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REMOVAL ACTION NUMBER 9 NEUTRALIZATION, PRECIPITATION, DEACTIVATION, AND STABILIZATION TECHNOLOGY SPECIFIC WORK PLAN

06/28/96

DOE-1058-96
DOE-FN EPAS
350
WORK PLAN

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Department of Energy

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Fernald Area Office
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JUN 28 1996

DOE-1058-96

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Dear Mr. Saric and Mr. Pardi:

REMOVAL ACTION NUMBER 9 NEUTRALIZATION, PRECIPITATION, DEACTIVATION, AND STABILIZATION TECHNOLOGY SPECIFIC WORK PLAN

This letter is to transmit, for approval, the Fernald Environmental Management Project (FEMP) Mixed Waste Chemical Treatment Project Neutralization, Precipitation, Deactivation, and Stabilization (NPDS) Technology Specific Work Plan. The NPDS Project will be implemented under the scope of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Removal Action Number 9 - Removal of Waste Inventories, the Director's Final Findings and Orders (DF&O), dated October 4, 1995, and the General CERCLA Work Plan for the Chemical Treatment Project.

The DF&O approved the FEMP Site Treatment Plan (STP) as developed to comply with the Federal Facility Compliance Act (FFCA). Under the approved STP, the Department of Energy, Fernald Area Office (DOE-FN) committed to submitting technology specific work plans to the U.S. Environmental Protection Agency (U.S. EPA) and Ohio Environmental Protection Agency (OEPA) for Mixed Waste Chemical Treatment. The General CERCLA Work Plan for the Mixed Waste Chemical Treatment Project requires the DOE-FN to submit technology specific work plans for each specific treatment process to be conducted under the scope of the Chemical Treatment Project. This Technology Specific Work Plan is submitted to comply with commitments in the General CERCLA Work Plan for the Mixed Waste Chemical Treatment Project and the DF&O.

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Recycled and Recyclable

This Technology Specific Work Plan describes the treatment processes that will be used to treat four categories of mixed waste currently stored at the FEMP site. Treatment will consist of neutralization, precipitation, deactivation, and stabilization technologies. Three of the waste categories (barium chloride, reactives, and oxidizers) will be treated for land disposal at the Nevada Test Site (NTS). The fourth waste category, corrosives, will be neutralized to eliminate their corrosive characteristic, and held for subsequent management under the Liquid Mixed Waste Project. A contract was awarded to Perma-Fix Environmental Services, Incorporated on April 26, 1996, for treatment of these mixed waste streams.

If you have any questions or want to discuss any aspect of this project, please contact Robert Danner at (513) 648-3167.

Sincerely,

Glen Griffith

for Jack R. Craig
Project Manager

FN:Danner

Enclosure: As Stated

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FEMP MIXED WASTE CHEMICAL TREATMENT PROJECT

Neutralization/Precipitation/Deactivation/Stabilization

TECHNOLOGY SPECIFIC WORK PLAN

DOCUMENT #8ADD9-2200-005

Rev. 0

June 1996

Prepared by
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Contract DE-AC24-92OR21972

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FEMP MIXED WASTE CHEMICAL TREATMENT PROJECT

Neutralization/Precipitation/Deactivation/Stabilization

TECHNOLOGY SPECIFIC WORK PLAN

Tim Kimball, Vice President Perma-Fix Environmental Services, Inc.	Date
Melissa Thomas, Project Manager FERMCO	Date
Dan Dilday, Manager Mixed Waste Handling & Disposal FERMCO	Date

FEMP MIXED WASTE CHEMICAL TREATMENT PROJECT
Neutralization/Precipitation/Deactivation/Stabilization

OEPA RCRA PART B PERMIT
SUBSTANTIVE COMPLIANCE DEMONSTRATION

APPLICABLE Y/N	ITEM	CROSS REFERENCE INDEX
Y	Hazardous Waste Determinations (OAC 3745-52-11) (40 CFR 262.11)	Section 2.0
Y	Interim Status: Treatment, Storage, and Disposal General Facility Standards (OAC 3745-65-13 through 16) (40 CFR 265.13 through 265.16)	Sections 2.0, 3.2, 3.3, 3.6, 3.7.1, 3.7.2
Y	Interim Status: Treatment, Storage, and Disposal Facility Preparedness and Prevention (OAC 3745-65-31 through 35, 3745-65-37) (40 CFR 265.31 through 265.35, 265.37)	Sections 3.6.1 through 3.6.5, 4.0
Y	Interim Status: Treatment, Storage and Disposal Facility Contingency Plan and Emergency Procedures (OAC 3745-65-51 through 56) (40 CFR 265.51 through 265.56)	Sections 3.6.1 through 3.6.5, 4.0
Y	Container Storage (OAC 3745-52-34, 3745-66-70 through 77) (40 CFR 262.34, 265.170 through 265.177)	Section 3.6.3
Y	Residue of Hazardous Waste in Empty Containers (OAC 3745-66-11, 3745-66-14) (40 CFR 265.111, 265.114)	Sections 3.5 and 3.6.3
Y	Reusable Equipment Decontamination (OEPA Closure Plan Review Guidance for RCRA Facilities)	Section 3.9
Y	Land Disposal Restrictions (OAC 3745-59) (40 CFR 268)	Section 4.1

NOTE: Compliance with the applicable, or relevant, and appropriate requirements (ARARs) is discussed in Section 4.0 and in Table 4-1 of the attached Technology Specific Work Plan (TSWP).

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FEMP MIXED WASTE TREATMENT PROJECT
Neutralization/Precipitation/Deactivation/Stabilization

TECHNOLOGY SPECIFIC WORK PLAN

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Appendix B - Quality Assurance Program Plan
Appendix C - Material Evaluation Form
Appendix D - Sampling and Analysis Plan

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LIST OF ACRONYMS

ACA	Amended Consent Agreement
ALARA	As Low As Reasonably Achievable
AEDO	Assistant Emergency Duty Officer
ARAR	Applicable or Relevant and Appropriate Requirements
ASL	Analytical Support Levels
AWWT	Advanced Waste Water Treatment
BAT	Best Available Technology
BDAT	Best Demonstrated Available Technology
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CWG	Compatible Waste Groupings
DOE	Department of Energy
DOE-FN	U. S. Department of Energy, Fernald Field Office
DOT	Department of Transportation
DQO	Data Quality Objectives
EPA	Environmental Protection Agency
EPCRA	*Emergency Planning and Community Right-to-Know Act*
FFCAct	*Federal Facility Compliance Act*
FEMP	Fernald Environmental Management Project
FFCA	*Federal Facility Compliance Agreement*
HEPA	High Efficiency Particulate Air
IDLH	Immediately Dangerous to Life or Health
LDR	Land Disposal Restrictions
LLRW	Low Level Radioactive Waste
MEF	Material Evaluation Form
MSDS	Material Safety Data Sheet
NEMA	National Electrical Manufacturer's Association
NEPA	*National Environmental Policy Act*
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NFS	Nuclear Fuel Services
NPDES	National Pollutant Discharge Elimination System
NPDS	Neutralization, Precipitation, Deactivation, and Stabilization
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSHA	Occupational Safety and Health Administration
PDC	Performance Development Corporation
PESI	Perma-Fix Environmental Services, Inc.
PWBS	Project Work Breakdown Structure

LIST OF ACRONYMS
(Continued)

RA	Removal Action
RAWP	Removal Action Work Plans
RCRA	*Resource Conservation and Recovery Act*
RWP	Radiation Work Permit
SARA	*Superfund Amendments and Reauthorization Act*
SCQ	Site-Wide CERCLA Quality Assurance Project Plan
SPCC	Spill Prevention Control and Countermeasures Plan
STP	Site Treatment Plan
TBP/K	Tributyl phosphate/kerosene
TC	Toxicity Characteristic
TCLP	Toxicity Characteristic Leaching Procedure
TLD	Thermo Luminescent Dosimeter
TSDF	Treatment, Storage, and Disposal Facility
TSWP	Technology Specific Work Plan
UHC	Underlying Hazardous Constituents
USEPA	United States Environmental Protection Agency
UTS	Universal Treatment Standard
WAC	Waste Acceptance Criteria
WMB	White Metal Box

FEMP MIXED WASTE CHEMICAL TREATMENT PROJECT
Neutralization/Precipitation/Deactivation/Stabilization

1.0 INTRODUCTION

This technology specific work plan describes the objectives and scope of work for the Mixed Waste Chemical Treatment - Neutralization/Precipitation/Deactivation/Stabilization Project to be conducted at the U. S. Department of Energy's Fernald Site. The Fernald Site, also known as the Fernald Environmental Management Project (FEMP) is a government owned, former uranium processing facility located near Cincinnati, Ohio. The site was placed on the National Priorities List in 1989 and is currently undergoing remediation under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) in accordance with the 1991 *Amended Consent Agreement* (ACA) between the DOE and the U. S. Environmental Protection Agency (EPA). Removal Action (RA) No. 9, "Removal of Waste Inventories" was identified in the ACA, to address the removal of low level radioactive waste (LLRW) inventories. Treatment of the mixed waste materials is also being initiated under RA No. 9.

RA No. 9 requires the Department of Energy, Fernald Field Office (DOE-FN) to submit an annual compendium of existing procedures and documentation for the site's LLRW Management Program, in lieu of Removal Action Work Plans (RAWP). Additionally, DOE-FN committed to submitting technology specific work plans for certain projects, including the Neutralization/Precipitation/Deactivation/Stabilization Project in Addendum No. 1 to the RA No. 9 - Removal of Waste Inventories Work Plan.

The General CERCLA Work Plan for the Mixed Waste Chemical Treatment Project, approved January 1996, is intended to satisfy ACA and RA No. 9 driven requirements by incorporating documentation and management of the project under RA No. 9. The General CERCLA Work Plan describes multiple treatment processes which will be used to treat listed and characteristic mixed LLRW currently being stored at the FEMP. The General CERCLA Work Plan requires DOE-FN to prepare Technology Specific Work Plans for each specific treatment process. Development of Technology Specific Work Plans is also driven by commitments made by the FEMP in the Site Treatment Plan (STP). Submittal of this technology specific plan is intended to satisfy the STP driven requirements by incorporating documentation and management of the project under RA No. 9.

The Chemical Treatment Project is the implementation of the Ohio Mobile Chemical Treatment System preferred option presented in the FEMP STP. The U.S. Department of Energy (DOE) was required to prepare Site Treatment Plans describing the development of treatment capacities and technologies for treating mixed waste under Section 3021(b) of the *Resource Conservation and Recovery Act* (RCRA), as amended by the *Federal Facility Compliance Act* (FFCAct). Mixed waste is defined by the FFCAct as waste containing both hazardous waste subject to RCRA and source, special nuclear, or by-product material subject to the *Atomic Energy Act of* 1954 (42 U.S.C. 2011). The STP was approved and a Director's Final Findings and Orders was issued October 1995.

