and other undesirable constituents, including approximately 95% of the radiological contaminates, are "boiled" to the top of the molten metal bath where they are

skimmed off using electrical and manual slag removal devices. The FERMCO slag was collected in innerpack boxes and awaited further processing.

The slag and oxidation was further processed by either: (1) characterizing, volume reducing and overpacking of non hazardous slag and oxidation or (2) particle size reducing (if necessary) and solidifying to eliminate the leachability of metals listed as characteristicly hazardous under RCRA. These waste streams were transported to the NTS for disposal.

The baghouse dust generated from melting the FEMP metal was processed as SEG waste and transported to Barnwell for disposal.

Other radioactively contaminated wastes that were generated as a result of melting the FEMP metal were processed as SEG wastes and disposed of at a licensed commercial landfill. These wastes consisted of PPE, disposable furnace temperature monitoring equipment, non-segregatable slag, and unused portions of sampling equipment packaging.

4.0 SUCCESSES AND PROBLEMS ENCOUNTERED

This scrap metal project has been a success for SEG, FERMCO, and DOE by starting the recycling and beneficial reuse of weapons complex metals for reuse within DOE and the private sector. This project can be used as the catalyst for future DOE recycling programs that not only reduces the amount of burial ground space but also reduces the amount of raw materials purchased for future government projects. SEG has demonstrated by sizing and packaging approximately one hundred-fifty tons of heavy equipment, such as bulldozers, cranes, and graders, that were excessed throughout the years, in addition to the existing scrap metal pile that future projects can contain a wide variety of recyclable metals.

This project has also been a success by showing how the government and the commercial industry can work together, through turn-key subcontracts, in completing Removal Actions mandated by Consent Agreements within the allowed schedule. SEG, through this turn-key subcontract, successfully completed the onsite project activities at a DOE facility with our own personnel that were disciplined in many vocations, such as health physics and health and safety. The transportation portion of the project was also included in the onsite work and was very successful by way of completing approximately one hundred-forty radioactive material shipments with our personnel and without incident.

Another way this project has been a success is by showing how SEG can meet the traceability, segregation, packaging, and shipping requirement of a DOE owned burial facility. SEG is the first commercial processing facility approved to generate DOE waste at a

non-DOE site for burial under NTS waste acceptance policies (NVO-325). The approval process required SEG to undergo and successfully pass quality assurance audits by the NTS.

With successes also come some problems. Four individual problems were overcome in completing this recycling project. Below is a description of each of the problems encountered.

4.1 Breach of UF-6 Cylinder

On May 27, 1993, an incident occurred on the scrap metal pad involving the shearing of a small container of UF-6 that resulted in the formation of an airborne cloud. FERMCO Emergency Response personnel were called in to contain the breached cylinder and to investigate the cause of the incident.

It was determined by viewing photographs, interviewing project personnel, and reviewing incident critique minutes that the cylinder had recessed ends and appeared to be a pipe from the vantage point of the shear operator. The cylinder had been inadvertently missed by the FEMP operating contractor when removing similar type containers during the 1987 Radioactively Contaminated Metal Segregation Project. SEG was found free from any fault in the breach of the cylinder.

The post incident meetings and critiques derived methods to ensure the incident did not occur again. The methods included a more thorough and frequent inspection of the pile and training of the equipment operators on the appearance of different containers used at the FEMP throughout the production years.

The post incident investigation and time needed to disposition the UF-6 cylinder caused a two week delay in the scrap metal packaging operation.

4.2 Spill of Gasoline from Fire Truck

While size reducing a fire engine with the shear, a fuel tank was cut open containing 20 or 30 gallons of gasoline. As a result, FERMCO personnel were called in to excavate the soil that absorbed the gasoline.

Post incident meetings determined that a checklist had not been completed by FERMCO decontamination personnel that would have confirmed that all fluids had been drained prior to releasing the truck to SEG.

Once the affected soil was removed and all remaining vehicles and equipment included in the scrap metal pile were confirmed to have all fluids drained, SEG was released to continue size

reduction activities. The project schedule was delayed one week to allow for the completion of this investigation.

