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PLANT 7 STRUCTURAL STEEL DECONTAMINATION AND RECYCLING ENGINEERING STUDY FINAL REPORT

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REPORT

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Department of Energy

Ohio Field Office
Fernald Area Office
P. O. Box 538705
Cincinnati, Ohio 45253-8705
(513) 648-3155

OCT 1 5 1996

DOE-0004-97

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

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

Dear Mr. Saric and Mr. Schneider:

PLANT 7 STRUCTURAL STEEL DECONTAMINATION AND RECYCLING ENGINEERING STUDY FINAL REPORT

The purpose of this letter is to transmit the enclosed Plant 7 Structural Steel Decontamination and Recycling Engineering Study Final Report.

The objective of this study was to demonstrate a process for decontaminating 761 tons of Plant 7 structural steel for unrestricted release to recycling vendors. Approximately 445 tons of steel were successfully released for unrestricted reuse by this project.

Results from the study indicate that structural steel decontamination is a feasible approach for the recycling of structural steel. However, further refinement of structural dismantlement operations is needed to optimize steel recycling.

If you have any questions, please contact John Trygier at (513) 648-3159.

Sincerely,

Johnny Reising

Johnny W. Reising
Fernald Remedial Action
Project Manager

FEMP:Hall

Enclosure: As Stated

Recycled and Recyclable

000001

cc w/enc:

S. Fauver, EM-425/GTN
R. L. Nace, EM-425/GTN
A. Murphy, DOE-FEMP
J. Trygier, DOE-FEMP
P. Yerace, DOE-FEMP
G. Jablonowski, USEPA-V, 5HRE-8J
R. Beaumier, TPSS/DERR, OEPA-Columbus
T. Schneider, OEPA-Dayton (3 copies total of enc.)
F. Bell, ATSDR
D. S. Ward, GeoTrans
R. Vandegrift, ODOH
S. McLellan, PRC
T. R. Clark, FDF/52-3
T. Hagen, FDF/65-2
J. Harmon, FDF/90
J. Leslie, FDF/52-3
L. Miller, FDF/52-3
AR Coordinator/78

cc w/o enc:

C. Little, FDF/2
EDC, FDF/52-7

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT (FEMP)

FINAL REPORT

FOR THE

PLANT 7 STRUCTURAL STEEL DECONTAMINATION AND RECYCLING ENGINEERING STUDY

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Attachment I — Alaron Final Report for the FERMCO Metal Recycling Treatability Study

Attachment II — Plant 7 Steel Recycling Cost Analysis

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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.

Under the guidance of Removal Action 19 (RvA 19), Plant 7 Dismantling, included the decontamination and dismantlement of Plant 7. The work included gross decontamination of Plant 7 using a high-pressure/low-volume spray with a maximum pressure of 1,800 psi (pounds per square inch) and minimum discharge capacity of 3.5 gpm., (gallon per minute) followed by the application of a lockdown encapsulant (latex paint) in areas of potential loose contamination. The lockdown encapsulant was sprayed on in a 1-mil thick layer.

The structural pipe supports, steel tanks, overhead bridge crane and trolley were dismantled, downsized using a mechanical shear, torch cut, and loaded in large white metal boxes (8-foot x 8-foot x 20-foot top-load containers). The penthouse and elevator shaft were dismantled and downsized and loaded into boxes or stacked.

The structural steel, generated as a result of decontamination and dismantlement of Plant 7, was in the form of deck grating, deck plating and structural members. Structural members include all I-beams, cross members and purlins. All of the metal was assumed to be primed and painted with lead based paint. In general, the contamination levels of the steel ranged between 3,000 dpm/100 cm^2 to 1,000,000 dpm/100 cm^2 total activity. Plant 7 processed normal and depleted uranium and, as a result, the contamination is not considered special nuclear material.

For the building frame, three structural steel dismantlement alternatives (mechanical tripping, modular dismantlement and controlled detonation) were evaluated for safety. Based on enhanced worker safety and increased cost effectiveness, it was proposed to use controlled detonation. The controlled detonation dismantlement (felling) of Plant 7 involved a specialized steel-cutting method of linear shaped charges to cut structural support columns. Column cuts were made and the shaped charges were placed. The first detonation attempt resulted in an incomplete felling. The first two floors of the building collapsed as planned, the third, fifth and sixth floors did not separate as anticipated and the building did not come completely down. Shaped charges were again placed on the fourth, fifth and sixth floors to further break apart the weakened structure. The second detonation successfully brought the remaining Plant 7 structure to the ground.

After the implosion on September 17, 1994, the structural steel beams, columns, purlins, floor decking and miscellaneous structural members were sheared into sizes which would fit into large white metal boxes (LWMB). Two shears were used to cut, and load material into the LWMBs. The material was to be sheared to meet an envelope of a box size of 19 foot long, 7 feet wide and 7 feet high (approximate inside dimensions). Most of the steel was mangled and twisted due to the felling of the structure and the cutting and shearing methods. The material was cut but upon loading initial boxes, the steel ripped or punctured

the 12 gauge sided boxes. The box of choice changed to a roll off box (ROB), a 1/4 inch thick box with a 21 foot long by 8 foot long by 8 foot side by 5.5 foot height. Eighteen LWMBs were filled with structural steel. Seven of the LWMBs were later repackaged into roll off boxes due to either damage to the box or overloading of the container. Overloading of the containers made it difficult to seal the containers for shipment. In total, 62 roll off boxes and 17 LWMBs were packaged. Some of the material loaded included some miscellaneous metal and other debris. The shearing operation using a large excavator with a 100,000 pound La Bounty head and a smaller shear cut the steel into sizes that provided the maximum weight that could be placed in the container until it was nearly full. The height of the pile after the implosion was about 55 feet. The main structural members were welded to the floor plate; therefore, separation of plate and steel was nearly impossible without a great deal of cutting by hand. The shearing operation and loading of containers were completed on November 18, 1994.

On January 5, 1995, Alaron Corporation and the Fernald Environmental Restoration Management Company (FERMCO) entered into an agreement to subcontract to perform an enginnering study for decontamination, processing, radiological monitoring, and unrestricted reuse of an estimated 700 tons of low level radioactively contaminated steel, and preparation of a final report.

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, Alaron'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, Compensaton 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 steel. The demonstration consisted of decontamination of the steel for unrestricted reuse, recycling the released material through a scrap metal dealer, and processing and disposing of secondary waste. The results of the study would be used to demonstrate a processing method that can be implemented on a larger scale as remediation of the FEMP.

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 and provides a synopsis of the work performed by FERMCO and Attachment I provides a synopsis of the Alaron scope of work, certifies that the work was performed, explains modifications to the subcontract, describes 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 of work involved the packaging of the structural steel and oversight of the following: transportation; receipt; interim storage; decontamination; processing; characterization; radiological monitoring; and recycling of the steel.

The Alaron scope of work for this project involved the transportation, receipt, necessary interim storage, decontamination, processing, radiological monitoring, and recycling of 700 tons of radioactively contaminated steel. Additionally, the Alaron scope included the processing, packaging, transport, and return of the waste and waste containers to the FEMP.

A modification to Alaron's contract during December, 1995 increased the quantity of steel to be processed from 700 tons to 761 tons to allow FERMCO to disposition additional steel from the Plant 7 decommissioning.

3.0 SUMMARY OF WORK PERFORMED

The Plant 7 Steel Decontamination and Recycling project was performed in an eight phase effort to allow for the successful completion of the work defined in Section 2.0. The eight phases consisted of transportation from the FEMP of the radioactively contaminated steel to Alaron's Wampum, PA facility, interim storage of the steel, segregation, processing of recyclable components, processing of non-recyclable components, radiological surveys, waste disposition 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; and
- Quality Assurance Project Plan

The Offsite Processing Work Plan provided a description of project integration and management, offsite activities, transportation, Alaron 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 steel. The purpose of this procedure was to establish guidance to properly classify, describe, package, mark, label and manifest radioactive materials for transportation to and from the FEMP. All shipments were conducted in accordance with the Alaron State of Pennsylvania 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 Alaron. This document was written as a supplement to the existing Alaron Quality Assurance Program document.

3.2 Readiness Assessment/QA Surveillances

After review of the subcontract deliverables, FERMCO performed an audit of the Alaron Corporation, Northeast Regional Service Facility, Wampum, PA and Kindrick Trucking Company, Harriman, TN facilities to evaluate the preparedness to transport, receive and treat (decontaminate) the Plant 7 steel. The audit identified five findings, three concerns and two recommendations. After all audit findings, concerns, and recommendations were resolved, FERMCO instructed Alaron to began processing. The audit assured that the Alaron facilities were ready to transfer, store, process, free release, and package the material and waste.

FERMCO QA surveillances were performed throughout the project to certify that the waste and processing of the material met regulatory requirements, to verify subcontract requirements and to certify that the waste, when packaged, met the FEMP Waste Acceptance Criteria.

3.3 Transportation and Receipt of Plant 7 Steel

At the Fernald site, FERMCO's Waste Management Representative loaded the containers onto Alaron's shipper, Kindrick Trucking, flatbed or drop deck conveyances for shipment to Alaron's Northeast Regional Service Facility. All transportation was performed in accordance with the project specific Transportation Plan. Alaron's shipping representative and FERMCO QA assured that the loads were secured in accordance with tie-down instructions in the transportation plan.

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 Limited Quantity (LQ) criteria. The steel was loaded unto the transporters truck by FERMCO.

See Attachment I, Section 10.0 for further details.

3.4 Sorting, Cutting and Sizing

The attached, (Attachment I, Section 11.0) the Final Report for the FERMCO Metal Recycling Treatability Study performed by Alaron Corporation, describes the sorting, cutting and sizing methods used to prepare the structural steel for decontamination.