The work to be performed under the NPDS Project involves treatment of characteristic mixed waste solids, sludges, and liquids that contain waste constituents specified in EPA waste codes D001 through D043. These mixed wastes have been generated from former production activities, and in the decontamination and decommissioning of uranium production facilities at the FEMP Site. The project will proceed under RA No. 9, and the FFCAct STP as negotiated between DOE, the U.S. EPA, and the Ohio EPA (OEPA). These regulatory drivers make it possible for the project to proceed on the FEMP site without a hazardous waste treatment, storage and disposal (TSD) permit. The project may also proceed under the radioactive waste processing authority granted to DOE by the *Atomic Energy Act*.

This Technology Specific Work Plan, including the Quality Assurance Plan and the Health and Safety Plan demonstrates that the proposed project will be accomplished in compliance with Applicable or Relevant and Appropriate Requirements (ARAR), mandated under Federal, state, and local regulatory requirements, DOE Orders, and site procedures.

1.1 OBJECTIVES

The objective of the Neutralization, Precipitation, Deactivation and Stabilization (NPDS) Project is to safely treat approximately 360 containers of four waste categories currently being stored at the Fernald Site. The containers range from 5-gallon buckets to 112-cubic foot White Metal Boxes (WMBs). Treatment will consist of NPDS technologies. These four waste categories to be treated are summarized in Table 1-1. Three of the waste categories (barium chloride residues, reactives, and oxidizers) will be treated for land disposal at the Nevada Test Site (NTS) in Beatty, Nevada, using NPDS to meet *Resource Conservation and Recovery Act* (RCRA), Land Disposal Restrictions (LDR) and NTS waste acceptance criteria (WAC) established under the *Nevada Test Site - Defense Waste Acceptance Criteria, Certification, and Transfer Requirements* (NVO-325, Rev. 1). Corrosive liquids will be neutralized to eliminate their corrosive characteristics and bulk shipped for treatment at the TSCA Incinerator through another mixed waste project. Phase I of the project involves project planning activities and approvals by the FEMP, DOE, US EPA, and OEPA. Phase II involves the performance of on-site mixed waste treatment using mobile treatment processes.

On-site waste treatment will be accomplished by personnel from Perma-Fix Environmental Services, Inc. (PESI) and Performance Development Corporation (PDC) working in conjunction with FEMP site personnel. Perma-Fix and PDC personnel will manage the on-site treatment process and will perform all of the mixed waste treatment operations conducted on site for this project.

Table 1-1
Summary of Waste Treatment Campaigns

Technology	Waste Category Description	# of Anticipated Containers
Neutralization	Corrosives	101
Precipitation/Stabilization	Barium Chloride Residues	174
Deactivation	Reactives	25
Deactivation/Stabilization	Oxidizers	58
TOTAL		358

1.2 ORGANIZATION OF THE WORK PLAN

This Technology Specific Work Plan is organized in the manner that is consistent with previously submitted and approved work plans. This work plan and its attached appendices provide a complete description of how and where the NPDS project will be performed. The plan identifies the parties responsible for storage, handling, treatment, and disposal of mixed wastes, and those parties having oversight responsibilities for quality assurance, environmental compliance, health and safety. Section 2.0 of the Work Plan provides a description of the mixed wastes to be treated and stabilized in terms of the Material Evaluation Form (MEF) characterization process. Section 3.0 provides a detailed description of the treatment process and all of its ancillary and support activities to be scheduled. This process description is presented in terms of the major work tasks and a Process Flow Diagram, Figure 3-2. Section 4.0 describes the applicable or relevant and appropriate requirements for this project. Section 5.0 and Appendix A, "Health and Safety Plan," describe the health and safety program to be implemented during this project. Section 6.0 describes the organization of the project team, and how the work and the project schedule will be managed. Appendix B is the Quality Assurance Program Plan, Appendix C is the MEF Listing, and Appendix D is the Sampling Plan for this project.

2.0 WASTE DESCRIPTION

Since October 1991, RCRA closure actions and CERCLA response actions have redirected the central mission of the FEMP towards the implementation of waste management and environmental restoration initiatives. One of these initiatives is to identify, characterize, treat, and dispose of all legacy waste stored at the FEMP in accordance with applicable federal, state and local requirements. Approximately 360 containers of legacy mixed waste have been identified to be treated under this project. The mixed waste is currently stored and managed in RCRA-permitted facilities at the FEMP.

The mixed wastes in this project are divided into four waste categories as summarized in Table 1-1 and further described in Table 2-1. These categories were established based on the chemical and physical characteristics and the treatment needs and requirements of the waste streams. The containers of mixed waste have been grouped and categorized using the MEF procedures discussed later in this section. The mixed waste is material contaminated with constituents with EPA waste codes D001 through D043. Multiple treatment technologies such as neutralization, precipitation, deactivation, and stabilization may be required to treat waste in each waste category.

The barium chloride residues category consists of solidified furnace salt, brick, floor sweepings, and miscellaneous trash containing EPA waste codes D005 and D008. These streams contain high concentrations of barium chloride and lead. The corrosive waste category consists of acidic and caustic solutions. Most of these liquids are radioactive lab wastes, metal extracts and digests. Some of the drums may contain organic sludges. The corrosive waste streams contain EPA waste codes D001 through D043. The reactive waste category contains magnesium metal, powder and turnings with EPA waste codes D001 and D003. There is also one drum of unfired reduction charges containing thorium fluoride, calcium, fluoride, calcium metal, and zinc fluoride. Since this drum contains thorium, it will be processed in a similar manner to wastes in the oxidizer category. The oxidizer waste category is mainly uranyl and thorium nitrate solids and liquids. There are two drums of decanted water from sump/filter cake and a drum of unused Draw Temp 275, an oxidizer which contains sodium nitrite, sodium nitrate, and potassium nitrate. The oxidizer waste stream contains EPA waste codes D001, D002, D005, D007, and D008. The oxidizer category also contains wastes which do not contain nitrates, but do contain thorium. These are included in this category based on similar treatment requirements and radioactive handling requirements.

Mixed waste to be treated as part of this project has been characterized using process knowledge and sampling and analysis results in accordance with site procedure EW-0001, "Initializing Waste Characterization Activities Using the Material Evaluation Form." A listing of the MEF categories to be treated is listed in Appendix C. The waste characterization methodologies specified by EW-0001 are consistent with U.S. EPA and OEPA hazardous waste regulations. Although the drums of mixed waste have been characterized under EW-0001, it is possible that some waste containers may contain waste materials that are prohibited from disposal under NTS WAC or other candidate disposal sites. During waste treatment

operations, prohibited materials will be physically removed from the waste, repackaged, and placed back in the FEMP RCRA inventory for evaluation and projectization into other waste treatment projects. Prohibited materials will not be stabilized or encapsulated in the final stabilized product that will be disposed of. Additional information on NTS prohibited items is included in Table 3-2 of Section 3.5.2.

The primary guidance for completing waste characterization is the three page MEF which is part of EW-0001. The first page of the MEF is the Generator's Section which summarizes information provided by the FEMP (internal) waste generator. It is similar to the waste profile sheets used by commercial TSD facilities allowing for documentation of information regarding: generator and waste stream identification; generation information; gross material characteristics; material composition; and health and safety precautions.

The second and third pages of the MEF are the Evaluation Section, which summarizes the results of the waste characterization with respect to the evaluation criteria. It summarizes pertinent information from the evaluation process including: material regulatory status; material management requirements; and health and safety precautions.

The MEF evaluation process relies on a combination of process knowledge and sampling and analysis to complete the waste characterization process. Process knowledge includes the sum of all information that can be collected on a material, including information from operating procedures, manufacturing specifications, material safety data sheets (MSDS), spill reporting logs, visual inspections, and personnel affidavits. All process knowledge that is brought to bear on waste characterization is documented in the waste characterization files.

Sampling and analysis conducted in support of the MEF process is conducted in accordance with site procedures based on USEPA SW-846, *Test Methods for Evaluating Solid Waste,* for RCRA waste characterization. Protocols required by other regulatory programs are used when applicable. All data required to support waste characterization by sampling and analysis are included in the MEF waste characterization files. This includes the request for analysis, sampling plan, field sample log book, analytical data report, QA/QC report, chain-of-custody forms, and statistical treatment of analytical data once the sampling and analysis is completed.

Table 2-1 identifies the waste categories, EPA waste codes, and the anticipated volume for each category and subcategory of waste to be treated under the project.

TABLE 2-1

SUMMARY OF CORROSIVES Waste Subcategory(EPA Waste Codes)	Anticipated Volume
Lab Generated Waste, Acid Digestates (D002, D007, D008, D018, D019, D028, D039, D043)	12 Drums
Metals Extracts and Digestates (D001, D002, D008, D009, D010, D018, D019, D028, D040, D043)	12 Drums
Radioactive Acidic Lab Waste (D002, D007, D008, D018, D019, D021, D022, D028, D029, D035, D039, D040, D043)	47 Drums
Lab Generated Waste Flammable Organic Extracts D001, D002	4 Drums
Magnuspray/surplus chemicals (D002, D007)	1 Drum
Nitric Acid (D002, D007)	1 Drum
Wastewater Lab Sample Reagents (D001, D002, D006, D007, D009, D011)	1 Drum
Water Contaminated with oil from Baker Sump (D002, D018, D019, D039, D040)	17 Drum
CTC Corrosive Waste D002,	1 Drum
Acidic Extract Waste D002,	4 Drums
Corrosive, Flammable Lab Waste D001, D002, D007, D018	1 Drum
Total	**101 Drums**
SUMMARY OF BARIUM CHLORIDE RESIDUES **Waste Subcategory (EPA Waste Codes)**	**Anticipated Volume**
Scrap Salts (D005, D008)	25 Drums
Contaminated Soil & Rocks (D005)	22 Drums
Sludges, Salt, Chloride (D005)	50 Drums
Furnace Salt, Solidified, Chloride (D005, D008)	1 Drum
Hardened Salt Bath Sludge (D005)	7 Drums
Salt & Furnace Brick (D005, D008)	69 Drums
Total	**174 Drums**

SUMMARY OF REACTIVE CATEGORY WASTE Waste Subcategory (EPA Waste Codes)	Anticipated Volume
Magnesium Powder and Turnings (D001)	19 Drums
Contaminated Magnesium (D001)	4 Drums
Magnesium Metal Contaminated With Oily Rags (D003)	1 Drum
Unfired Reduction Charge Plus Calcium Fluoride - Thorium (D001, D003)	1 Drum
Total	**25 Drums**
SUMMARY OF OXIDIZER CATEGORY WASTE Waste Subcategory (EPA Waste Codes)	**Anticipated Volume**
Draw Temp 275 (Clay Wire/Pink/White/Orange) (D001)	1 Drum
Decanted Water from Sump/Filter Cakes (D002, D007)	2 Drums
Thorium Nitrate Solutions (D002, D005, D007, D008)	9 Drums
Uranyl or Thorium Nitrate Solution (D002, D001)	1 Drum
Impure Thorium Nitrate (Solid) (D001, D007, D008)	19 Drums
U-contaminated Soil, Rocks, Etc. (D001, D002, D004, D007, D008, D011)	1 Drum
Discarded Process Residues, Slurries, Etc. (D002)*	1 Drum
Thorium Trailer Cakes (D002, D005, D009)*	1 Drum
Thorium Oxide/Fluorides (D005)*	2 Drums
Thorium Nitrate Solid (D001, D005, D007, D008)	6 Drums
ThO_2 Powder, Refinery Feed (D008)*	1 Drum
Contaminated TBP and/or Kerosene Mixtures and Sludges (D002, D005)	2 Drums
Tributyl Phosphate/Kerosene UNH (D002, D005)	8 Drums
Clean-up Material - UNH (D002, D005)	1 Drum
Impure Uranyl or Thorium Nitrate - Solid (D001, D002, D005)	3 Drums
Total	**58 Drums**

* Solely due to the presence of thorium.