4.3 Melting of Lead

On September 19, 1993, while melting FEMP metal at SEG, the furnace sustained a ground fault interruption. After failed attempts to restart the furnace an emergency pour was conducted. As molten metal was poured into two starter block molds it was suspected that lead had been introduced into the furnace. This visible observation was confirmed by analysis on September 21, 1993. The confirmation of lead was found to be suprising to SEG since it is known that quanities of lead greater than nominal amounts have damaging effects on induction furnaces and was not intended to be included in scrap metal.

Soon after the emergency pour, it was found that the last charge dumped into the furnace had not fully melted and the remaining lead had been mixed in and thus adhered the mass to the furnace refractory. A complete refractory change was performed during week ending September 26, 1993.

During the refractory change out the source of the ground fault interruption was found. A small piece of lead had migrated through the furnace wall and had shorted out on one of the heating coils.

An investigation report was written by FERMCO, however the specific piece of equipment from which the lead came from could not be identified. It is believed by FERMCO that the lead may have come from a fork lift counter weight that was modified during the 1960's and was probably encased within.

4.4 High Lead Levels in Slag and Oxidation

Levels of lead above the action level as defined by RCRA (>5.00 mg/L)were found in some of the slag and oxidation waste from melting FEMP scrap metal. It is believed that lead was derived from processing scrap metal coated with lead based paint.

SEG had not seen lead above the regulatory action level prior to processing the FEMP metal. In the early production phase of the SEG Metal Melt facility, an extensive sampling and analysis program was utilized to determine the secondary waste characteristics of many different types of metals. As processing continued, SEG adopted, with State of Tennessee concurrence, a supplementary sampling plan that utilized process knowledge and confirmatory sampling and analysis.

After the presence of lead was identified, SEG initiated a

FERMCO specific sampling plan. SEG collected composite samples so that each sample represented four containers of slag or oxidation. If the composite analysis showed a lead result of >25% (>1.25 mg/L) of the action limit, each of the four boxes would be analyzed individually. Individual analysis of waste boxes in excess of the regulatory limit were held for particle size reduction (if necessary) and stabilization prior to final dispositioning.

5.0 CONTRACT MODIFICATIONS

Table 5-1, below, provides a description and value of modifications that were related to the scrap metal subcontract:

MODIFICATIONS TO SUBCONTRACT NO. 2-21486		
Modification No.	**Description**	**Cost Impact**
Modification 001	Changes the Buyer name from WEMCO to FERMCO.	NONE
Modification 002	Changes the Contract Administrator from John Davis to James Craig and the Technical Representative from Daniel Burns to Richard Hairston.	NONE
Modification 003	Language change in C.10.2 to state: FERMCO will provide a Nuclear Material Transaction Report and a shipping order for nuclear materials; SEG is responsible for all radioactive manifests. Language change in C.11 to state: SEG will provide interim storage for the direct waste pending approval of the waste by DOE.	NONE

Modification 004	Language change in C.10.2 to state: The DOE shall be identified as the generator of all wastes resulting from any operation under this subcontract. Language change in C.11 describes the waste to be disposed of as secondary waste and not the scrap metal itself. Replaces H.21 (Payments) with a Earned Value Milestone Payment Schedule.	NONE
Modification 005	Changes the FERMCO Technical Representative from Richard Hairston to Grant Hale.	NONE
Modification 006	Modified C.10.2 and C.11 to allow Quadrex to dispose of their secondary waste at a commercial disposal facility since it could not be segregated from other clients wastes. Modified the cost sections to include the increased money for disposal of waste at a commercial facility.	Subcontract increase of $50,105.00

Modification 007	Corrected typographical error in Modification 006: Changed cubic foot rate for burial at the commercial facility from $100.21 to $110.21.	NONE
Modification 008	Included language to allow for standby time while waiting for metal to be added to the scrap metal pile.	Subcontract increase of $158,366.00

6.0 CHRONOLOGICAL SUMMARY OF SUBCONTRACT EVENTS

Table 6-1, below, is a chronological summary of subcontract events and the dates in which they occurred.