3.5 Processing and Decontamination of Structural Steel

The attached, (Attachment I, Section 11.0) the Final Report for the FERMCO Metal Recycling Treatability Study performed by Alaron Corporation, describes the processisng and decontamination methods used to process the structural steel.

3.6 Release for Unrestricted Reuse

The attached, (Attachment I, Sections 11.0 and 12.0) the Final Report for the FERMCO Metal Recycling Treatability Study performed by Alaron Corporation, describes the processing and decontamination methods used to process the structural steel.

3.7 Waste Processing, Treatment and Disposition

There were 46 roll-off boxes and 13 LWMBs returned to the FEMP with non-recycled structural steel (approximate 300 tons). Sixteen roll-off containers were returned empty and transferred to the Plant 4 D&D project. The four remaining large metal boxes were returned with wood, HEPA filters, compactible trash, and wood and metal, respectively. There were also 130 55-gallon drums (approximate 42 tons) returned of secondary waste generated from the recycling process. These drums contained spent grit blast material, slag, and torit dust. One drum containing oil from the bridge crane was returned (see Attachment III).

The drums of grit blast, slag and torit dust were all sampled. The samples were analyzed for RCRA metals, percent moisture, Total U, alpha/beta, and % U235. The sampling met the Nevada Test Site (NTS) confirmatory sampling requirements. All samples were determined to be non-RCRA, low level waste.

Roll-offs and large metal boxes that were returned with non-recycled structural steel were visually inspected for void spaces. Containers that were not relatively full with steel were consolidated into other roll-off boxes or were used to top-off already full large metal boxes and roll off boxes. The consolidation activities have emptied 27 roll-off boxes for reuse on other on-site projects. The remaining boxes containing steel are currently being stored on the Plant 1 Pad. The drums of secondary waste are currently being stored in Plant 6. The oil drum is currently in RCRA storage.

The remaining four large metal boxes are currently staged at Plant 7 pad. The contaminated wood pallets will be removed and utilized on-site. The compactible trash will be removed and processed through the SuperCompactor, if the trash meets the Supercompactor WAC. The other two large metal boxes are being stored.

Currently, the 300 tons of structural steel is being considered for beneficial reuse or on-site cell disposal. The small metal boxes generated from the consolidation of the secondary waste will be transported and disposed at NTS. The compactible waste will be disposed along with other FEMP generated waste at NTS. The other remaining large metal boxes are currently being held for disposition in the on-site cell.

The attached, (Attachment I, Sections 13.0 and 14.0) the Final Report for the FERMCO Metal Recycling Treatability Study performed by Alaron Corporation, describes the waste processing and dispositioning of waste streams generated as a result of processing the structural steel.

4.0 Material Balance and Waste Tracking Inventory

The attached, (Attachment I, Sections 14.0 and 15.0) the Final Report for the FERMCO Metal Recycling Treatability Study performed by Alaron Corporation, describes the material balance and waste tracking inventory the structural steel and the waste streams generated as a result of processing the structural steel.

5.0 LESSONS LEARNED

Reinforced LWMBs are a less suitable alternative to packaging in roll off boxes. If the subcontractor is loading boxes, provide oversight by site personnel of loading to ensure care is taken while loading. Less jagged, straighter material would have filled less boxes and been a more accurate representation of the bulking factors originally used for the project. Have specific material criteria before containers are loaded so that the material being studied can be hand selected during loading. This would have allowed less containers and less transportation.

In support of implosion technology, implosion reduces risk to DOE for safety reasons overall, for cost and schedule objectives as well. Implosion reduces exposure to workers cutting structural steel at high altitudes, reduces risks associated with rigging material from high altitudes and finally eliminates the disassembly and man handling of material using conventional methods which might lead to first aid and recordables. 58% of the material was recycled. In order to recycle the remaining 42% shearing or torch cutting was required and the cost of additional shearing/ torch cutting would be considerably higher in a non-competitive mode of pricing. The extra scope of shearing/torch cutting could also impact the schedule. Better material cutting and shearing methods would aid in the elimination of twisted, smashed and bent steel.

See Attachment I for lessons learned by ALARON.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This engineering study has been a success for DOE, FERMCO, and Alaron by demonstrating technology that can be implemented on a larger scale as remediation of the FEMP. The total cost for Decontamination and Recycling of the Plant 7 Structural Steel is $2,446,275, the cost per pound is $1.61, and the cost per cubic foot was $787.57. The salvage value of the structural steel was $28,417.33 (889,270 pound).

A cost analysis is enclosed as Attachment II. All structural steel which could be processed that was in the scope of Alaron's work (98%) was released for unrestricted reuse. Hazardous waste was not generated as a result of the processing. It is currently estimated that there is 15,000 tons of structural steel 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.

Final Report for the FERMCO Metal Recycling Treatability Study

Performed by

ALARON Corporation

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1.0 INTRODUCTION

ALARON Corporation is a comprehensive nuclear and environmental remediation company which maintains a fixed base facility located in western Pennsylvania that is regulated and licensed by the Nuclear Regulatory Commission (NRC). ALARON has been performing decontamination and waste processing services at the western Pennsylvania facility since 1986.

This report includes a synopsis of work that was performed by ALARON Corporation on behalf of FERMCO in accordance with contract number 95PS001025. Throughout the work performed, modifications to the original plan were made. These changes are described in the project activities and where applicable, "lessons learned" resulting from these modifications are included in italics. Challenges and successes are described in these lessons learned segments.

As part of this report, a summary of the progression of the project is provided in table form. Summary reports are included showing the disposition of the material received and the waste generated from processing.

The requirements for information gathered throughout this project were explicitly defined by FERMCO at the onset of our working relationship. Treatability Study requirements were incorporated into ALARON's procedures to assure the information was gathered. Specifically, weights and volumes were measured throughout each processing step in an effort to monitor waste generation versus decontaminated material.

Performance data reports are also attached as part of this report which summarizes the project results.

2.0 HISTORY

In early 1994, FERMCO issued a request for proposal to recycle an estimated 700 tons of contaminated structural steel produced during the dismantling of Plant 7 located at the Fernald, Ohio site. This recycling effort is part of a treatability study to determine the recyclability of this material type. The study was to include information regarding the amount of metal that could be recycled versus the amount of waste produced through the decontamination process. Several decontamination and recycling companies submitted proposals to perform this work.

On December 22, 1994, ALARON Corporation was given formal notification of the award of the contract to perform recycling of 700 tons of contaminated structural steel to be generated from the demolition of Plant 7. The objective of this contract was to perform work according to treatability study guidelines in an effort to determine the

feasibility of decontaminating and recycling structural steel components versus burial of this material as waste.

The metal chosen for the study consisted of the structural steel components of Plant 7 including I-beams, deckplating, C-channels, angle iron and bridge crane metals. The structural members had been painted with a lead-based paint approximately 8 mils thick during its original construction prior to performing any radioactive operations in the building. As part of the demolition, the building was washed with high-pressure water to remove gross loose contamination. Following the wash, the steel was coated with a latex paint about 0.5 mils thick to "fix" the remaining loose contamination and reduced the potential spread of contamination during demolition.

FERMCO provided a "Summary of Contamination Surveys on Plant 7 Structural Steel" as part of the Request for Proposal (RFP) #JC-97686. The information contained in the summary follows:

> Radiological contamination surveys were performed on Plant 7 structural material for removable and fixed-plus removable contamination prior to and post decontamination / lockdown efforts. Process knowledge information indicates only natural and depleted uranium to have been introduced to this building. Additionally, representative swipe samples have been submitted to the analytical lab for quantitative isotopic analysis (U-235) to support the process knowledge information. Reported results show no concentrations above natural enrichment (0.71%).
>
> Initial contamination surveys obtained from floors, ductwork, piping, beams / angle iron and other miscellaneous surfaces reported removable contamination levels of: 450 dpm / 100 cm^2 alpha (average) with a maximum of 2879 dpm / 100 cm^2 and, 530 dpm / 100 cm^2 beta / gamma (average) with a maximum of 19,666 dpm / 100 cm^2. Direct frisk (total fixed plus removable) for beta / gamma reported averages of : 457,500 dpm on floor surfaces and 47,285 dpm on all other surfaces with a maximum of 1,000,000 dpm.
>
> Post decontamination / lockdown surveys reported average removable contamination levels have been reduced to: 60 dpm / 100 cm^2 alpha and, 124 dpm / 100 cm^2 beta / gamma. Direct frisk (total fixed plus removable) reported results that are essentially unchanged from the initial assessment.

In order to provide the most cost effective, turnkey recycling services available, ALARON employs a systematic decontamination sequence which maximizes decontamination effectiveness and, at the same time, minimizes overall secondary waste generation. The processing sequence emphasizes the following:

- Minimizing processing costs by competent up-front planning and material sorting to ensure that each structural component enters and proceeds through the process train in the most efficient sequence possible.
- Focusing the major portion of decontamination efforts on the removal of lead-based paint from the metal surface. Since most of the contamination is associated with the paint, effective removal of this coating is required to free-release the major portion of the contaminated metal.
- Minimizing costs associated with material survey by employing decontamination technologies proven effective in similar applications.
- Segregation of FERMCO's material and associated wastes from all other materials and wastes at ALARON's facility by dedicating decontamination processes to FERMCO material.
- Avoiding the generation of hazardous wastes by employing state-of-the-art decontamination technologies proven in similar applications.

The ALARON decontamination process was designed to remove the painted surfaces of steel with an abrasive media, to capture the contaminated lead-based paint and there by decontaminate the steel. An abrasive blast descaler unit was designed and installed at ALARON's Northeast Regional Service Facility to perform this decontamination process. The descaler was the heart of a comprehensive process that includes sorting and segregating on-spec metal from off-spec metal and size reducing metal to fit the descaler inlet opening of approximately 30"h x 24"w. Metal passes through the descaler on a conveyor system that forwards the decontaminated steel to the survey area where qualified technicians survey 100% of the surface area for free-release. Released material is then placed in a scrap dumpster and transferred to a scrapyard for unrestricted reuse.