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3.0 TREATMENT DESCRIPTION

The key to chemical treatment success will be to effectively match treatment recipes to the waste categories for which they have been designed and to respond to waste variability within each category. Treatment recipes will be designed for each waste category or major subcategory, as appropriate, based upon bench-scale testing. Once developed, design recipes will be communicated to the treatment operators using postings called Design Recipe Notices. It will be the responsibility of the Perma-Fix Project Manager to enforce compliance with the Design Recipe Notices.

3.1 TREATABILITY STUDY

A treatability study was performed by Nuclear Fuel Services, Inc. (NFS), on samples from three of the four waste categories, and documented in a final report entitled, *Treatability Study Report for the FERMCO Chemical Treatment Project, NFS-SP-WST-006, Rev. 0, April 23, 1996*. A treatability study was not performed on the oxidizer waste category because treatability and actual process information is available for similar waste streams which have been successfully treated on-site. The goal of the treatability study was to perform bench-scale tests to determine treatment methods which would render the waste non-hazardous, and to recommend treatment methods that are likely to be successful for full-scale treatment of the waste.

Bench-scale testing on the barium chloride salts indicated that the waste can be rendered non-hazardous by precipitating the barium as an insoluble salt. NFS used a soluble sulfate compound in the form of aluminum sulfate to precipitate the barium and then added Portland type 1 cement to solidify the waste, bind up any free liquids, and immobilize any remaining toxicity characteristic metals. Bench-scale testing conducted on the corrosive waste stream indicated that neutralization of the waste will remove the corrosive characteristic. Treatment for the remaining hazardous constituents in the corrosive waste stream is outside the scope of this project. NFS also added sodium sulfide to precipitate the metals from the neutralized solution. Bench-scale testing on the reactives waste stream indicated that deactivation by stabilization with Petroset II and mineral oil can be used to render the waste non-hazardous. NFS also added methanol to the mixture to catalyze the hardening process during mixing. At this time, it is anticipated that adding a catalyst during mixing will not be required to successfully treat mixed wastes under the NPDS project.

3.2 DESIGN RECIPES

The key to successfully meeting the RCRA LDR treatment standards and disposal site WAC is application of well-designed and demonstrated treatment recipes to specific wastes. Initial treatment recipe development for each waste category in the project was performed in the NFS treatability study. After mobilization on the Fernald site, the treatment subcontractor may

conduct additional bench-scale tests to further optimize the final Design Recipes. The information obtained by the NFS treatability study will be used as a starting point for any bench-scale optimization testing. The same process control parameters that are planned for the full-scale treatment campaign will also be used in the bench-scale testing. Treatment recipe development will proceed in three stages:

- Stage 1 - Design Recipe Development
- Stage 2 - Design Recipe Optimization
- Stage 3 - Design Recipe Adjustment

3.2.1 Stage 1 - Design Recipe Development

The treatment planned for this project is tailored to each of the major waste categories; barium chloride residues, corrosives, reactives and oxidizers. These major waste categories are considered primary wastes in the treatment scheme. The waste categories each have unique physical and chemical characteristics which must be considered in the design recipe development and in the treatment scheme. Prescribed treatment recipes will be developed for each of the major waste categories, and for any of the subcategories presented in Table 2-1 which deviate significantly from the characteristics of the other wastes in the category. The Treatability Study Report described in Section 3.1 represents the basis upon which design recipes will be developed. If necessary, design recipe optimization as described below will be performed.

3.2.2 Stage 2 - Design Recipe Optimization

After mobilization on the FEMP site, the Perma-Fix team may conduct tests to optimize the final design recipes. In performing bench-scale testing in the process area, selected waste containers will be taken to the Drum Opening and Inspection Station (See Figure 3-5), sampled, closed and returned to the staging area. The samples will be taken to the Sorting Booth where the bench-scale tests will be performed under negative pressure ventilation.

Since some MEFs may not have enough volume to fill a White Metal Box (WMB) once the waste is treated, they will be combined with compatible MEFs to produce a sufficient volume of waste to fill the WMB. Only compatible MEFs from the same waste category may be combined. For example, a reactive waste may not be combined with an oxidizer. Before multiple MEFs are combined and treated, their compatibility will be evaluated, and if necessary, bench-scale compatibility tests and/or design recipe optimization tests may be performed.

Upon completion of design recipe optimization, the design recipe for each MEF will be provided to the operators in the form of a Design Recipe Notice, Figure 3-1, which will be posted at each mix unit location for ready reference by the mix unit operators. The Design Recipe Notice will include:

- A Raw Waste Profile
- Prescribed Reagent Dosages
- Performance Specifications

The raw waste profile provides the mix unit operator with a physical description of the waste to which the design recipe can be successfully applied. If the mix unit operator encounters a waste that does not fit the raw waste profile, processing of that waste will be postponed until the Project Manager or the Waste Treatment Operations Supervisor decides how best to proceed. New optimization tests may be required. The prescribed dosages specify to the mix unit operator the minimum reagent dosages necessary to successfully treat waste that meets the raw waste profile. The performance specifications describe to the mix unit operator the physical and chemical attributes that should be exhibited by waste after the treatment has been completed. He may add more reagents than the Design Recipe Notice requires if increased dosages are needed to meet the performance specifications.

3.2.3 Stage 3 - Design Recipe Adjustment

If performance standards are not met by the design recipe, or if additional reagents must be routinely added to meet the performance standards, the design recipe may require adjustment. In these situations, additional optimization tests may be performed to provide a basis for adjustment of the design recipe. The mix unit operator will provide the Waste Treatment Operations Supervisor with timely process feedback so that decisions whether or not to adjust the design recipe can be made in a timely and deliberate manner.

3.3 PRIMARY WASTE TREATMENT

The following subsections describe the treatment technologies and their application to each of the identified primary wastes. Please refer to the process flow diagrams of Figure 3-2 during review of each treatment technology.

3.3.1 Neutralization Treatment Technology Application

Neutralization Treatment for this project will involve additions of acid or base, as appropriate, and mixing to adjust the pH of the waste into the range of 5.0 to 9.0 standard units. For waste having a pH less than 5.0, base will be added. For wastes having a pH over 9.0, acid will be added. Based on waste characterization data, it appears that most, if not all of the corrosive wastes are acidic (pH < 5.0). Caustic waste materials can be combined with acidic waste materials, and then additional base may be added as necessary to adjust the pH to between 5 and 9. The waste descriptions show that the corrosives may be broken down further into the subcategories shown in Table 2-1. There are two main types of corrosives, inorganic (aqueous) and organic. As shown in Figure 3-2, the treatment scheme varies depending on whether the waste matrix is inorganic or organic. Typically, inorganics will be processed

Figure 3-1

FEMP MIXED WASTE CHEMICAL TREATMENT PROJECT

Design Recipe Notice

Waste Category Designation _____

Posting Date_____ Posting Time_____

Raw Waste Profile

Color_____
Texture_____

Free Water
Content _____

Macro Solids_____
_____
_____

pH_____

Freeboard _____ inches.

Prescribed Reagent Dosages

1. Adjust pH to _____,
with _____.

2. Stabilize Barium & Chromium
with _____ Gallons of _____%
Ferrous Sulfate, Mix _____ min.

3. Adjust pH to _____,
with_____.

4. Allow to Soak _____ hrs.

5. Stabilize all metals with
_____ Gallons of_____%
Sodium Sulfide, Mix _____ min.

6. Add solidification reagent
_____ lbs/gallons of Type ____
Portland Cement, Mix ____ min.

Performance Specifications

Final Color of Treated Waste _____.

Final Texture of Treated Waste _____.

Lead Acetate Test Color Intensity Value, _____ minimum (CIV).

Blade Slump Range _____to_____ (inches).

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before organics, in order to prevent the processing equipment from becoming contaminated with organic and other F-listed constituents that could contaminate inorganic wastes processed later in the same equipment. If for some reason inorganics cannot be processed before the organics, the equipment will be triple rinsed, per Section 3.9 of this work plan, for decontamination before treatment of inorganics begins, to prevent cross-contamination.

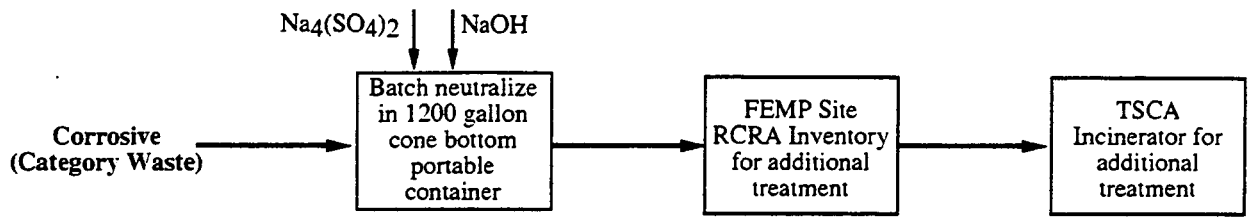
The process flow diagram for neutralization in Figure 3-2 shows that the corrosive wastes will be bulked in a portable cone-bottom container, followed by elementary neutralization of the acids with sodium hydroxide and bases with sodium bisulfate. The goal of the elementary neutralization step will be to remove the corrosive characteristic. Neutralized corrosive liquids will be transferred to the Liquid Mixed Waste Project for eventual treatment in the TSCA Incinerator at the K-25 Site near Oak Ridge, Tennessee.