EVENT	DATE OCCURRED
Subcontract signed	6/19/92
Subcontract suspension effective (due to unsuccessfull bidder protest)	8/28/92
Subcontract restart notification	10/26/92
Approval of Deliverables	1/8/93
Work area preparation completed by FERMCO	2/5/93
Mobilization complete at FEMP	2/12/93
Start of non-ferrous scrap metal loading	2/15/93
First scrap metal shipment off-site	3/2/93
Initial FERMCO QA audits of SEG and Quadrex	3/8/93
Completed non-ferrous loading	4/12/93

Start of ferrous scrap metal loading	4/13/93
First shipment of ferrous metals to SEG for metal melting	4/16/93
First ferrous metal melt	5/11/93
UF-6 cylinder incident and work shutdown	5/27/93
Work restart after UF-6 cylinder incident	6/7/93
Spill of gasoline from shearing of fire truck	8/16/93
Restart of Quadrex shipping of non-ferrous metal from the FEMP	8/30/93
Large quantity of lead melted in SEG induction furnace	9/19/93
Demobilization completed from the FEMP	9/30/93
Quadrex completed shipments of unsuccessfully decontaminated scrap metal to SEG for processing	1/24/94
SEG completed melting of FEMP metals	3/27/94
FERMCO surveillance of SEG Metal Melt facility for approval to process waste for disposal at the NTS	1/31/94
DOE-NV surveillance of SEG Metal Melt facility for approval to process waste for disposal at the NTS	2/14/94
Start of secondary waste size reduction	4/26/94
Start of lead bearing slag and oxidation stabilization	4/26/94
Lead incident waste treatment	9/15/94*
Completion of waste shipments to the NTS	8/26/94*

Completion of lead incident waste to Envirocare of Utah	9/20/94*
Project Complete	9/21/94*

* - Estimated

7.0 MATERIAL BALANCE

A material balance that illustrates the amount and type of scrap metal transported from the FEMP as part of this removal action can be found in Attachment I of this report. The material balance will also show how the metals were processed, wastes generated, and how the wastes were dispositioned.

The data provided in Attachment I does not balance to the exact pound due to accecptable error in scale accurracy. SEG's scales used for weighting the FEMP scrap metal are calibrated to NBS traceable weights to an accurracy of +/- 5%.