3.0 SCOPE OF WORK

The original scope of work involved the transportation, receipt, necessary interim storage, decontamination, processing, radiological monitoring, and recycling or beneficial re-use of about 700 tons of radioactively contaminated steel. Specific recycle / reuse requirements were to recycle the metal for unrestricted reuse or beneficial restricted reuse of the metal such as fabricating containers from homogeneously contaminated steel. The scope included documentation and preparation of a final report for use in the FERMCO Treatability Studies. Additionally, the scope included the processing, characterization, packaging, transport, and final disposition of secondary waste.

The revised scope of this project involved truck transport of approximately 761 tons of contaminated structural steel from the Fernald Environmental Management Project (FEMP) to ALARON's facility in Wampum, PA. The steel was then decontaminated

radiologically by ALARON and surveyed and released for unrestricted reuse. Steel released for unrestricted reuse was delivered to a local scrapyard for recycling. Off-specification metal and waste was shipped back to the FEMP

4.0 SYNOPSIS OF WORK PERFORMED

The project was identified as a treatability study for determining the feasibility of recycling contaminated structural steel for unrestricted reuse. Approximately 761 tons of material was received at ALARON and sorted for decontamination. The metal was processed for decontamination, decontaminated by using a continuous feed abrasive blast machine (see Photo 1, in Appendix 1) to remove the painted surfaces, and then surveyed for radiological release. The released metal was sent to a scrap yard for unrestricted reuse in the private sector.

The following diagrams 4.1 and 4.2 illustrate the projected flowpath of material in the decontamination process and the actual path taken to maximize recycling based on the condition of the material received:

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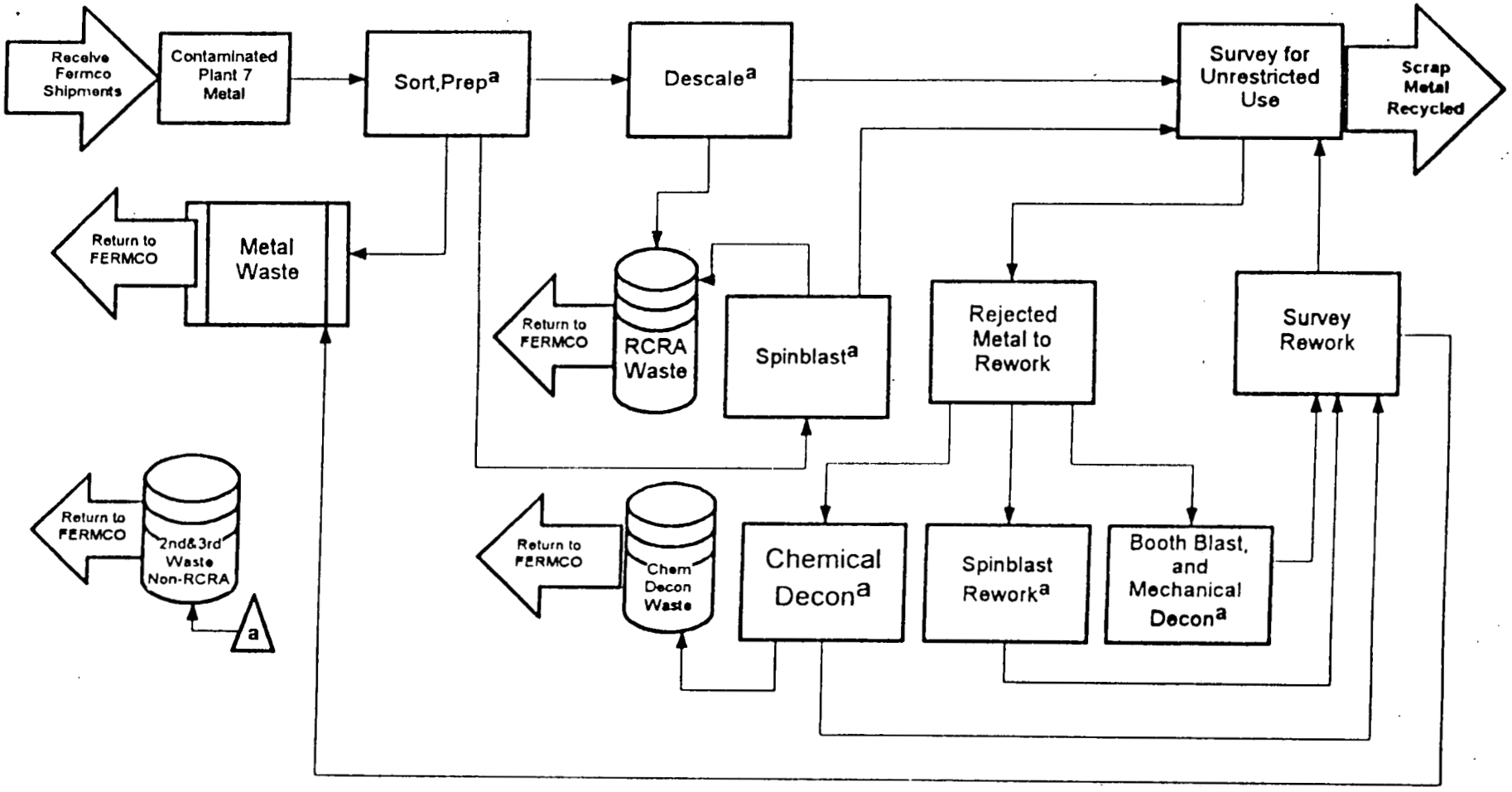
Decontamination and Recycling of FERMCO Plant 7 Metals

Diagram 4.1
FERMCO Recycling
Planned process flow



NOTE:

2nd and 3rd waste is that which results from the decon process. It consists of non-hazardous of slag, dust, abrasive media, paper, plastic, filter media etc.

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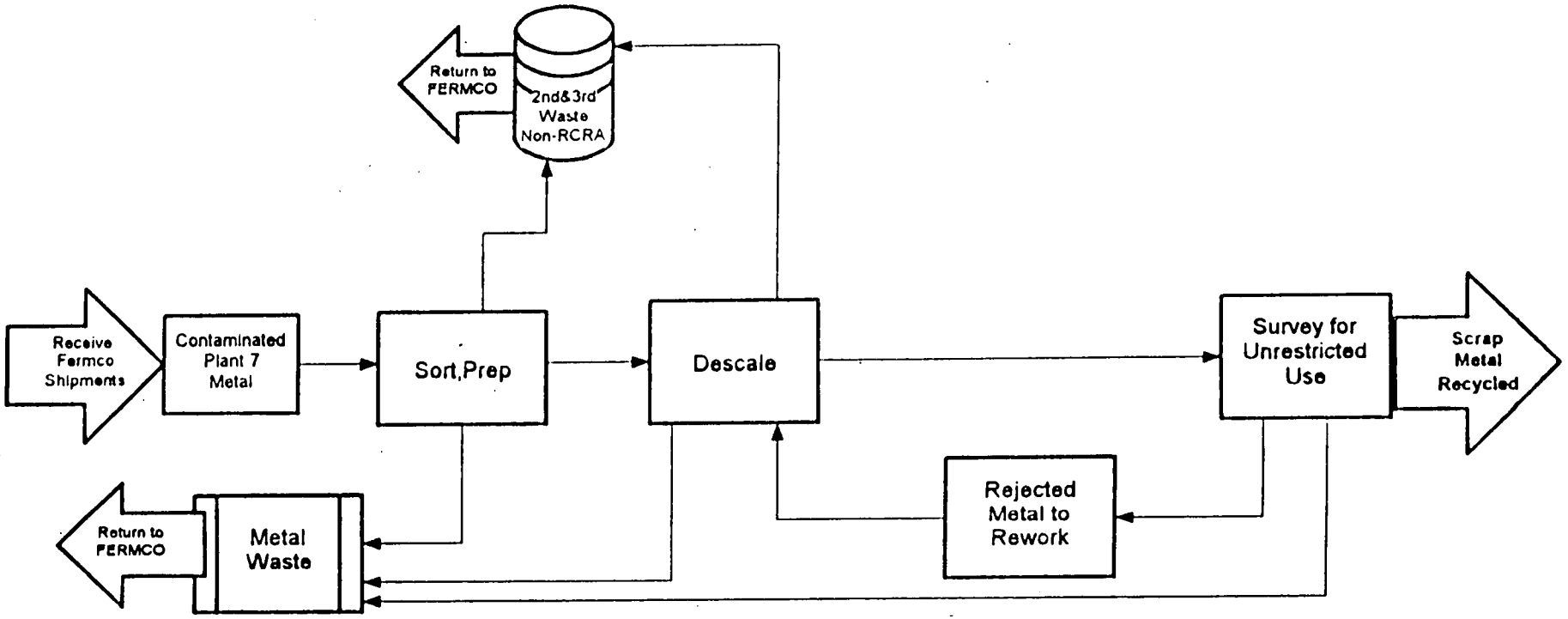
Decontamination and Recycling of FERMCO Plant 7 Metals

Diagram 4.2
FERMCO Recycling
Actual Flow



NOTE:
2nd and 3rd waste is that which results from the decon process. It consists of non-hazardous slag, dust, abrasive media, paper, plastic, filter media, etc.

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5.0 THE TEAM:

An alignment meeting was held with FERMCO and ALARON representatives between January 4-6, 1995 to identify the full scope of work, the progress schedule, and to develop a working team relationship between those directly involved with the project. This team concept contributed greatly to the project's success.

The team concept was also part of ALARON'S processing strategy to optimize worker performance. A dedicated team of workers was assigned to the project from the project's beginning through completion. The core of the team consisted of 19 workers, including supervisors, divided into three 8-hour shifts. Work was performed 24 hours per day, 5 days per week. Workers were trained to perform their job functions and were supervised in a continual basis. Productivity increased by using a dedicated team because workers improved on repetitive tasks.