3.3.2 Precipitation/Stabilization Treatment Technology Application

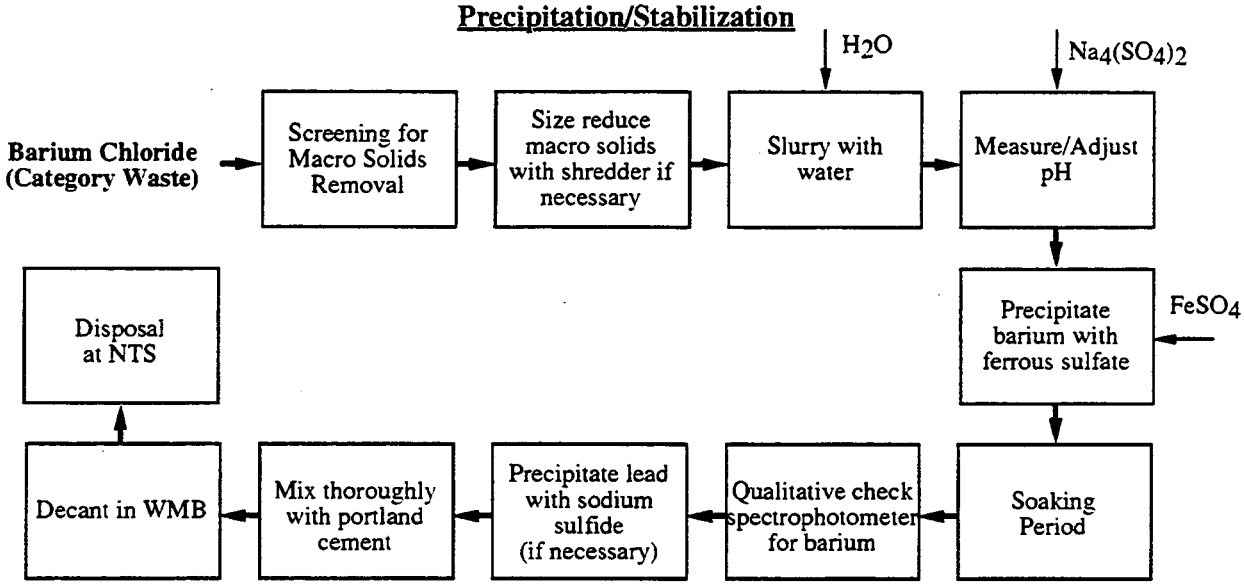
Precipitation/stabilization treatment, as it will be applied in this project, involves reaction of the soluble metallic cations in the waste matrix with a precipitation reagent followed by stabilization to produce a solid monolith. The products of these reactions will be metal precipitates having very low solubility in water, and therefore very low potential for leaching. The largest primary waste stream suitable for precipitation treatment is described as barium chloride residues. The waste descriptions indicate that the barium chloride residues may be broken down further into the subcategories identified in Table 2-1. The waste codes indicate that barium and lead are the main contaminants of concern. For the waste having barium only, the stabilizing agent will be a sulfate in a commercially available dry form (sodium, aluminum, or ferrous sulfate) with the dosage increased or decreased as appropriate to match the reagent demand of the waste. For the waste having barium and lead, a synergistic recipe using both ferrous sulfate and sodium sulfide will be used.

The physical characteristics of the barium chloride residues are expected to vary from contaminated soils and relatively soft salt cake to hard salt. As shown in Figure 3-2, the treatment scheme for these wastes will include screening and sorting of the waste to remove any prohibited items, size reduction in the shredder, slurrying with water, measurement and adjustment of pH (as specified in the Design Recipe), precipitation of barium with sulfate, upward pH adjustment, precipitation of lead with sodium sulfide (if necessary), solidification treatment with portland cement, and decanting of the treated waste into WMBs. Because the barium content of these wastes is high, a commensurately high dosage of sulfate will be used. Also, an appropriate soaking period may be utilized to ensure adequate time for the reaction of the sulfate. Before stabilization, reagents are added to the sulfate-treated waste, representative samples of the pretreated waste will be subjected to field extraction and analyzed for barium in the field. If leachable barium and chromium are still in excess of treatment targets, the mixing drums of waste will be returned to the mixer, treated with more ferrous sulfate and allowed to soak again. When an acceptable test result is obtained, the next step of treatment can proceed. Precipitation treatment technology will also be used to treat heavy metal constituents in the oxidizer waste category.

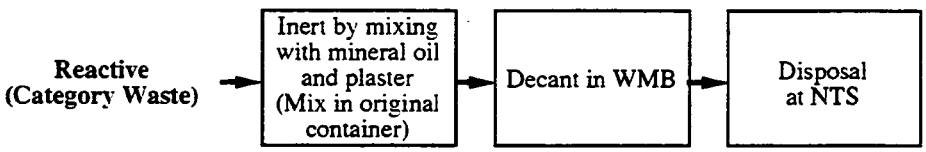
Neutralization



Precipitation/Stabilization



Deactivation of Reactive and Ignitable Metals



Deactivation/Stabilization

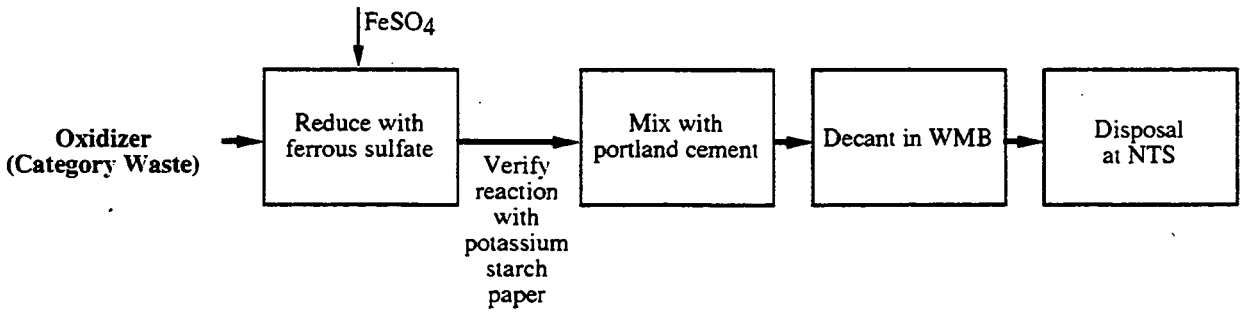


Figure 3-2
Process Flow Diagrams
Fernald Mixed Waste Chemical Treatment Project

If significant concentrations of other RCRA metals such as lead are present, sodium sulfide will be added to the waste drum under the mixer to precipitate the other RCRA metals of concern. A test of the precipitated waste with lead acetate paper will be performed to ensure that a slight residual of unreacted sodium sulfide is present after the reaction is complete. When a satisfactory result for the lead acetate paper test has been obtained, stabilization treatment will be performed.

After toxic metals have been precipitated, the waste will be stabilized with portland cement to produce a solid monolith for disposal. Stabilization technology is discussed in more detail in Section 3.3.4 below.

3.3.3 Deactivation Treatment Technology for Reactive and Ignitable Metals

Deactivation treatment for this project will consist of mixing the waste with an appropriate inerting reagent to produce a non-reactive treated waste form. Wastes classified as reactives for this project are primarily magnesium metal (D001) in several different physical forms, as shown in Table 2-1. One additional drum is reactive for calcium metal. Ignition is the main safety concern that will be addressed in processing these reactives.

As shown in Figure 3-2, the treatment scheme for the reactive metal wastes will include in-drum slurrying in mineral oil to minimize ignition potential, followed by inerting and solidification treatment with plaster (gypsum), or Petroset II as an inerting material. The mixing necessary to slurry the waste in mineral oil and disperse the solidification reagent will be provided with Perma-Fix's in-drum propeller mixer. This treatment scheme is a technical match with the methodology used by NFS in their treatability study.

As shown in Figure 3-2, the deactivation technology also has an application in the treatment of waste in the oxidizer category. The oxidation/reduction reaction between ferrous sulfate and the waste is a deactivation step. The application of deactivation and stabilization technology to the oxidizer category is discussed in more detail in Section 3.3.4 below.

3.3.4 Deactivation/Stabilization Treatment Technology Application

Wastes in the oxidizer category are hazardous because of their tendency to react with other chemicals in a sometimes violent oxidation/reduction reaction. Deactivation treatment takes advantage of this tendency by adding reducing agents in a safe and controlled manner, to bring the oxidation/reduction reaction to completion before the waste is offered for disposal. The waste descriptions show that the oxidizers may be further broken down into the subcategories shown in Table 2-1. Most of the wastes to be treated by deactivation are nitrate salts of various metals (sodium, potassium, uranium and thorium). In addition, thorium is present in its oxide and fluoride forms. RCRA metals of concern include barium, chromium, lead and mercury.

As shown in Figure 3-2, the treatment scheme for the nitrate, oxide and fluoride based wastes will include an in-drum reduction step using a sulfate. Reduction of hexavalent chromium and precipitation of barium are very important factors in treatment success, providing adequate reaction time and testing for completion in this metal's precipitation step. Slurrying of the waste with pH-adjusted water will precede reduction of the oxidizers with the sulfate. Throughout the slurrying and reduction steps, the waste will be mixed using Perma-Fix's in-drum mixer. At the conclusion of the reduction step, a test with potassium starch paper will be used to verify that sufficient reducing reagent has been added. A positive test result (black stain) indicates that all of the reagent has been consumed in the reaction and no residual exists, showing the need for more reducing agent. No color change in the potassium starch paper indicates that an unreacted residual of reducing reagent exists. No color change is the desired result.

In addition to the reduction of oxidizers, leachable RCRA metals will require precipitation in order to meet the LDR treatment standards under the Universal Treatment Standard (UTS). Leachable barium and chromium will be precipitated with the sulfate. If necessary, each mixing drum of reduced waste will be removed from the mixer and placed in a soaking area for 8 - 16 hours to allow reactions to reach completion. If soaking is required for deactivation of oxidizers, or if gas/vapor generation is anticipated, the soaking area will be provided with a tent enclosure which is ventilated through the HEPA filtration system. Before the drums are returned from the soaking area, representative samples will be extracted in the field and the extracts analyzed for barium and chromium concentration as described in Section 3.3.2. If leachable barium and chromium are still in excess of treatment targets, the drums will be returned to the mixer, treated with more ferrous sulfate, and allowed to soak again. When an acceptable test result is obtained, the drums will be returned to the mixer for the second step of the precipitation process.

Stabilization technology will be applied to the waste after precipitation has been achieved. The goal of the stabilization treatment will be to produce a solid monolith which has no free liquid. For dry or water-based wastes, the stabilization reagent will be portland cement. The amount of portland cement prescribed in the Design Recipe Notice will be added, thoroughly mixed with the waste, and evaluated for slump.