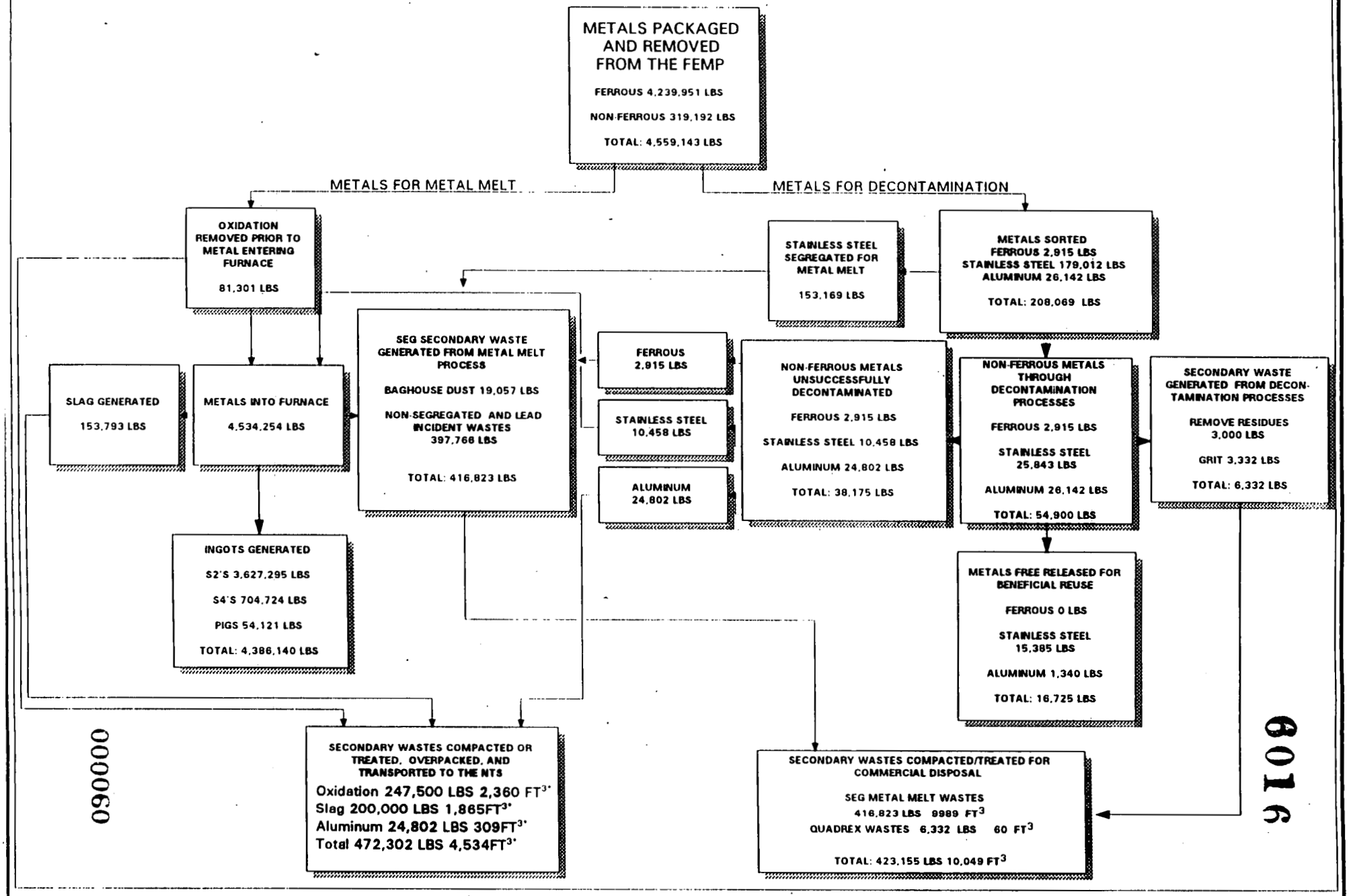
8.0 SUMMARY PROGRESS TABLE

A summary progress table that shows the duration of all major project activities can be found in Attachment II of this report.