Part of the team, FERMCO Quality Assurance (Q.A)., visited the ALARON facility on 01/26/95 in preparation for performing a readiness assessment audit. The site tour provided an opportunity to explain the processes so that FERMCO Quality Assurance (Q.A.) personnel could prepare for the audit scheduled on 03/15/95. Material tracking and segregation for the FERMCO Project material was the main focus area. ALARON proved to have acceptable handling and tracking procedures.

The readiness assessment audit was performed March 15-17. All action items regarding readiness were addressed and completed prior to performing work at ALARON.

Training to Nevada Test Site (NTS) requirements, NVO-325, was performed by FERMCO's QA Waste Certification group on March 28, 1995 for ALARON's facility personnel involved with any aspect of the project. This training made the employees knowledgeable of the strict waste acceptance criteria (WAC) requirements for waste acceptance at the Nevada Test Site. The training was performed in the event that waste was shipped directly from ALARON to NTS. However, approval was given to have waste returned to the FEMP for determination of the most appropriate final disposition.

6.0 SCHEDULE

A project schedule was developed identifying key milestone dates for the project. Key tasks of the baseline schedule are shown in Table 6.1.

Table 6.1
Baseline Schedule

Start Date	End Date	Event
01/09/95	05/19/95	ALARON to install and test new decon system
01/09/95	02/03/95	ALARON to prepare and submit deliverable plans and procedures
02/03/95	03/13/95	FERMCO to review and approve plans and procedures
03/15/95	03//17/95	FERMCO to perform readiness assessment audit at ALARON
03/14/95	05/12/95	Shipping of containers from FERMCO to ALARON
03/06/95	03/06/95	FERMCO to perform NVO-325 Training at ALARON
05/01/95	05/19/95	ALARON training of project personnel
05/22/95	11/19/95	Stage 1 processing (RCRA) cycle
05/22/95	11/20/95	Free release survey of deconned metal
10/30/95	11/20/95	Stage 2 processing Rework cycle
7/17/95	12/14/95	Shipments from ALARON to the FEMP of empty containers, off-specification material and waste
10/31/95	10/31/95	Submit draft of final report to FERMCO
11/01/95	12/22/95	Prepare and submit final report to FERMCO

As the scope of work changed, the schedule was modified to keep the project within the overall original schedule time frame. Few changes were made to the schedule with the exception of the changes made in processing. Chemical decon and spinblast methods that made up part of the stage 1 decon process were not used because of the effectiveness of descaler unit. Even with the additional weight received and the large amount of off-specification material, the project was completed on schedule.

A brief summary of general project events is shown in Table 6.2.

Table 6.2

Start Date	End Date	Event
01/05/95	05/22/95	Project preparation
03/27/95	05/03/95	Transport contaminated material to ALARON
05/22/95	10/26/95	Material processing
07/17/95	11/16/95	Return off-spec metal and waste

A summary progress table of the work performed is shown in Table 6.3.

Table 6.3
SUMMARY PROGRESS TABLE

Date	Event
12/22/94	ALARON notified of Award of Recycling project
01/03/95	Alignment meeting between FERMCO team and ALARON team
01/05/95	Contract No. 95PS001025 signed with ALARON to perform the work
02/03/95	Submittal of deliverable documents by ALARON
03/27/95	Began shipments of contaminated steel from the FEMP
03/28/95	Personnel training begins
04/24/95	FERMCO performs Readiness Assessment Audit
05/03/95	Last of 79 shipments from the FEMP completed
05/22/95	Decontamination process begins
07/10/95	TCLP sampling and analysis performed by FERMCO on waste
07/17/95	Initiated the return of 16 empty containers back to the FEMP

07/28/95	Identified large quantity of off-spec material affecting recycle rate
07/31/95	Modified operations to maximize recycling of off-spec material
08/16/95	TCLP results show that process does not produce a hazardous waste
08/30/95	Meeting held at the FEMP to determine project "path forward"
09/18/95	Returned 16 containers of off-spec material to FERMCO
10/02/95	Returned 16 containers of off-spec material to FERMCO
10/16/95	Returned 16 containers of off-spec material to FERMCO
10/20/95	Completed processing materials from Roll-offs and Top-loaders
10/26/95	Completed processing of all materials and began decon of area
10/31/95	Return 11 containers of off-spec material to FERMCO
11/03/95	Decon of area complete and released from FERMCO project status
11/13/95	Ship remaining 4 containers and waste
11/16/95	Project complete
11/30/95	ALARON submits a draft of the final report
12/22/95	Final report submitted to FERMCO

7.0 SAFETY

From the beginning and throughout the project, safety was the number one priority. A project specific Health and Safety Plan was followed which was a key to the safe performance during the project.

Low radioactive contamination levels minimized radiological concerns during the project. The project did however, present many challenges ranging from ergonomics to lead exposure. The dedicated efforts of the project team members in meeting these challenges, and in ensuring a safe workplace, are reflected by the fact that only one (1) OSHA recordable incident occurred during the entire project. Considering the enormous amount of material handling required over the course of the project, the overall project safety performance clearly represents an exemplary record for decontamination activities. When the decision to implement torch cutting was made, a lead compliance and surveillance program including respiratory protection measures, was initiated. Engineering and administrative controls helped to maintain worker's

blood lead levels below action limits as confirmed by actual blood test analyses. In spite of demanding production schedules, worker health and safety conditions were never compromised. This was illustrated by the medical surveillance results verifying that these controls prevented personnel from being exposed to contaminants above OSHA permissible limits. The success of this project illustrates that successful production operations can be conducted safely.

ALARON had the following incident statistics in 1995. The single lost time accident was a back injury 06/19/95 on second shift. Two employees working on the FERMCO project picked up a piece of decontaminated steel (later weighed at 64 pounds) to move it for free release survey. One of the employees experienced back pains and was sent to the local hospital for immediate treatment. He missed 15 days of work and was restricted from lifting an additional 47 days. This was the only OSHA-recordable injury on the FERMCO project. Table 7.1 shows ALARON's incident rate statistics compared to similar industries.

Table 7.1

SCOPE	Entire ALARON Facility 1995	Manufacturing[a]	Fabricated Structural Metal Products[a]
Employee Hours Worked	193000		
Average Number of Employees	80		
Lost Workday Cases	1		
Lost Workdays	15		
Restricted Workday Cases	3		
Restricted Workdays	87		
Total Recordable Cases	14		
Lost Time Frequency (Cases/100 man-years)	**1.0**	**5.4**	**7.3**
Lost Time Severity (Lost Days/100 man-years	**15.5**	**124.6**	**157.6**
Recordable Frequency (Cases/100 man-years	**14.5**	**12.5**	**17.8**

[a] Source of statistics is 1992 Annual Survey of Occupational Injuries and Illnesses conducted by the Bureau of Labor Statistics, U.S. Department of Labor (as reported in Accident Facts 1994 Edition, National Safety Council, 1994, Itasca, IL)

8.0 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

FERMCO Q.A. performed continuous surveillances during the first month of processing until confidence was established to perform only periodic surveillances.

ALARON's QA monitoring was performed as outlined in the project QA plan and consisted of inspections performed daily by its QC Inspectors, supplemented by the Quality Specialist's weekly inspections, and the QA Manager's monthly assessment. This proved to be highly successful in providing the quality oversight necessary for this project. ALARON's quality inspections identified only four minor nonconformances (NCRs) during the project. These consisted of: two (2) drums failing incoming receipt inspections prior to their use, one (1) item failing survey overcheck for an inaccessible area prior to free-release (after removing the inaccessible area the item was acceptable for release), and one (1) incident of broken tamper seals on containers in storage. The broken tamper seals resulted from two containers that were stationed very close together. Personnel moving between the containers inadvertently "brushed" against tamper seals and consequently broke seal on adjacent containers. To verify that the containers were not tampered with, each was reweighed and compared to the receipt weight. The conclusion was that there was no tampering with the container contents.

Documentation and procedural compliance were virtually flawless over the course of the project. Commitments by the project manager, supervisors, and workers, helped to ensure that quality requirements were strictly maintained at the highest levels.

9.0 PROCEDURES

As required by the contract, ALARON submitted plans and procedures to FERMCO for approval on February 3, 1995. The Transportation plan was the first to be approved. Approval of this procedure occurred on March 24, 1995 in time to proceed with shipping of the containers from the FEMP on March 27, 1995. The Project Work Plan, Health & Safety Plan, QA Plan, Operation & Maintenance Plan and applicable ALARON standard operating procedures were approved prior to the start of decontamination operations in conjunction with the readiness assessment documentation.

The specific plans ALARON issued for this project are shown in Table 9.1.

Table 9.1

Procedure Number	Title	Date	Revision
RSF-OP-235	FERMCO Transportation Plan	11/10/95	3
RSF-OP-236	FERMCO Metals Recycling Operations and Maintenance Plan	03/13/95	1
RSF-OP-237	FERMCO Metals Recycling Project Workplan	03/23/95	0
RSF-IH-304	FERMCO Metals Recycling Health and Safety Plan	03/23/95	0
RSF-QA-110	FERMCO Metals Recycling Quality Assurance Project Plan	05/19/95	2

Operations at ALARON are performed according to a written set of operating procedures. In addition to these procedures, some specific procedures that affected the project directly are noted in Table 9.2.

Table 9.2

Procedure Number	Title	Date	Revision
RSF-OP-214	HEPA Vacuums Operations and Maintenance	05/01/95	2
RSF-OP-238	Operating Procedure for the BCP Continuous Feed Descaler	05/09/95	0
WI-AR-0295-021	FERMCO Metal Recycling Process Control	05/19/95	2

WI-AR-0795-028	Empty Package Shipments to FERMCO	07/14/95	0

10.0 TRANSPORTATION

The containers were packaged and loaded onto trucks by FERMCO. A trained ALARON shipper was present at the Fernald site for the inspection of the shipments and shipping documentation and to sign for the transfer of material from FERMCO to ALARON.