Due to the health and radiological hazards associated with the various forms of Thorium to be treated with this technology, all major process equipment used to handle Thorium-containing wastes will be enclosed in temporary enclosures that by means of isolating materials and negative pressure ventilation prevent release of airborne particulates into the Plant 6 work space. These enclosures will be connected to the negative pressure ventilation system that discharges outside the Plant 6 Building by way of the HEPA filtration system.

A completely different form of oxidizer is tributyl phosphate in a kerosene carrier (TBP/K). The TBP/K waste stream is not classified as ignitable, but it probably is combustible by the National Fire Protection Association (NFPA) criteria based on the flash point of kerosene. The TBP/K waste stream is also contaminated with barium. Ignitability and the potential for exothermic reactions are the main safety concerns that will be addressed in processing these

oxidizers. The treatment for this waste stream will be similar to the other oxidizers, except that plaster (gypsum) or Petroset II will be used as the stabilization reagent instead of portland cement.

3.4 SECONDARY WASTE TREATMENT

During the project, two main types of waste will be managed: primary waste and secondary waste. Primary waste includes all waste containers of the approximately 360 containers comprising the four waste categories. Secondary wastes include byproduct streams derived from the primary wastes.

Table 3-1 provides rough estimates of the types and volumes of primary and secondary waste, along with the anticipated disposal or long-term storage sites. These volume calculations are based on prior operating experience gained from treatment of similar wastes during the Fernald Mixed Waste Stabilization Project. Volumetric swell resulting from generation and incorporation of secondary waste will also be minimized.

To the greatest extent possible and consistent with the disposal site WAC, secondary wastes will be disposed along with the primary wastes with which they are associated by incorporating them into the processed waste. If separate disposal is required, secondary wastes will be compacted to the extent possible to minimize their volume. Efforts will be made to prevent contamination of solid waste materials with mixed waste constituents. Uncontaminated solid wastes are managed separately and properly disposed of by FEMP site personnel.

Secondary waste production will be minimized to the greatest extent possible by use of recyclable personal protective equipment such as respirators, and outer boots. The Perma-Fix team uses disposable protective clothing over launderable protective clothing. Wastes which must be disposed will be packaged as directed, properly labeled and marked, and transferred to the custody of FEMP site personnel.

3.5 PROCESS DESCRIPTION

The process that will be employed in treating the specified wastes, is a production process, in which mixed waste (exhibiting hazardous and low level radioactive characteristics) will be treated to produce stable LLRW forms capable of meeting disposal site WAC. The barium chloride residue, reactive and oxidizer categories will be rendered non-hazardous after treatment and will therefore be eligible for disposal at NTS. Most of the waste in the corrosive category bear F-listed waste codes or exhibit the toxicity characteristic for TC organic constituents which are prohibited by NTS. After these wastes are treated, they will be returned to the FEMP site RCRA inventory to await additional treatment and/or disposal actions in further FEMP site projects. Perma-Fix will perform all treatment activities and will

Table 3-1
Summary of Estimated Waste Volumes for Storage/Disposal

Waste Description	Volume Raw/Treated (Cubic Feet)	Disposal or Storage Site
Primary Mixed Wastes Treated to Eliminate Hazard Characteristic		
Barium Chloride Residues	1,500/2,700	NTS
Corrosives	794/79*	Envirocare/TSCA Incin.
Reactives	241/362	NTS
Oxidizers	278/348	NTS
Total Waste Volume	2,813/3,489	----
Secondary Mixed Wastes Generated From Treatment Activities		
Compacted Anti-C Clothing	125	FEMP/NTS
Compacted Respirator Cartridges	260	FEMP/NTS
Damaged Respirator	2.00	FEMP/NTS
Wipes & Plastic	75	FEMP/NTS
Excess Water	800*	FEMP/NTS
Totals Mixed Waste	1,262	----
On-site Recycle or Reuse		
Used Drums	400/450	FEMP/NTS
Totals On-site Reuse	400/450	----
Free Release Solid Waste		
Uncontaminated packaging	20	Off-site landfill

* 95% of the original volume will be supernate further treated and disposed of outside this project by FEMP site personnel. The settled sludge will be 5% after settling and 10% after treatment. Supernate is included in the excess liquid total.

manage all waste containers in the process area. This section describes each of the major process units and the manner in which one or more of these units is used in the performance of each treatment technology. Figure 3-3 is a schematic diagram illustrating how major materials handling activities will be accomplished. Figure 3-4 is a production flow diagram of the mixed waste chemical treatment process. Figure 3-5 is an equipment layout drawing of the process area in the Plant 6 Building. The individual process units, which make up the waste treatment production process, are enclosed by dashed lines in Figure 3-5 and designated as follows:

Process Unit A - **Waste Preparation**
Process Unit B - **Macro Solids Sorting and Size Reduction**
Process Unit C - **Chemical Precipitation**
Process Unit D - **Deactivation/Stabilization**
Process Unit E - **Decanting and Curing**
Process Unit F - **Reagent Makeup**
Process Unit G - **Neutralization**

All process operations will be performed by highly qualified and experienced technicians, who will be referred to in the following presentation as "operators."

3.5.1 Process Unit A - Waste Preparation

Process Unit A, Waste Preparation, is the process unit in which Compatible Waste Groupings (CWG) are created, and in which the waste and containers in each CWG are processed to prepare them for treatment. The waste preparation begins when waste containers are transported from an Incoming Waste Staging Area (See Figure 3-5) to the Deheading and Inspection Station where the containers are logged in, opened and inspected.

Free liquid layers encountered in the raw waste containers will be pumped out with an air-driven double diaphragm pump, which will discharge by way of hoses to a contaminated water holding tank. This tank is located within a manufactured secondary containment of sufficient capacity to contain over 100 percent of the capacity of the tank. The floor of the Deheading and Inspection Station is spill protected by a Herculite™ floor covering. The Deheading and Inspection station is also equipped with an engineered negative pressure dust/fume collection system which discharges outside the building through a prefilter and a high efficiency particulate air (HEPA) filter.

Some waste containers have been overpacked one or more times while in on-site RCRA storage. A fork lift and suitably rated T-bar and drum clamp will be used to lift the inner container out of the overpack. This operation will be performed over the Herculite™ so that any spills due to container leakage will be contained. Waste from the inner container may be decanted into the overpack and then managed in the same manner as other containers that contained no inner containers. The leaking container removed from the overpack may also be bagged to contain leakage until it can be emptied. Empty inner containers and lids will be inspected and cleaned, if necessary, to ensure compliance with the RCRA empty container rule

promulgated in 40 CFR 261.7 (Ohio Administrative Guide [OAC] 3745-51-07), and placed in an Empty Container Storage Area to await disposition by FEMP site personnel. Rinse waters will be collected, and pumped to the contaminated water holding container in the same manner as the excess liquids were removed from the containers.

After the waste containers have been opened, the excess liquid removed, and the inner containers separated from the waste, the waste containers are grouped by the operators at the Deheading and Inspection Station into CWGs. A CWG is sized, based on the design recipe, to fill a WMB after all hydration water, reagents and shredded solids have been combined with the waste in the stabilization step.

In the next step of the waste preparation process, macro solids (over 2 inches in any dimension) will be separated from the waste by passing the waste through a bar screen in a screening hopper as shown in Figure 3-4. Each drum in a CWG is clamped in an engineered hydraulic drum lift, and lifted to the top of the screen hopper, and the contents dumped onto the bar screen. Macro solids retained by the bar screen are raked down a chute onto a sorting table where Process Unit B begins. Waste that passes through the bar screen is dispensed from the bottom of the screen hopper through a discharge valve into a heavy wall 55-gallon mixing drum. If necessary, the loading of solids and liquids in each mixing drum is adjusted to the proper ratios, and freeboard is provided to make room for the added reagents. Screening for macro solids removal can be used on any of the wastes identified for this project except those containing thorium. If thorium wastes must be repackaged or inspected for macro solids prior to treatment, the wastes will be manually transferred inside a ventilated enclosure. The exhaust air flow from the enclosure will pass through the HEPA filtration system prior to discharge to the atmosphere.

In performing the treatment technologies specified for this project, some aspects of Process Unit A will be utilized in each. Waste drum receipt, staging, opening and inspection, and the management of empty containers will be as described above and as shown in Figure 3-4 for all four treatment technologies. The precipitation technology as it is applied to the barium chloride residue waste category is the only one of the four technologies expected to employ the drum lift and screen hopper for raw waste screening. The barium chloride is the only project waste stream that will require decanting of free liquid out of the container. Due to the health and radiological concerns relating to thorium compounds, we plan to perform deactivation/ stabilization treatment in the original containers if possible. Only if the oxidizer drums are damaged or deteriorated will we repackage prior to treatment.

3.5.2 Process Unit B - Macro Solids Sorting and Size Reduction

Based upon the existing knowledge of these waste streams, it appears that only the barium chloride residue waste category will be processed in Process Unit B. If monoliths have to be broken up and reprocessed due to WAC failure, the rubble will reenter the treatment process in Process Unit B at the sorting booth, the inclined belt conveyor, or the shredder.