ATTACHMENT I

FEMP SCRAP METAL MATERIAL BALANCE

MATERIAL BALANCE OF FERROUS AND NON-FERROUS METALS REMOVED FROM THE FEMP



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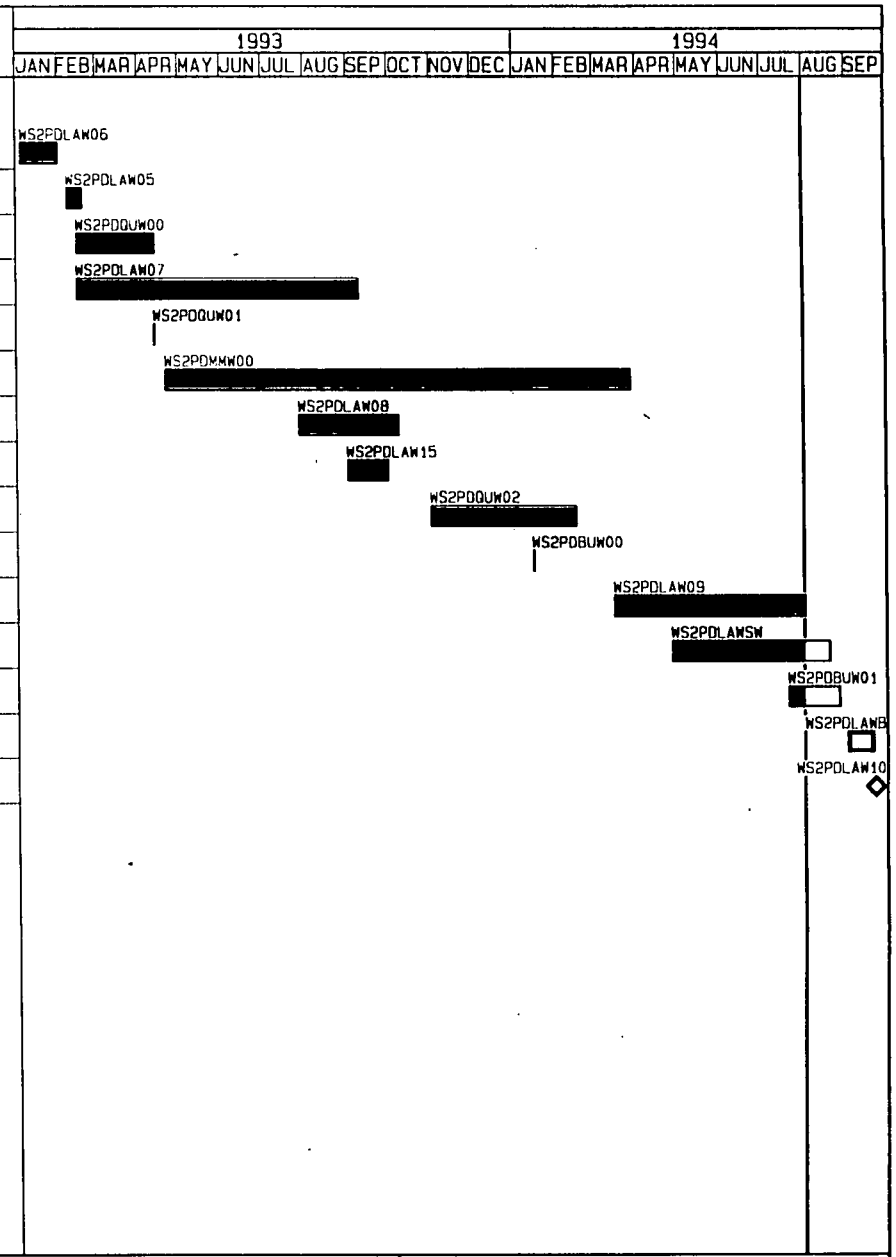
* = ESTIMATED VOLUME

ATTACHMENT II

SUMMARY PROGRESS TABLE

ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	REM DUR
ON SITE TRAINING	5JAN93A	1FEB93A	0
MOBILIZE	8FEB93A	19FEB93A	0
QUADREX PKG NON-FERROUS	15FEB93A	13APR93A	0
ONSITE PROCESSING (FEMP)	15FEB93A	9SEP93A	0
QUADREX DEMOB	13APR93A	13APR93A	0
METAL MELTING	21APR93A	27MAR94A	0
DEMOBILIZATION	28JUL93A	8OCT93A	0
QUADREX SHIPPING	1SEP93A	30SEP93A	0
QUADREX PROCESSING (DECON)	1NOV93A	15FEB94A	0
BURIAL (BARNWELL)	15JAN94A	15JAN94A	0
FINAL REPORT	15MAR94A	1AUG94A	0
SECONDARY WASTE PROCESSING	26APR94A	19AUG94	15
BURIAL AT NTS	20JUL94A	26AUG94	20
BURIAL OF LEAD INCIDENT WASTE	1SEP94	20SEP94	13
PROJECT COMPLETE		21SEP94	0



Plot Date 1AUG94
Data Date 1AUG94
Project Start 19JUN92
Project Finish 21SEP94

(c) Primavera Systems, Inc.

Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

SCAF

Sheet 1 of 1

FERNALD ENVIR RESTORATION MGT CO
SCRAP METAL PROJECT
SUMMARY PROGRESS TABLE

COST & SCHEDULE PERFORMANCE

Date	Revision	Checked	Approved

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ATTACHMENT B

CHRONOLOGICAL SUMMARY OF REMOVAL OF THE SCRAP METAL PILES

Attachment B. Chronological Summary of Removal of the Scrap Metal Piles.[1/]

Activity Date	Activity Description
SEG contract award	10/26/92
Approval of plans	1/8/93
Week ending 1/10/93	SEG and subcontractors (Quadrex and SAM) arrive to begin site-specific training. SEG/subcontractor office trailers mobilized on site.
	USEPA approves the SEG Removal Action Project Plan (RAPP).
Week ending 1/17/93	Training and badging of SEG/subcontractor personnel continues.
Week ending 1/24/93	Training completed. 1,200-ton capacity shear brought on site and assembled.
Week ending 1/31/93	FERMCO begins laying clean rock/gravel over contaminated areas of pad. Project kickoff meeting held. Assembly of shear completed. FERMCO begins clearing pad area to allow SEG access.
Week ending 2/7/93	FERMCO completes rock/gravel placement. Electrical service completed to SEG trailers.
Week ending 2/14/93	SEG mobilizes trackhoe and shear, mobile fuel tanker, front end loader, equipped tool trailer, yard tractor, and four non-ferrous shipping containers.
	Onsite mobilization completed 2/12.
Week ending 2/21/93	Loading of non-ferrous scrap metal begins 2/15. Weather (snow) slows operations.
Week ending 2/28/93	First load of non-ferrous metals completed and prepared for shipment 2/22 (21,000 pounds of non-ferrous metals).
	Second container of non-ferrous scrap metals loaded 2/25.
February 1993 summary	To date no scrap metal transported from the FEMP. However, approximately 45,000 pounds of non-ferrous metals were packaged and readied for transport.
Week ending 3/7/93	First two shipments of non-ferrous scrap metal transported to Quadrex 3/2.
Week ending 3/14/93	Fourth container filled 3/9.
	Weather (snow) delays.
Week ending 3/21/93	Weather (snow) delays continue. Fifth container loaded 3/16, sixth container loaded 3/17, seventh loaded 3/19.
Week ending 3/28/93	50-ton crawler crane brought on site to assist loading of scrap metal. Loading of eighth container completed 3/22. Ninth and tenth boxes loaded 3/24 and 3/25, respectively.
	Segregation and sizing of ferrous materials begins.
Week ending 4/4/93	Eleventh, twelfth, and thirteenth containers loaded.
March 1993 summary	Approximately 17.5 tons of low-level non-ferrous metal transported off site during March 1993. No scrap metal processed (off site) to date.

Attachment B. Chronological Summary of Removal of the Scrap Metal Piles.[1/]

Activity Date	Activity Description
Week ending 4/11/93	Containers #14,15,16 for non-ferrous metals loaded.
Week ending 4/18/93	Final Quadrex container loaded 4/12. Total of 17 containers loaded with non-ferrous metals. Fourteen of the 17 containers remain at the FEMP awaiting shipment.
	Loading of ferrous metals begins 4/13. Three SEG metal boxes loaded 4/13. Eight metal boxes loaded total and two shipments of two boxes each made to SEG-Oak Ridge facility.
Week ending 4/25/93	Additional metal shipments to SEG-Oak Ridge put on hold until conditional approval for melting metal was obtained from FERMCO. Verbal approval granted 4/21, shipments resume 4/22. Twenty boxes loaded and three shipments made.
Week ending 5/2/93	Nine more loads of scrap metal shipped to SEG-Oak Ridge with an average six boxes loaded per day.
April 1993 summary	Approximately 192 tons of ferrous scrap metal transported off site. No processing (off site) of scrap metal to date.
Week ending 5/9/93	12 shipments of ferrous metals made to SEG Metal Melt Facility. SEG relocated Quadrex containers on pad 5/6. Scrap metal wetted 5/6 to suppress dust.
Week ending 5/16/93	Weather (heat) delays. Eight loads of ferrous scrap metal transported to SEG-Oak Ridge.
Week ending 5/23/93	Metal loading continues.
Week ending 5/30/93	UF-6 incident occurs 5/27.
May 1993 summary	Approximately 555 tons of ferrous scrap metal transported off site.
Week ending 6/6/93	No scrap metal sizing or packaging conducted due to UF-6 incident investigation. Scrap metal project review meeting held at SEG-Oak Ridge facility with FERMCO.
Week ending 6/13/93	Scrap metal operations resume on site. Revision 1 to SSHP in effect to include modifications required by UF-6 incident.
Week ending 6/20/93	Sizing and packaging of scrap metal continues.
Week ending 6/27/93	Sizing and packaging of ferrous metals commences. Bulk material, believed to be green salt and magnesium fluoride found within containers and piping. Materials removed for FERMCO characterization and disposal.
Week ending 7/4/93	Meeting held 6/28 to discuss additional metals that could be recycled.
June 1993 summary	Approximately 455 tons of ferrous scrap metal transported off site.
Week ending 7/11/93	Additional metals added to SEG subcontract by FERMCO to be processed by SEG. Includes furnace pots.
Week ending 7/18/93	Complete size reducing furnace pots.