Transport of containers from the FEMP to ALARON was performed using trucks with single-drop trailers hauled by a qualified, QA approved carrier. Kindrick Trucking was the approved carrier subcontracted by ALARON to perform this service.

Seventy-nine single container shipments were required to transfer the 761 tons of metal to ALARON's facility. The number of shipments per day was increased from the initial rate of 2 to 4 per day after the first two weeks of shipping to expedite the shipping and to optimize truck capacities.

Transportation began on March 27, 1995 and due to the shipping schedule acceleration was completed on May 3, 1995, seven days ahead of schedule. A total of seventy-nine containers in seventy-nine Limited Quantity shipments were transported to ALARON during this period without incident.

The containers were of two styles. One style was a roll-off type box that had a payload volume of 887 ft^3 and a tare weight of 8950 lbs. This box was of all metal construction except for the roof which consisted of a heavy PVC tarp material. The other style was a top-loading white metal box with a bolt on lid of all metal construction. This box had a payload volume of 971 ft^3 and a tare weight of 7050 lbs.

Upon receipt at ALARON, all containers were weighed to verify manifested weights. Weight discrepancies were noted. Because some of the differences were significant, ALARON purchased and installed a new platform scale which was calibrated to national standards. Containers were re-weighed at ALARON to confirm actual weights before processing. Re-weighing was also performed at FERMCO to minimize the weight discrepancies. ALARON confirmed the total weight of material received to be 1,522,560 lbs. or 761 tons. Receipt inspections identified minor rips and tears in tarps and minor holes in some of the containers. It is believed that the holes were caused by sharp edges of the metal that shifted during transport.

After receipt surveys and inspections were performed, the containers were placed in an interim outside gravel storage area until they were retrieved for processing.

Lessons learned: (1) caution should be used when packaging the containers to prevent sharp edges of the metal from coming in contact with the outer parts of the container as much as practical. Lining the boxes with plywood or using heavier construction materials for the manufacturing of the box would alleviate this problem, (2) determine the maximum number of shipments per day that is possible to make the best utilization of resources. In this case, 4 shipments per day was practical and efficient.

Primary waste was returned to the FEMP in the original roll-off and top-loading containers. Shipping schedules were established to return the containers as quickly as possible after processing so that they could be put to another use by FERMCO. Containers returned were loaded and shipped on flatbed trailers. Because of the reduced weight of the containers (free-released metal was removed) two containers were shipped on each flatbed for most of the loads. Return of the 79 FERMCO boxes was achieved with only 40 return shipments. Secondary waste such as the used blast media, paint chips and dust were packaged in 55 gallon steel drums and banded on pallets for return. Tertiary waste such as compactable waste and filters were returned to FERMCO in top-load boxes to make effective use of empty container space. This reduced the need for additional containers and maximized the transportation efficiency.

Incidental out-of-scope materials found in containers during processing such as wood, rubber, insulation, and lead were placed back into the containers with the off-specification metals for return to the FEMP. FERMCO requested that ALARON not load the secondary waste drums being shipped back to the FEMP into top-load white metal boxes due to difficulties in unloading the drums if shipped in this manner. At FERMCO's request, the drums were shipped in a closed van trailer. Additional transportation costs were incurred to accommodate this change since flatbed shipments could not be maximized.

11.0 MATERIAL PROCESSING

During the pre-job planning for the project, processing was separated into nine phases numbered 1 through 9. Phase 1 was to remove the container from the interim storage area and stage it in the processing area. Phase 1 operations were performed as planned. Phase 2 was to sort the material and prepare it for decontamination. Phase 2 involved mechanical and thermal cutting methods. In Phase 2, slag was generated and metal that was off specification was sorted out as primary waste. Phase 2 operations were later modified to include extensive torchcutting because of the large volume of badly damaged, off-specification metal.

Phase 3 was the paint removal phase. This was to include several techniques for removing all painted surfaces of the metal. The primary method for paint removal was the use of a continuous feed descaler abrasive blast unit (CFD). Other methods included a second large volume abrasive blast unit called the Spinblast unit, needle scaling, vacublasting, mechanical paint strippers, scrapers, and sandpaper. Only the descaler was needed to perform the paint removal/decontamination.

It was in Phase 3 where there was the potential to produce RCRA waste from the removal and capture of the lead-based paint. Analysis of the waste produced concluded that the waste was non-hazardous.

Phase 4 was the survey phase at which point the decontaminated metal was monitored for contamination. This phase included any material that was reworked through the process. Paint-free (decontaminated) surfaces were consistently below the contamination release levels.

Phase 5 operations involved preparing rejected metal (that which was not successfully decontaminated in Phase 3) for a second decon effort utilizing preparation steps similar to Phase 2.

In Phase 6 material that had the paint removed but was still contaminated was to be decontaminated in the Spinblast unit. Since the metal entering this phase was paint-free, no RCRA waste would be generated. This phase was not required once it was determined that metal that was paint-free was successfully decontaminated.

The purpose of Phase 7 was similar to Phase 6 in that material in this phase was paint-free. The Phase 7 process however involved chemically decontaminating rejected metal. It was suspected that this phase would be needed to deckplate material since it was ALARON's experience that flooring material is usually exposed to conditions that embed contamination deep into the surface of the metal. Throughout the project, this was found to be true for the deckplate metal. However, rework was successfully performed for most of the rejected deckplate by reworking it through the CFD abrasive blast unit.

Phase 8 was a rework step to mechanically decontaminate small areas on large pieces that were decontaminated except for discrete areas of contamination. Typically, decontamination methods used here are grinding, sand paper, or scraping.

Finally, Phase 9 was the phase where waste produced was prepared (sampled and analyzed) packaged and shipped.

Approval to begin processing was granted by FERMCO on May 19, 1995. On May 22, 1995, ALARON began decontaminating the Plant 7 structural steel. The first week and a half of operations progressed slower than scheduled due to modifications and

adjustments needed in the processing equipment. During the removal of the lead-based paint from the steel, higher than estimated lead particulate levels were experienced. The generation of lead airborne particles above the permissible exposure limit (PEL) for an 8 hour time weighted average (TWA) resulted in the implementation of more stringent administrative, engineering and worker health and safety controls.

Once these controls were implemented, airborne lead levels dropped well below the action levels and consequently, the lead program controls were lifted. Engineering modifications to the descaler unit were required to prevent bent and oddly shaped metal from lodging in the descaler unit processing area. Metal successfully processed through the paint removal phase was subsequently torch cut to remove inaccessible areas and then successfully released for unrestricted reuse. Only about 1% by weight of metal processed through the descaler was rejected from free release. The majority of rejected pieces were deck/plating material.

Most of the material received did not conform to the original material specifications set forth in FERMCO's request for proposal (RFP). This out-of-specification material caused significant problems in processing due to the high percentage of inaccessible surfaces and the generally poor condition of the metal. As shown in Photo 2, Appendix 1, a large proportion of the metal was bent, smashed and twisted. Processing methods for achieving maximum recycling were developed. Thermal cutting methods were used in place of mechanical cutting to improve both effectiveness and efficiency. Torch cutting proved to be most effective and efficient. However, torch cutting did result in elevated lead exposure levels (above the PEL) in the work area. Consequently, ALARON's lead compliance program was put into effect. However, extensive torch cutting was required to maximize recycling.

Small pieces cut from larger sections were staged for processing in ALARON's Spinblast unit. Metals staged for this unit were later successfully decontaminated through the descaler with a minor engineering modification. This effort reduced the amount of blast media and handling time that would have been required if the Spinblast unit had been utilized.

Metal staged for chemical decontamination (deck plate) was also decontaminated using the descaler. This contributed to further waste reduction by eliminating chemical decontamination secondary waste. The amount of metal that would have been chemically decontaminated was 21,570 lbs. or about 1/4th of the expected load for the process. All decontamination processing efforts concluded on October 26, 1995.

Lessons learned: *The most important lesson learned is that if recycling of metal is a goal during building demolition, then implosion is not the most desirable method for bringing a building to the ground. It may appear on the surface to be the most cost effective and safest, but a comparative cost and safety analysis of various methods*

should be performed on each structure so an educated determination of the most suitable method for building take-down can be made.

Processing off-specification material required engineering and administrative changes to adapt the process to the condition of the metal received. A better approach would have been to incorporate decontamination process requirements into the initial building demolition and dismantlement plans and procedures. Severely bending, twisting and smashing the steel caused the most difficulty in achieving a higher rate of recycle. However, it was shown that even in the worst condition, it is still possible to recycle the steel but additional time and funding would be required. A totally integrated plan and procedure based on final waste disposition and recycling requirements is required to improve the economics of future building dismantlement projects of this type.

12.0 RADIOLOGICAL CONDITIONS

Radioactive contamination levels on the material as received were minimal. A cursory survey of the materials in each container was performed upon receipt; the tarp (or lid) was removed to permit a spot check of fixed and removable levels of the top-most items. Loose (removable) contamination levels were consistently less than 100 dpm/100 cm^2 alpha which is below the ALARON release limit for removable contamination. One roll-off was found to contain material with up to 1,000 dpm/100 cm^2 of removable alpha contamination; all others were < 100 dpm/100 cm^2 alpha. Fixed contamination levels of up to 30,000 dpm/100 cm^2 alpha were identified. Contamination control was easily maintained by capturing the paint chips removed from the steel during processing.