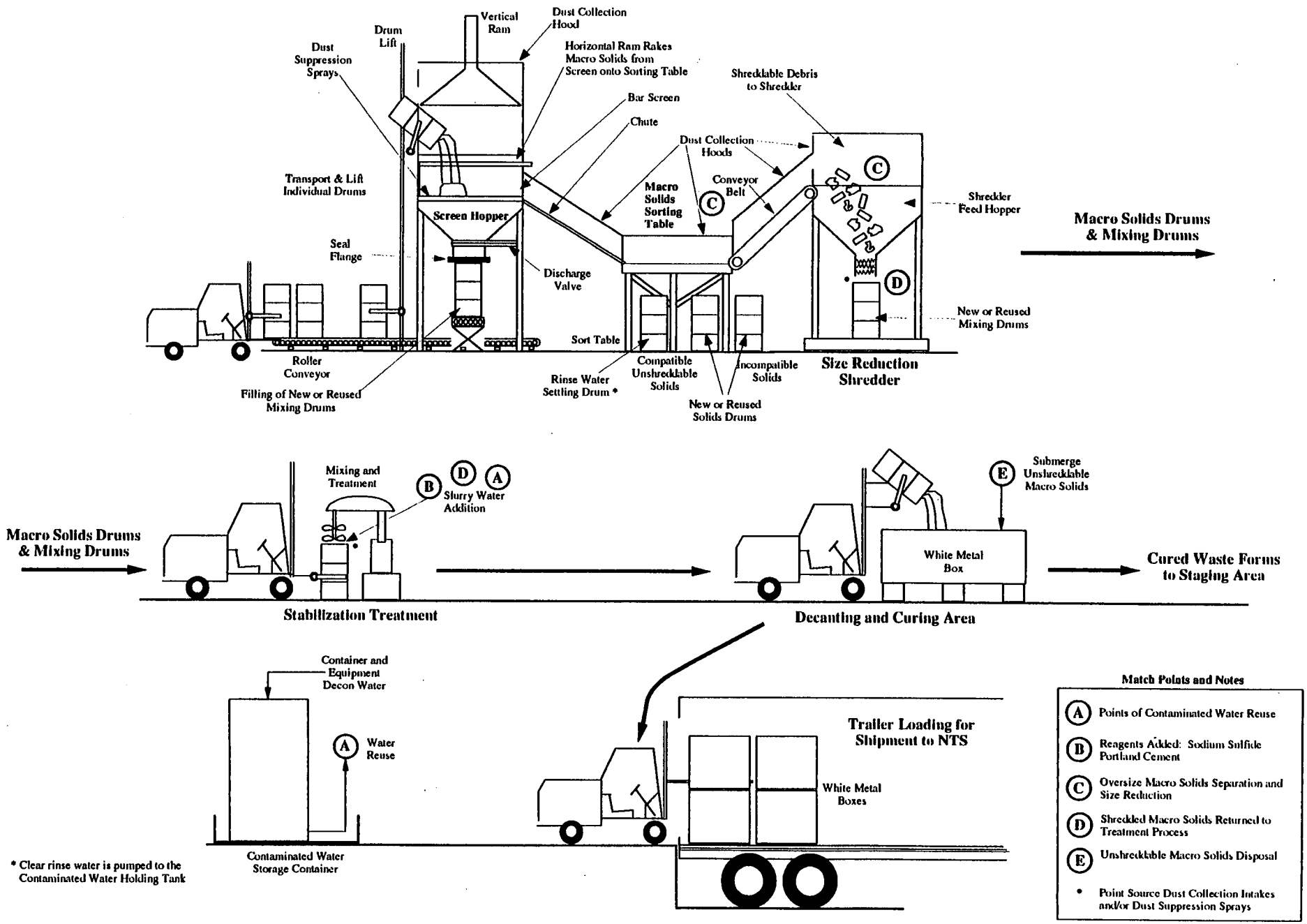


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Figure 3-3A
Schematic Diagram of Treatment Process

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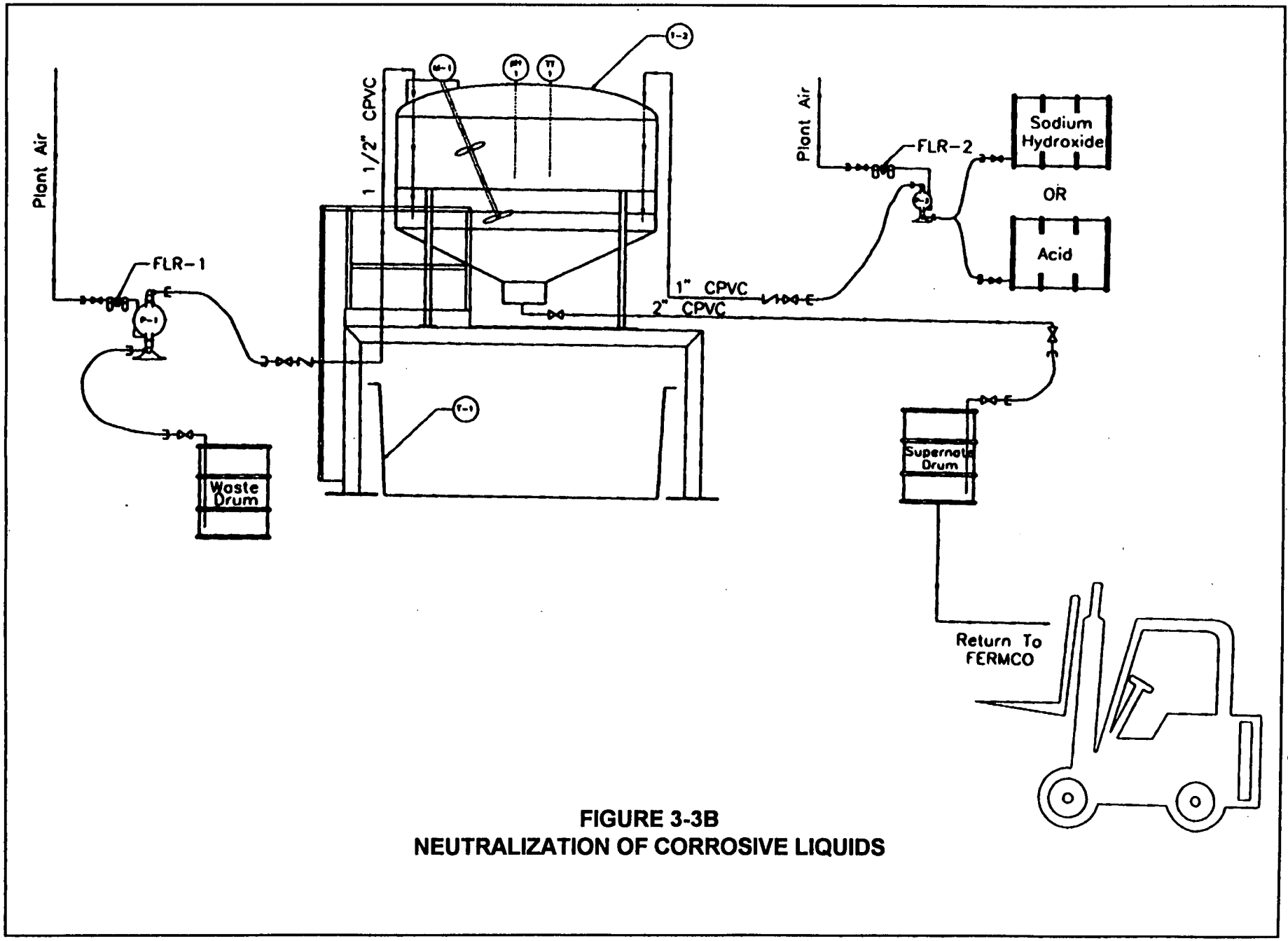

FIGURE 3-3B
NEUTRALIZATION OF CORROSIVE LIQUIDS

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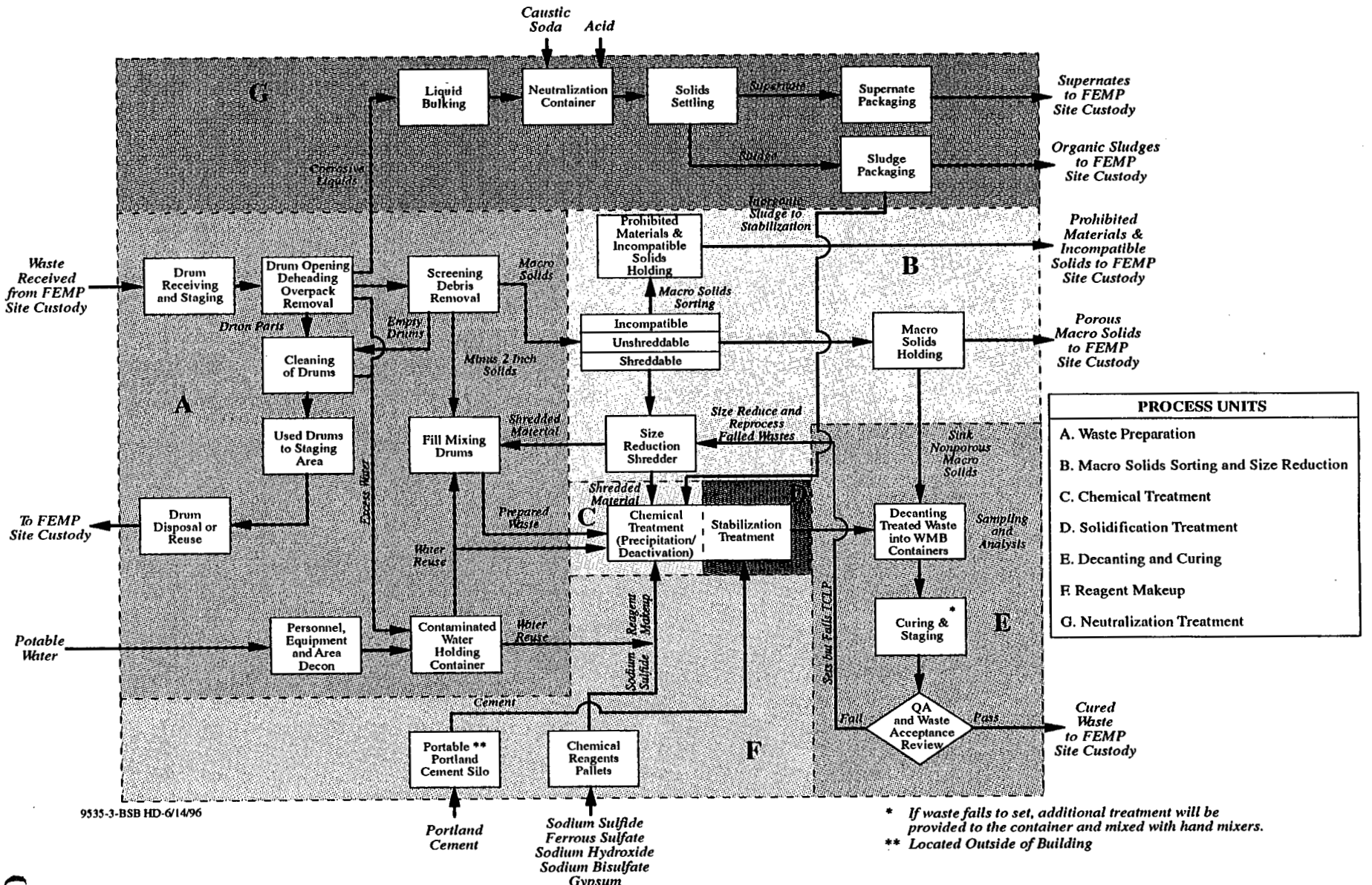