Attachment B. Chronological Summary of Removal of the Scrap Metal Piles.[1/]

Activity Date	Activity Description
Week ending 7/25/93	SEG completes size reduction activities of all materials in scrap metal pile 7/19.
	Processing of additional materials continues.
Week ending 8/1/93	Official notification received by SEG from FERMCO to demobilize 7/27. Demobilization commences 7/28.
July 1993 summary	Approximately 420 tons of ferrous and non-ferrous scrap metal transported off site.
Week ending 8/8/93	Project remobilized to process additional 300 tons of scrap metal (scrap vehicles and equipment).
Week ending 8/15/93	Remobilizing 8/9 and 8/10.
Week ending 8/22/93	Size reduction of vehicles and equipment. Fire engine fuel spill incident occurs 8/16.
Week ending 8/29/93	Size reduction of vehicles and equipment continues.
Week ending 9/5/93	Size reduction completed. Quadrex shipped first two of 14 remaining containers for decontamination. Decontamination of equipment, demobilization.
August 1993 summary	Approximately 348 tons of ferrous and non-ferrous scrap metal transported.
Week ending 9/12/93	Last six SEG metal melt boxes loaded with items requiring size reduction, shipped to SEG-Oak Ridge for melting. Three FERMCO sealand sized containers loaded and transported off the FEMP site.
Week ending 9/19/93	Last two FERMCO sealand sized containers loaded and transported to SEG-Oak Ridge for melting. Decontamination, disassembly, and transport of track hoe, shear, and crane continues. Quadrex transports two containers off site for decontamination.
Week ending 9/26/93	Quadrex transports two more containers off site for decontamination.
Week ending 10/3/93	Demobilization completed 9/30. The last pieces of project equipment were free released from the FEMP or wrapped and transported to SEG-Oak Ridge for decontamination. Quadrex removed the last six containers from the FEMP.
September 1993 Summary	Approximately 396 tons of ferrous and non-ferrous scrap metal transported off site. All scrap metal removed from the FEMP.
1/24/94	Quadrex completes shipments of unsuccessfully decontaminated scrap metal to SEG for processing.
3/27/94	SEG completes melting of Phase I RA-15 metals.
1/31/94	FERMCO conducts audit of SEG metal melt facility for approval to process waste for disposal at the NTS.

Attachment B. Chronological Summary of Removal of the Scrap Metal Piles.[1/]

Activity Date	Activity Description
2/14/94	DOE-NV audits SEG metal melt facility for approval to process waste for disposal at the NTS.
4/24/94	Start of lead bearing slag and oxidation stabilization.
4/26/94	Start of secondary waste size reduction at SEG.
11/15/94[2/]	Completion of lead incident and slag waste treatment at SEG.
11/30/94[2/]	Completion of shipment of lead incident wastes to Envirocare and slag waste to Nevada Test Site (NTS).
2/15/94[2/]	Completion of oxidation waste treatment at SEG.
2/28/95[2/]	Completion of waste shipments to the NTS or approved commercial facility.
2/28/95[2/]	Project complete.

1/ Material weights are approximate, a material balance for the scrap metals is contained in Figure 2-5.
2/ Forecast completion dates. Actual dates will be provided as the actions occur.