A total of 886 containment air quality and breathing zone air samples were collected during the May through November project. General air quality samples were collected using a continuous air monitor and/or fixed station sampler. Lapel air samplers worn by operations personnel were utilized to assess breathing zone air concentrations. All samples were counted for alpha and beta activity, using a bench-top scaler. Results and summary statistics (gross alpha) are tabulated below in Table 12.1.

Table 12.1

Sample Category	No. Of samples	Total sampling hours	TWA alpha air conc, mCi/mL	Mean alpha air conc, mCi/mL (& std. dev)	Max. alpha air conc, mCi/mL	DAC Fraction* TWA	DAC Fraction* Max.
Breathing Zone samples> LLD	97	549	3.3E-12	2.7E-12 (1s=4.4E-12)	2.4E-11	1%	8%

All Breathing Zone samples collected	392	2293	3.73E-12	3.8E-12 ((1s=3.3E-12)	2.8E-11	1%	9%
General Area samples> LLD	219	1951	3.0E-13	4.5E-13 (1s=7.3E-13)	8.5E-12	0.1%	3%
All General Area samples collected	494	4369	1.97E-13	3.4E-13 (1s=5.7E-13)	8.5E-12	< 0.1%	3%

*class *w* Uranium DAC = 3E-10 mCi/mL

Airborne contamination producing operations such as abrasive blasting and torchcutting were performed in a downdraft crossflow HEPA ventilated containment to control the airborne exposure to workers.

Decontaminated metal was subjected to a radiological survey of 100% of the surface area of each item. Metal that qualified for free-release was shipped to a scrapyard for unrestricted reuse (see Photo 3 in Appendix 1).

FERMCO personnel performed an overcheck of the ALARON free-release program by reviewing the release documents and performing random surveys of the released scrap metal. Their overcheck revealed no discrepancies with the ALARON free-release program.

13.0 SAMPLING AND ANALYSIS

Within the first month of processing, ALARON performed some informational sampling and analysis to determine if the secondary waste produced was hazardous. The informational samples showed that secondary waste was non-hazardous. A FERMCO sampling team performed sampling and analysis on July 11, 1995 in accordance with FERMCO procedures. The sample data results confirmed that the secondary waste produced in the decontamination process was RCRA non-hazardous.

14.0 MATERIAL BALANCE AND INVENTORY CONTROL

Material balance was maintained through a continuous inventory tracking and accountability control system designed by ALARON. The material balance for the project exhibited a deviation of less than 1% from the actual amount received and processed through final disposition.

Bulk weights were verified using a calibrated platform scale with an accuracy +/- 1% and rounded to the nearest 10 pound increment.

Accountability and control measures were maintained throughout the project to prevent commingling of FERMCO material with other generator's material. Processing and storage areas were designated to contain FERMCO project materials only.

Table 14.1 provides summary of the disposition of each container received. In addition to Table 14.1, Chart 14.2 shows processing progress in graphical form.

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Table 14.1

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Container Processing Summary

				Material Disposition		
Container #	ALARON SHIP#	Weight Received lbs.	% Recycled	Metal Released lbs.	Metal Returned lbs.	Slag from Torch cutting
49665	95-89	18,720	55%	10,300	8,140	140
49666	95-95	19,770	55%	10,900	8,600	150
49667	95-36	20,680	64%	13,200	7,190	180
49668	95-107	21,260	51%	10,840	10,070	160
49669	95-98	18,750	19%	3,640	14,870	130
49670	95-33	16,900	37%	6,210	10,490	120
49671	95-103	16,480	54%	8,835	7,325	150
49672	95-104	17,580	76%	13,390	3,910	170
49673	95-40	19,770	85%	16,870	2,660	100
49674	95-79	17,360	45%	7,771	9,360	99
49675	95-108	20,810	66%	13,720	6,865	140
49676	95-64	20,080	57%	11,400	8,440	150
49677	95-73	24,130	88%	21,210	2,709	130
49678	95-43	18,930	45%	8,430	10,280	100
49679	95-105	32,610	95%	30,850	1,510	150
49680	95-28	17,650	49%	8,620	8,820	105
49681	95-110	16,720	51%	8,510	7,940	140
49682	95-109	21,860	40%	8,785	12,755	210
49683	95-94	21,470	54%	11,625	9,610	125
49684	95-57	21,640	41%	8,900	12,480	150
49685	95-62	21,280	47%	10,000	11,050	140
49686	95-56	20,710	56%	11,690	8,810	80
49687	95-106	18,570	51%	9,520	8,820	120
49688	95-100	18,910	56%	10,620	8,050	100
49689	95-58	21,700	58%	12,580	8,910	90
49690	95-30	17,780	54%	9,525	8,015	120
49691	95-99	19,550	58%	11,360	7,950	125
49692	95-44	24,800	54%	13,380	11,220	100
49693	95-61	19,350	70%	13,470	5,640	110
49694	95-39	22,700	52%	11,710	10,750	110
49695	95-66	17,030	25%	4,320	12,480	140
49696	95-63	19,630	55%	10,810	8,550	150
49697	95-101	19,450	58%	11,240	8,000	100
49698	95-42	21,650	23%	4,990	16,420	140
49699	95-80	21,610	65%	14,070	7,280	140
49700	95-87	20,290	67%	13,680	6,360	150
49701	95-72	17,880	41%	7,420	10,190	150
49702	95-32	18,140	62%	11,305	6,545	150
49703	95-96	25,940	72%	18,700	6,930	180
49704	95-88	23,080	54%	12,560	10,240	150
49705	95-49	20,400	50%	10,165	10,035	100
49706	95-27	16,770	36%	6,065	10,490	100
49707	95-71	21,620	38%	8,130	13,248	120
49708	95-35	19,920	52%	10,283	9,417	100

Table 14.1

49709	95-86	23,950	63%	15,125	8,525	160
49710	95-81	22,090	57%	12,560	9,250	160
49711	95-85	17,430	53%	9,200	7,990	100
49712	95-91	21,170	61%	12,920	8,000	125
49713	95-97	19,490	83%	16,230	2,910	200
49714	95-92	22,040	74%	16,200	5,635	140
50338	95-29	29,430	99%	29,025	160	100
50349	95-41	19,080	71%	13,530	5,300	140
50350	95-16	16,380	74%	12,050	4,130	90
50351	95-22	17,970	79%	14,178	3,557	150
50352	95-18	16,130	77%	12,370	3,570	80
50354	95-19	15,170	57%	8,640	6,304	145
50355	95-20	15,050	97%	14,590	210	150
50356	95-25	11,300	62%	7,020	4,070	140
50357	95-21	11,330	92%	10,400	730	135
50358	95-26	15,560	69%	10,740	4,590	80
50368	95-15	18,780	88%	16,527	2,013	100
50369	95-23	11,610	82%	9,550	1,840	100
361501	95-67	18,460	56%	10,250	7,900	155
361502	95-111	20,390	51%	10,500	9,550	230
361504	95-75	18,210	70%	12,660	5,310	130
361528	95-68	21,550	64%	13,850	7,330	250
361540	95-93	18,160	41%	7,520	10,410	135
361633	95-54	18,670	56%	10,440	7,870	240
361651	95-78	16,760	57%	9,630	6,850	150
361655	95-55	18,260	40%	7,260	10,700	150
361656	95-77	16,430	57%	9,370	6,770	155
361657	95-48	16,390	63%	10,378	5,632	240
361663	95-45	17,470	57%	10,010	7,220	110
361667	95-70	16,070	53%	8,500	7,300	140
361668	95-51	19,580	56%	10,940	8,340	145
361669	95-46	16,090	58%	9,320	6,510	140
361683	95-50	20,510	52%	10,692	9,448	240
361695	95-76	16,140	45%	7,290	8,570	160
361697	95-69	17,530	48%	8,460	8,810	120
In process totals:		1,522,560	59%	899,524	602,728	10,949

Actual verified weights	1,522,560	58%	889,270	602,660	10,949
	(1)	(2)	(3)	(4)	(5)

(1) Metal weight received
(2) % Recycled from metal received
(3) Metal released for unrestricted use (weight of metal sent to scrapyard)
(4) Metal returned to FERMCO as non-recyclable
(5) Slag generated from torch cutting operations

Secondary Waste generated	Grit Blast	28,738 lbs.
	Torit dust	44,570 lbs.
	Total:	73,308

Of the secondary waste generated, 61,100 lbs. were from blast media used in processing. Therefore, waste from paint removed from the metal was 12,208 lbs.

FERMCO Recycling Project 5/22/95 through 10/20/95

First Time Through Process (Phase 2)