Figure 3-4
Production Process Flow Diagram

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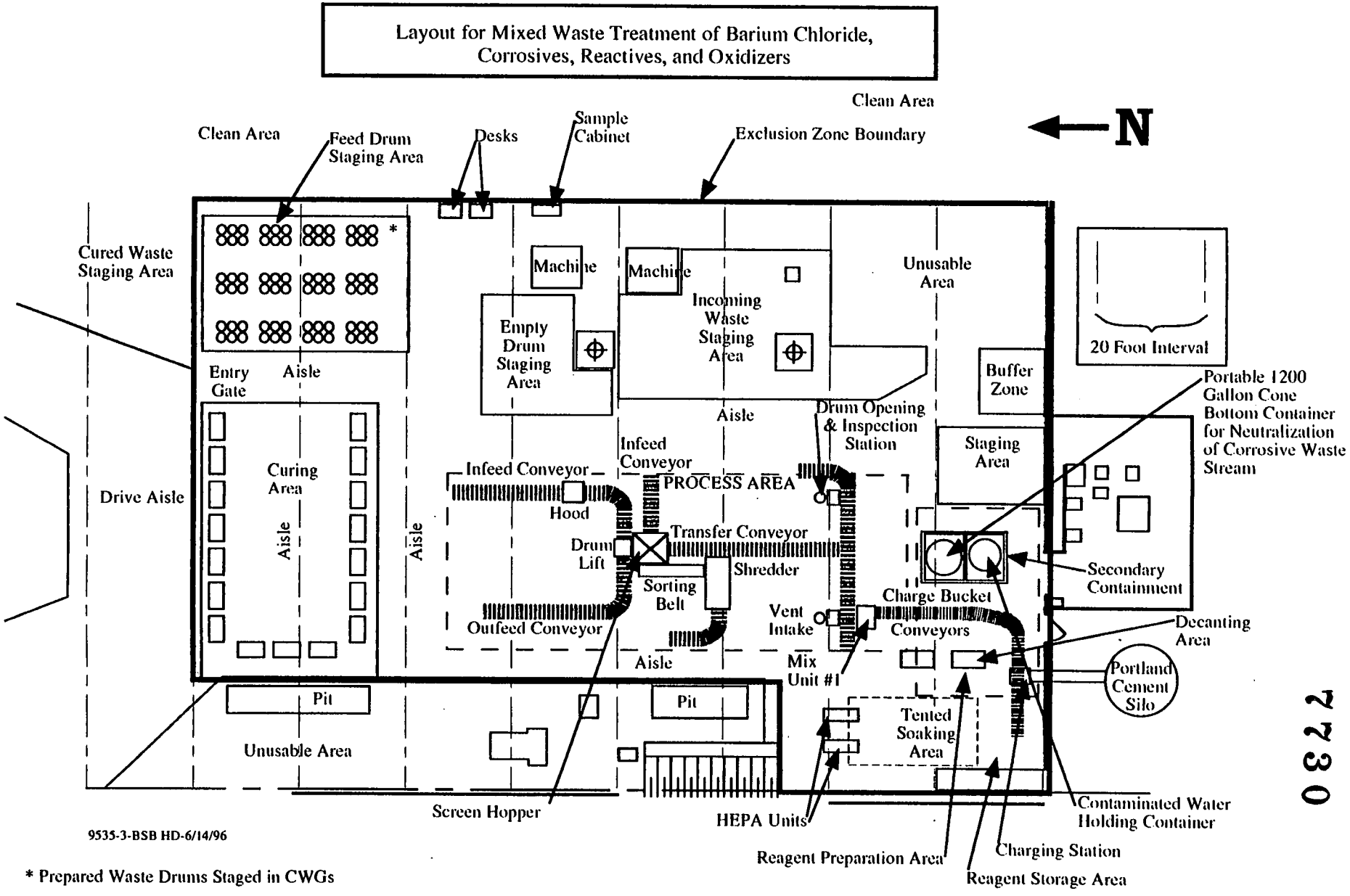

Mixed Waste Stabilization Project Layout Modified to Treat Barium Chloride and Other Waste Residues
Plant 6 Equipment Layout

Figure 3-5
Fernald Plant 6 Layout of Mobile Treatment Unit

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In Process Unit B, Macro Solids Sorting and Size Reduction, macro solids that have been screened out of the waste at the Screen Hopper will be raked down a chute onto a sorting table enclosed in a negative pressure ventilation booth. The macro solids will be manually sorted to remove any prohibited materials or solids that are incompatible with the downstream treatment process.

Prohibited materials and process incompatible solids (Table 3-2) are sorted by physical characteristics, repacked, and labeled, in containers for return to FEMP site RCRA inventory. Sorting also separates process compatible solids into shreddable and unshreddable categories. Unshreddable solids are confirmed by project procedure to be compatible with applicable disposal site WAC, and sent to the Decanting and Curing Area (See Figure 3-5) for submerging into the treated wastes in the WMB before the grout sets.

Shreddable solids are placed on a belt conveyor and transported to the feed hopper of a size reduction shredder. Shredded solids exit the shredder through the bottom, directly into a single 55-gallon drum. Shredded solids are then moved to the Chemical Precipitation Process Unit, and added by hand to the mixing drum during the mixing process. In this way, the waste and the size-reduced solids are treated together in the mixing drum.

If any solidified waste in the Cured Waste Staging Area or the Decanting and Curing Area (See Figure 3-3) is found to have failed a Toxicity Characteristic Leaching Procedure (TCLP) extraction analysis, Universal Treatment Standard (UTS), or any other provision of the disposal site WAC, the operations logs will be reviewed, and the laboratory data will be validated. If the TCLP or UTS failure is confirmed, the monolith in the WMB will be jack hammered to break up the waste/grout monolith into manageable chunks. These chunks of monolith will be transferred to 55-gallon drums and transported back to the belt conveyor at the inlet of the shredder, fed through the shredder and repackaged in mixing drums. The shredder is the point where WAC-rejected monoliths re-enter the treatment process for reprocessing.

3.5.3 Process Unit C - Chemical Precipitation/Deactivation

Chemical precipitation/deactivation is a key component of the treatment technologies which will be applied to the treatment of barium chloride residues and the oxidizer waste categories. Also it may be used to precipitate and stabilize inorganic sludges produced in the neutralization treatment of corrosives.

Process Unit C, chemical precipitation/deactivation, is the operation in which toxic heavy metals and radionuclides in the waste are chemically precipitated to transform them into a chemical form that exhibits low water solubility, and therefore makes them less leachable. Also, this technology is used in deactivating oxidizers in an oxidation/reduction reaction.

Table 3-2

Prohibited Materials and Process Incompatible Solids (Based Upon NTS WAC)

Prohibited or Incompatible Materials	Examples	Classification
Batteries	Auto, Ni-Cad, Lithium, or Mercury	NTS prohibited items
Lead-bearing Material	Lead metal, pipe dope, lead flashing, oil filters	NTS prohibited items
Mercury-bearing Material	Switches, vacuum pumps	NTS prohibited items
Solvents or Solvent Soaked Rags	Kerosene, Toluene, Acetone	NTS prohibited items & process incompatible, and potentially ignitable
Liquid or Semi-Solid Petroleum	Oil, grease, soft tar	Process incompatible & potentially ignitable
Compressed Gas Containers	Aerosol Cans, gas cylinders	Process incompatible unless empty (at atmospheric pressure), potentially ignitable
Polychlorinated biphenyls	Transformers, capacitors, fluorescent light ballasts	NTS prohibited items
Explosives and pyrophorics	Explosives, pycric acid residues, porous uranium metal, uranium turnings and grinding sludges, and metal powders	NTS prohibited items & process incompatible, potentially ignitable
Chelating Agents	EDTA, NTA, amino-polyacetic acids	Process incompatible
Infectious Agents	Medical wastes, animal carcasses	NTS prohibited items & process incompatible

To ensure that treated waste meet RCRA LDR treatment standards and disposal site WAC, most of the waste streams will be subjected to chemical precipitation as described in the following discussion.

Mixing drums of waste, previously prepared and staged in CWGs in Process Units A and B, are transported on roller gravity conveyors to Process Unit C, the Chemical Precipitation/Deactivation Process Unit, and placed under a mix unit. The mix unit operator performs the chemical precipitation of the waste in each 55-gallon mixing drum. The mix unit operator follows the design recipe and established procedures in adding the prescribed dosages of reagent chemicals, and in evaluating the treated waste for compliance with the performance specifications. If the MEF characterization data indicates high concentrations of barium or chromium, sulfate additions may be required. Reaction of the waste with sulfate will also be performed for reduction of oxidizers. The design recipe may also specify pH ranges for some reactions. When the operator's testing shows pH outside the required range, the pH will be adjusted by reagent additions. To raise pH, the operator will add sodium hydroxide or a small amount of portland cement. To lower pH, the operator will add sodium bisulfate. For some wastes, the design recipe may call for a period of soaking to allow reactions to proceed to completion.

Another chemical precipitation step could involve reaction of the heavy metals and radionuclides in the waste with sodium sulfide to produce low-solubility metal sulfides. The operator will test the waste with color-indicating lead acetate paper to detect the sulfide reaction end point (a slight excess of unreacted sulfide after all demand has been satisfied). Sulfide additions continue until the lead acetate test shows the endpoint to be reached. Treatment reagents will be completely mixed throughout the waste volume so that all leachable metals and amenable radionuclides are precipitated. The mix unit is a hydraulically-driven, variable speed, reversible propeller mixer with three staged impellers. The unit has complete freedom of movement within the confines of a cylindrical container. The sulfide reaction can be used alone or synergistically in combination with the ferrous sulfate reaction.

Shredded solids will be stabilized along with the prepared wastes in the chemical precipitation step. Shredded solids may be brought to the mixing location and added by hand to the batch during the chemical treatment stage. Alternatively, the mixing drums may already contain prepared waste and shredded compatible solids in the proper proportions to comply with the design recipe.

The mix units will be equipped with a negative pressure dust/fume collection system to protect the operator from exposure to dusty waste constituents, chemical fumes or vapors, and radioactive contamination. This negative pressure dust collection system will discharge to the atmosphere outside the Plant 6 Building by way of the prefilter and HEPA filter system.

Because of the use of sodium sulfide, there is a potential that hydrogen sulfide gas could be generated if sodium sulfide became mixed with acid or was added to a waste mixture that has a low pH. To protect against this possibility, pH of the receiving material (water or waste) will be checked each time before sodium sulfide is added. Sodium sulfide will not be added unless pH of the receiving material is at least 9.0. If a receiving material is found to have a pH less

than 9.0, its pH will be adjusted upward with an alkaline reagent such as caustic soda, lime or portland cement before the sodium sulfide is added.

Due to the nature of the chemical precipitation process, a potential for minor spillage and splash out of waste materials from the mixing drums under the mix unit exists. Operators will exercise care in mix unit operations to minimize spills and splashing. Daily housekeeping in these areas with HEPA wet-vacs will be performed to prevent a buildup of transferrable contamination on the floor in this area.

3.5.4 Process Unit D - Deactivation/Stabilization

Process Unit D, deactivation/stabilization, will be used after precipitation treatment of barium chloride residues and reduction of oxidizers. This process will also be used to provide deactivation treatment of reactive and ignitable metals.