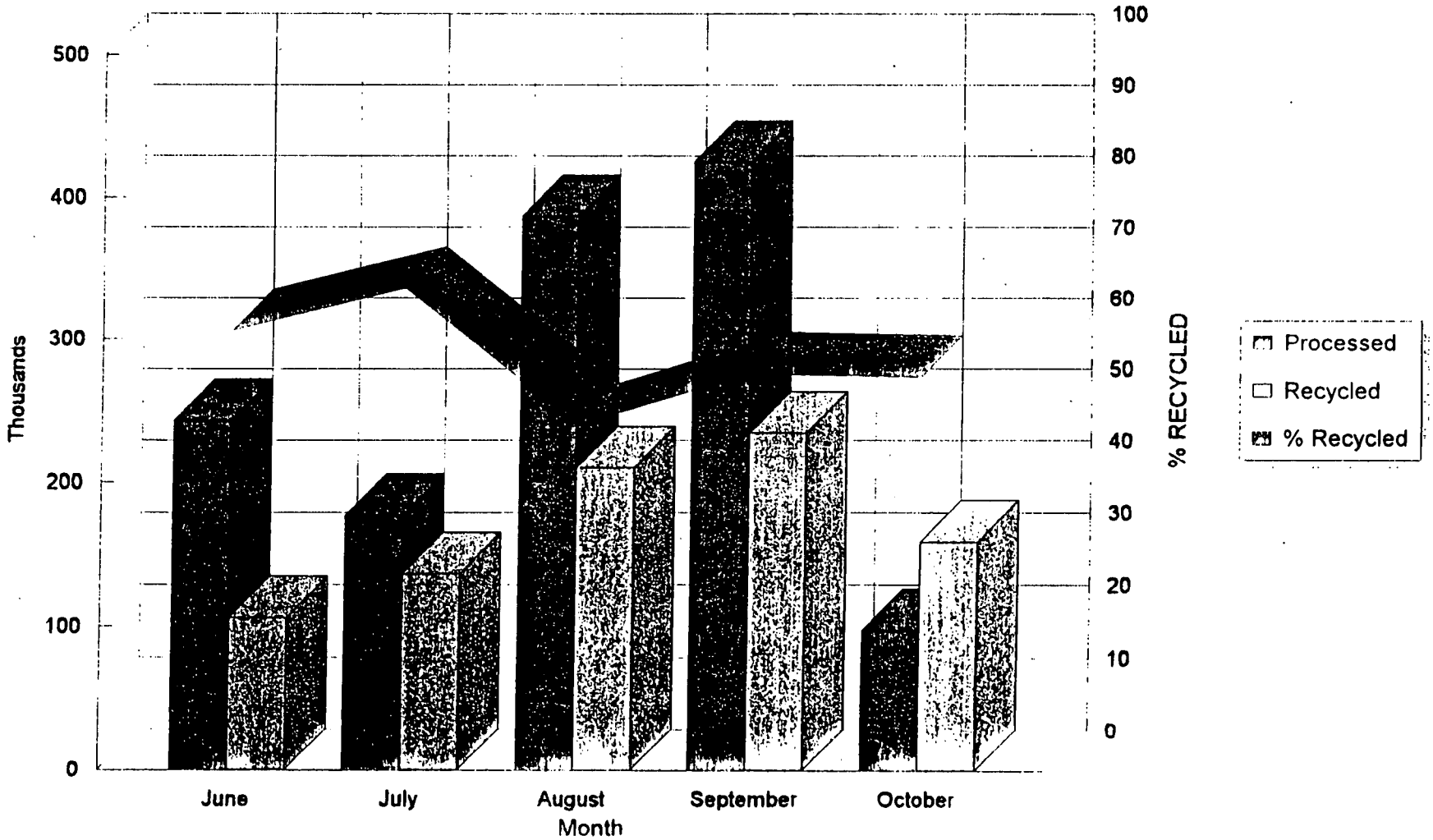

Chart 14.2

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15.0 MASS BALANCE

Tracking and control of material received at ALARON was achieved by identifying and weighing material throughout the various stages of processing. The sum of the weights in process was compared to the confirmed weight of the material as it was received at ALARON. A variance in weight of < 1% was maintained throughout the project.

The tracking system involved identifying each shipment of material received by a unique shipment number as well as tagging the container with a "FERMCO" label. FERMCO material was only permitted to be stored or processed in designated areas that were prohibited from containing other generator's materials. The decontamination train used for this project was dedicated specifically to FERMCO project material. The steps taken to assure total segregation of the project material were documented in procedures and personnel involved with the project were trained to those procedures.

The original anticipated mass balance summary is shown in Table 15.1.

Table 15.1

ORIGINAL
MASS BALANCE SUMMARY

ITEM	INPUT	RECYCLED	OUT AS SECONDARY WASTE
Steel	1,420,000 lbs.	1,384,500 lbs.	35,500 lbs.
Paint	12,600 lbs.	0	12,600 lbs.
Pallets	16,000 lbs.	0	15,000 lbs.
Super Absorbent Sheets	340 lbs.*	0	340 lbs.
Abrasive Media	30,770 lbs.	0	30,770 lbs.
Chemical Decon Process Chemicals and Water	4,500 lbs.	2,750 lbs.	1,750 lbs.

Solidification Media	68,930 lbs.	0	68,930 lbs.
Total	1,553,140 lbs.	1,387,250 lbs.	165,890 lbs.

* Burial volume associated with final waste form (s) is 1,890 ft^3. Of this total, only 956 ft^3 results from segmentation and decontamination of the steel. The remaining 934 ft^3 is associated with pallet and super absorbent sheet disposal.

The actual mass balance results from processing are shown in Table 15.2.

Table 15.2

ACTUAL MASS BALANCE RESULTS			
ITEM	INPUT	RECYCLED	OUT AS SECONDARY WASTE
Steel	1,510,352 lbs.	889,270 lbs.	10,200 lbs.*
Paint	12,208 lbs.	0	12,208 lbs.
Pallets	N/A	N/A	N/A
Super absorbent Sheet	N/A	N/A	N/A
Abrasive Media	61,100 lbs.	0	61,100 lbs.
Chemical Decon	N/A	N/A	N/A
Solidification Media	N/A	N/A	N/A
Total	1,583,660 lbs.	889,270 lbs.	83,508 lbs.

* Secondary waste consisted of paper, plastic, and other trash generated during decontamination processes. For a complete disposition summary see the Material Disposition Sheet in the "Reports" section.

N/A= Not Applicable; work not performed in these categories

16.0 TREATABILITY RESULTS

Table 16.1 shows the results based on the treatability requirements specific to this project.

Table 16.1
Treatability Study Guideline Results

Section No.	Description	Weight in lbs.*
1.1	Total weight received at ALARON	1,522,560
1.2	Weight of non-recyclable on first sort	564,975
1.3	Weight (first sort) to Continuous Feed Descaler	910,840
1.4	Weight (first sort) to Batch Feed Rotating Wheelabrator (Spinblast unit-SB)	N/A
2.1	Weight (from 1.3) to Continuous Feed Descaler =(1.3 weight -slag from size reduction)	899,891
2.2	Weight Free-released - First CFD pass =(Total released-Chem decon)	870,570
2.3	Weight reworked through CFD =(Chem-decon material)	21,570
2.3.1	Weight Free-released after rework CFD	18,700
2.4	Weight to Spinblast	N/A
2.5	Weight to Chemical Decon Unit	N/A
2.6	Weight determined to be non-recyclable	602,660
Section 3.0	Batch Feed Rotating Wheelabrator - Not used	N/A
Section 4.0	Chemical Decon Unit - Not used	N/A
5.1	Total weight of non-recyclable steel (same as 2.6)	602,660
6.1	Total weight of mixed waste - None Generated	N/A
6.2	Total Volume of mixed waste - None Generated	N/A
6.3	Actual weight of abrasive media used in process	61,100
6.4	Volume of abrasive media used in process	226.3ft^3
Section 7.0	Chemical Decon Unit not used - No CD Waste	N/A

*Unless otherwise noted

17.0 CONTRACT MODIFICATIONS

Three modifications were made to the original contract. The first two modifications covered the milestone payment schedule. The third modification to the contract covered the additional weight that was sent to ALARON (61 tons more that the original 700 tons). This modification also included additional shipments required as well as other changes in the original scope of work.

18.0 CONCLUSION

The feasibility/treatability team had established a goal for the free release of greater than 90% of the contaminated structural steel. During the initial processing of the material, numerous pieces were identified as being off-specification. The steel was so badly damaged that the feasibility for treating this type of material was questionable. A decision had to be made to continue with the project or to end the project at that point without further treatment and return the material to the FEMP.

A team meeting was held with FERMCO and ALARON members present on August 30, 1995 to discuss the appropriate path forward. Options discussed at the team meeting were (1) to keep processing to achieve an estimated 45% recycle rate and FERMCO to size reduce, store or bury the 55% of waste remaining, (2) To keep processing at additional cost and time to recycle 80% of the material and FERMCO would size reduce, store or bury 20% as waste, (3) Stop work, ALARON to shear metal, FERMCO to store or bury 70% as waste and (4) stop work, FERMCO to Repackage and ship remaining material to NTS for burial. The team concluded that option (1) would be the most feasible for the disposition of the remaining metal. This option resulted in a recycle rate of 58% rather than 45% as was originally estimated.

Of the 1,522,560 lbs. of material received, 602,660 lbs. or 40% was off-specification as defined in the original scope of work. While this material could also have been recycled with additional processing, it would have augmented costs which the customer considered a non-viable option. However, of the 60 % that ALARON was able to accept as within scope, 98% or 889,270 lbs. were released for unrestricted reuse. The remaining 2% consisted of inaccessible areas and slag from the reconditioning (torch cutting) process. **Overall, a release rate of 58% was achieved by ALARON's efforts to maximize recycling by reconditioning and recycling the greatest amount of material that was feasible.**

In light of the impending "National Scrap Metal Recycling Policy" (NSMRP) scheduled to be delivered to DOE's Headquarters and field offices by late December 95 or early 96, it appears that a consistent directive for implementing a recycling program at each

site is inevitable. This policy, in addition to the "Lessons Learned" from the Plant 7 project could serve as building blocks for a successful recycling program at the Fernald Site..

A very critical component to maximizing the amount of metal recycled is the condition of the metal received at the processing facility. This metal condition is determined primarily by two of the steps in building dismantlement; 1) the method in which a building structure is brought down, and 2) the methods employed during size reduction for packaging. To effectively employ a recycling strategy that maximizes the unrestricted release of metal, a strategy must be developed and included from the outset in the planning for building demolition.

Lessons learned: *A "Size Reduction, Segregation and Packaging Criteria" should also be developed and included as part of the RFP (or IFB) package for building dismantlement. This will create a template in which FERMCO may assess each bidder proposal on how they will meet this stated requirement. By having a Size Reduction, Segregation and Packaging Criteria in place you would effectively ensure that: metal is properly prepared for shipment to a recycler, only recyclable metal is packaged for shipment, and each container is filled to the maximum weight possible. Not having a Size Reduction, Segregation and Packaging Criteria in place provides only the results achieved with the Plant 7 metal. These results include: out of specification metal being packaged, non-metal items being packaged with metal, and an increased number of shipments required for all metal to be shipped to the recycler due to extremely low package volumes. Maximizing package density significantly reduces shipping costs since the same amount of metal is being packaged more densely and shipped using fewer shipments.*

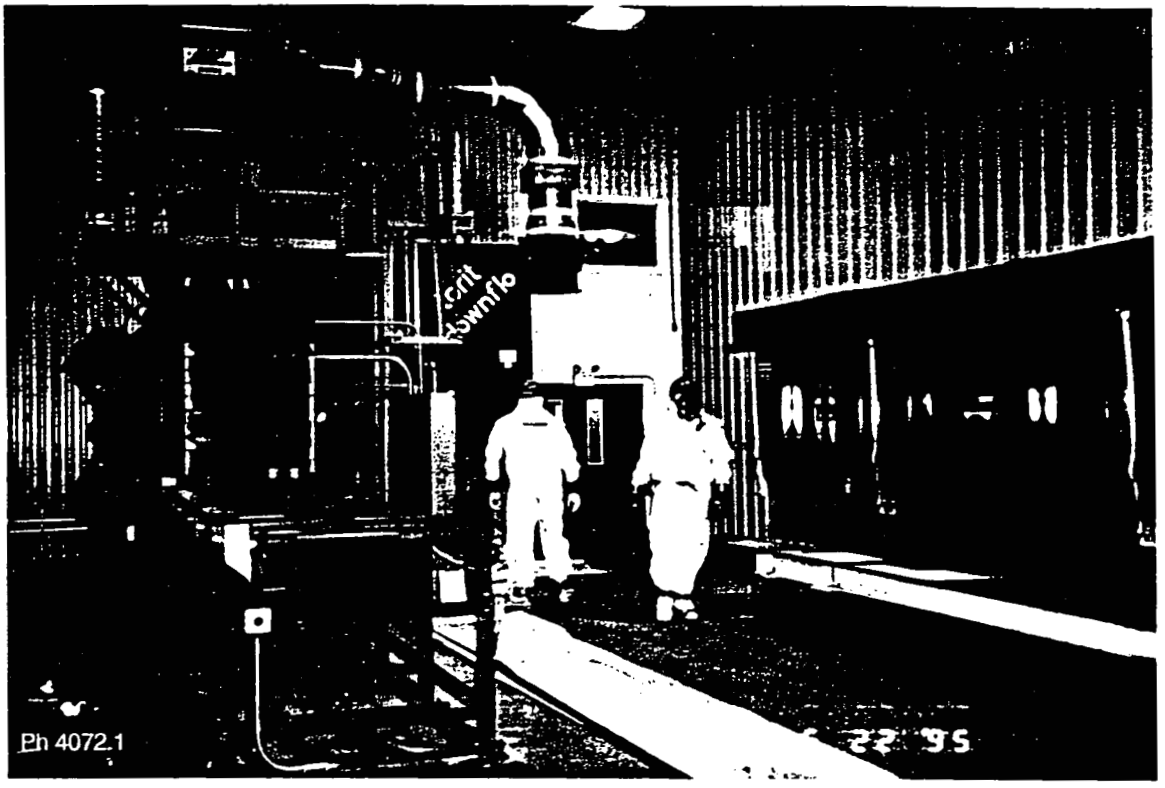
Effectively "filtering out" out-of-spec metal and material up front reduces costs at the recycler by elimination of "double handling" of this material as well as reducing the number of return shipments of secondary wastes back to the Fernald site, at which time this material would be triple handled by site personnel in preparing it for final disposal. These cost factors could become very significant when adding up all additional costs incurred at FERMCO as well as at the recycler by not having this criteria built into the RFP (or IFB).

Implementation of the DOE NSMRP will be a giant step in the positive direction to formalizing a recycling guideline for all DOE sites to follow in implementing their individual recycling programs. Problems encountered such as the ones described in this final report could be greatly reduced or completely eliminated by this policy, and coupled with the changes recommended above, by incorporating recycling incentives into each RFP (or IFB), or even by requesting that each bidder include a recycling contractor as part of its team.

Future projects for recycling this type of material should require the involvement of the recycler during the early stages of planning and determining material condition for optimum recycling. At a minimum the recycler should be involved in the packaging of the material in an effort to avoid shipment of off-specification material which would later need to be shipped back to the demolition site. The recycler could also evaluate the additional cost of processing severely damaged pieces in an effort to avoid double handling of the material. The result would be a considerable cost avoidance for transportation to return the pieces back to the demolition site. This will greatly improve the efficiency and effectiveness of recycling contaminated material for ***unrestricted reuse****.*

APPENDIX 1

(PHOTOS)



ALARON's Continuous Feed Descaler (CFD)

An example of the off-specification metal

Graphics 4072.1 6/96

Plant 7 scrap metal released for unrestricted use from the ALARON decontamination/recycling process

Graphics 4072.2 6/96

ATTACHMENT II
PLANT 7 STEEL RECYCLING
COST ANALYSIS

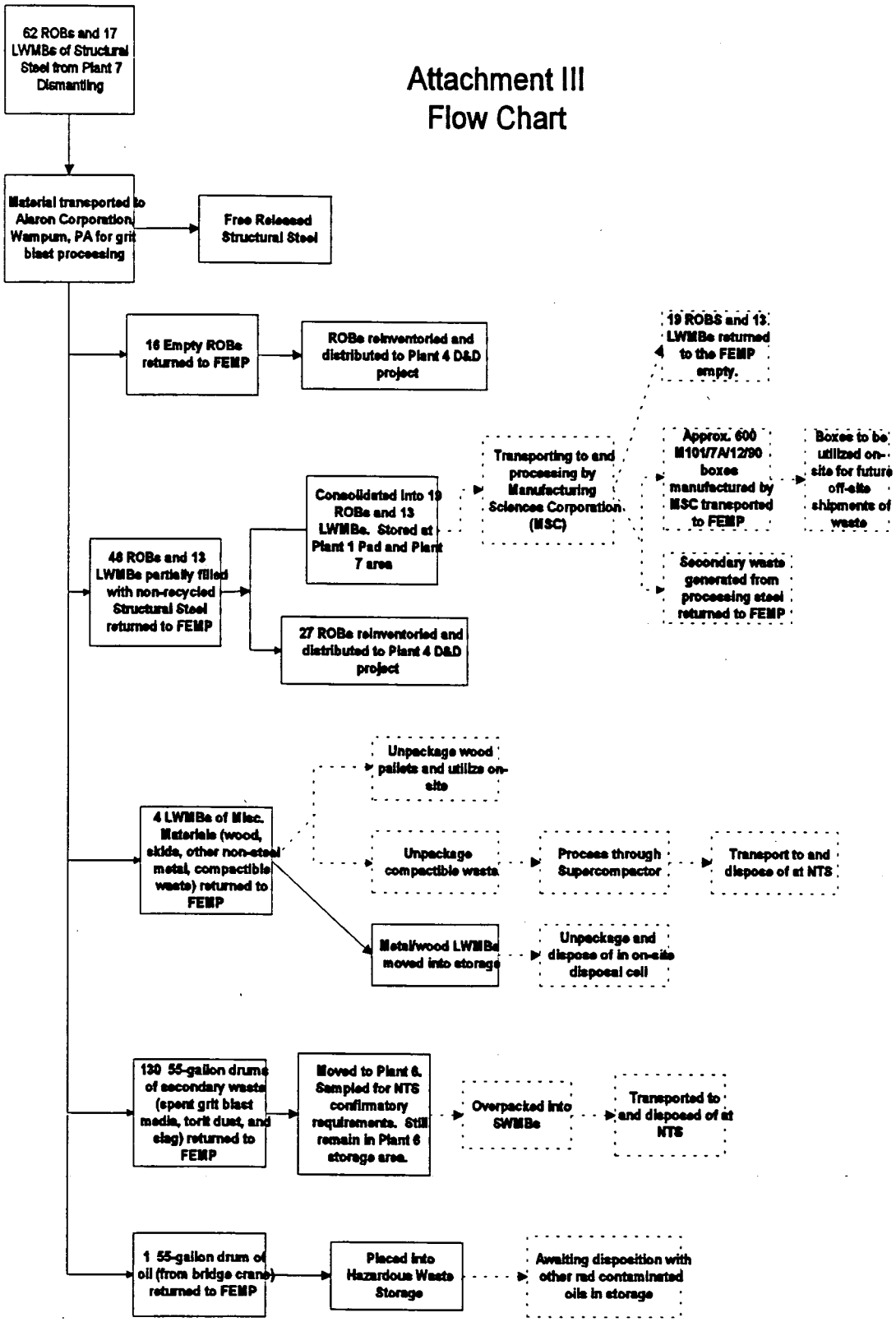
JAN. 95-SEP 96	COST	COST/1,522,000 LBS	COST/490LBS/CF
FERMCO COST	$887,599	$0.58	$285.75
ALARON	1,558,676	1.02	501.81
TOTAL COST	$2,446,275	$1.60	$787.56

NOTE: 761 tons or 1,522,000 lbs

The FERMCO scope of work involved the packaging of the structural steel and oversight of the following: transportation; receipt; interim storage; decontamination; processing; characterization; radiological monitoring; and recycling of the steel. The scope also included repackaging and shipment for final disposition.

The ALARON scope of work included the transportation, receipt, necessary interim storage, decontamination, processing, radiological monitoring, and recycling of the radioactively contaminated structural steel. Additionally, the ALARON scope included the processing, packaging, transport, and return of the waste and waste containers to the FEMP.

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 lead and the steel. All cost have been prorated at 97% of the total project cost. The 97% used to prorate the cost is a ratio between the time/cost to decontaminate the steel and the combined time/cost to decontaminate the lead and steel as charged to the Plant 7 dismantling engineering and waste control accounts.

Attachment III
Flow Chart