Process Unit D, deactivation/stabilization, is the operation in which solidification or inerting reagents are added to the waste and thoroughly mixed. After waste has been subjected to the chemical precipitation in Process Unit C, it will be further stabilized or deactivated with appropriate chemical reagents to bring about solidification of the waste into a solid waste/grout monolith. Solidification treatment takes place under the same mix units which were used to perform chemical precipitation or deactivation. Stabilization/Deactivation treatment may proceed immediately after chemical precipitation treatment has been completed, or it may take place at a later time. Stabilization/Deactivation reagents may include Type I portland cement, gypsum, or mineral oil/gypsum, as appropriate. The stabilization/deactivation reagent's primary purpose is to bind free water and solidify the waste into a solid matrix. Portland cement has the added benefit of raising the pH of the treated waste.

The mix unit operator constantly observes visual, textural, or consistency characteristics with respect to the design recipe and its performance specifications, and corrects any observed variance. If the operator finds that the prescribed reagent dosages of the design recipe are inadequate to meet the performance specifications, additional incremental doses of reagent will be added until the performance specifications are met.

3.5.5 Process Unit E - Decanting and Curing

Process Unit E, decanting and curing, will be used for all waste streams that are treated in Process Units C and D, with the possible exception of the thorium-containing wastes in the oxidizer waste category. Due to health and radiological hazards, the thorium wastes may be cured inside their mixing drums. After deactivation/stabilization treatment is complete, the lift truck/drum tipper is used to lift the drum of treated waste, remove it from the belt conveyor and transport it to Process Unit E, the Decanting and Curing Area, and decant the waste into a WMB. A large sheet of 10-mil plastic will be draped over the box and drum during decanting to prevent splatter of waste onto the floor.

Setting and curing begins immediately after decanting (initial set within four to twelve hours and a hard set after 24 hours). Additional curing time may be provided to achieve desired compressive strength criteria, but all necessary curing should be complete within 48 hours. The mix unit operators and process supervisor observe waste in the curing area to determine whether setting and curing are occurring as planned.

After the waste has cured, each WMB will be sealed and then moved by means of a fork lift truck to a staging area to await analytical results and pickup by FEMP site personnel. If sweating or bleeding of a monolith is observed, granular absorbent or dry Portland Cement will be placed on top of the monolith, before the container is sealed. These absorbent materials will absorb and chemically bind any sweat or bleed water to ensure that the WMB will contain no free liquid when shipped to the disposal site.

Waste acceptance samples will be collected in accordance with MEF-specific Sampling and Analysis Plans provided by the FEMP site Waste Characterization Group. The samples will be stored in a locked cabinet until transferred to the custody of FEMP site personnel. The samples will be subjected to the TCLP extraction and laboratory analysis to determine whether the reagent recipe has effectively treated the waste to meet applicable UTS or disposal site WAC. If the waste contained in any of the WMBs fail to meet specified requirements, the enclosed monolith will be broken up and reprocessed as described in Section 3.5.2. The division of responsibilities between Perma-Fix and FEMP Site personnel is addressed in the generic Sampling and Analysis Plan included in Appendix D.

3.5.6 Process Unit F - Reagent Makeup

Process Unit F, Reagent Makeup, is the operation in which reagents prescribed in the design recipe are prepared for addition to the waste. This activity involves reagent receiving, storage, and dispensing to prepare reagent charges for use in Process Units C, D and G. Since contaminated water from the contaminated water holding container may be reused for reagent dilution, this reuse water stream is also a material of concern.

The reagents and materials of concern include portland cement, gypsum, mineral oil, sulfates, sodium sulfide, pH adjusting chemicals and contaminated water. The storage, handling, and use aspects of each of these materials are described in the following paragraphs and in the MSDSs that will be maintained in the work area.

- **Portland Cement**

Portland cement is received in bulk shipments and stored in a portable cement silo equipped with a high efficiency bag filter to prevent significant emissions of cement dust during pneumatic truck unloading operations. Volumetric charges of portland cement are discharged dry from the silo by way of a screw feeder and charging hopper into covered buckets which are staged near the mixers. The charge buckets are manually emptied into the mixing drum by the

mix unit operator, slowly to minimize dust loss. The negative pressure dust/fume collection system will remove any portland cement dust from the air space over the mix unit. Another negative pressure dust/fume collector intake will be located at the charge bucket filling station.

- **Gypsum**

Calcium Sulfate is the primary chemical ingredient in commercial gypsum plaster and in the proprietary product, Petroset™ II. It is an experimental carcinogen in the human pulmonary system and can be an airborne silica hazard, depending on its composition. The dust removal capability of the compound respirator cartridges to be worn by all operating and maintenance personnel will provide adequate protection of personnel health. It will be received and stored in the dry powder form in plastic or paper sacks on pallets.

- **Mineral Oil**

Mineral Oil is an experimental tumorigen and a suspected carcinogen. Inhalation of vapor or particulates can cause aspiration pneumonia. This material is also combustible. Respirator cartridges will adequately protect personnel health. Suitable fire extinguishers will be maintained and accessible in the process area. Mineral oil will be received and stored in 55-gallon steel or plastic tight-head drums.

- **Sodium Sulfide**

Sodium sulfide flake is received in drums or bags on pallets which are then transferred to a designated storage area in reagent preparation area inside the Plant 6 Project Area (See Figure 3-5). Individual drums of sodium sulfide are transported to the reagent makeup area by lift truck. Sodium sulfide flake is usually fed dry and is stored at the mix unit in a single charge bucket. It can also be dissolved in water in a 55-gallon drum or a mixing tank and dispensed directly into the mixing drum as a sodium sulfide solution.

When preparing sodium sulfide solution, high pH water is used to minimize the potential for production of hydrogen sulfide gas in the work area. In the full-scale operation, pH of the reuse water will be checked and adjusted if necessary to ensure that its pH is above 9.0 before sodium sulfide is added. If traces of hydrogen sulfide gas are produced during the dissolving process, they can be easily collected and exhausted from the building by the negative pressure dust/fume collection system, which has an intake in the reagent makeup area.

- **Ferrous Sulfate**

Ferrous sulfate will be used for wastes having high concentrations of barium and chromium. Ferrous sulfate will be received as dry crystal in bags on pallets. These chemicals will be stored and handled in the same manner as sodium sulfide. Ferrous sulfate will be added dry to waste drums after sufficient slurry water has been added.

- **pH Adjustment Chemicals**

Some treatment recipes may require pH adjustment steps using acids or caustics. If acid is required, it will be added in the form of dry sodium bisulfate, which hydrolyzes with water to form sulfuric acid. If caustic soda is required, it will be received and stored in dry form. These materials will be stored in separate locations out of traffic patterns. Acid or caustic will be dispensed into compatible transfer containers suitable for that purpose, and added to the waste from those transfer containers. Acids will be segregated from caustics and sodium sulfide in the storage area by distance, so that reactions between these incompatible dry chemicals can not take place.

- **Contaminated Water Storage, and Reuse**

A 5,000 gallon polyethylene storage container will temporarily hold contaminated water from waste preparation and decontamination activities. This water is reused for waste slurrying and reagent hydration. The container will be located inside a plastic spill containment basin capable of holding 100 percent of the largest container, in an area of the building away from fork lift traffic but near points of contaminated water generation and reuse. Water is transferred to and from the tank using small diameter hoses and air-driven pumps. All pumping activities are attended by process operators at the suction and discharge ends of the hose.

3.5.7 Process Unit G - Neutralization

Process Unit G encompasses all of the processing steps included in the neutralization technology as it will be applied to the corrosives waste category.

Process Unit G, Neutralization, is the operation in which corrosive liquids are bulked together in an agitated cone-bottom neutralization container, and are treated with acid or base as appropriate to adjust the pH of the waste so that it no longer exhibits the corrosive characteristic. Where possible, waste streams will be mixed to minimize reagent requirements. For the purposes of this project, the pH control range will be 5.0 to 9.0. In most cases, caustic soda will be added to the liquids in the neutralization tank in order to raise the pH of these corrosives. For some alkaline wastes, acid additions may be required.

To minimize potential fume and vapor emissions during neutralization container operation, a submerged fill pipe will be used. Neutralization will be performed based upon titration curves developed for each batch, and in a deliberate and controlled manner, to prevent violent exothermic reactions. When the neutralization end point has been reached, the mixer in the neutralization container will be stopped, and any precipitated solids will be allowed to settle to the bottom of the container. The supernates will be removed and managed according to their physical and chemical characteristics. Organic layers will be packaged and returned to the on-site RCRA Inventory. Inorganic (water) layers will be packaged and returned to FERMCO for RCRA storage until their final disposition is determined. In a similar manner, sludge layers removed from the neutralization container will be managed based on their organic content.

Sludges containing organics or F-listed constituents will be packaged and returned to RCRA storage and subsequent disposition. Inorganic sludges will be precipitated and stabilized as previously described for Process Units C and D.

3.5.8 Reprocessing of Previously Treated Waste

In the event that treated waste in a drum (thorium waste) or in a WMB fails WAC testing, the waste monolith must be broken up and reprocessed. The first stage of this reprocessing operation is removal of the waste from its container. Either pneumatic or electric-powered demolition hammers will be used to chisel the monoliths into loose chunks. This operation could be a generator of airborne dust, so it will be performed in an enclosure with negative pressure ventilation with discharge through the HEPA system. If it is available, the C-13 Area inside the Plant 6 Building will be used. If C-13 is not available, an existing or new enclosure in the process area will be used. When the monoliths have been adequately broken up, they will be transported in their containers to the sorting station or the shredder. The chunks of waste will be fed into the shredder, either via the inclined conveyor from the sorting table or directly into the shredder. These process areas are also enclosed and connected to the negative pressure ventilation system. If the shredder must be used to reduce the size of thorium containing waste, the shredder will be completely enclosed and the enclosure will be ventilated through the HEPA filtration system.

3.6 Waste Minimization Plan

3.6.1 Waste Minimization by Prevention of Contamination

The potential for the project to significantly contribute to the contamination of Plant 6 is minimal. From a radiological and hazardous waste viewpoint, the historical use of Plant 6 has contaminated the building to the extent that this project has no potential to significantly contribute to the contamination, except for thorium. Special precautions will be taken to prevent contamination from thorium, and in areas where spills or leaks of liquid waste on the building floor are anticipated, Herculite™ or equivalent floor covering will be used to provide a local contamination barrier. Otherwise the floors of the building will not be covered.

Another precaution to be employed to minimize surface contamination and downstream costs associated with decontamination activities is selectively covering the exterior of equipment and container surfaces with plastic sheeting. These temporary coverings greatly limit the degree to which equipment and containers become contaminated on their exterior surfaces. This prevention measure should expedite health physics clearance for release of equipment and containers for off-site shipment.

Another means of containing the spread of contamination may be the enclosure of fugitive dust sources within temporary structures. These enclosures may be connected to the negative dust collection system and vented through a HEPA controlled system.

Also, to minimize potential waste materials brought into the Plant 6 exclusion zone, unwrapping, decontainerizing, or unpacking of equipment (including tools and materials) will be done prior to entry into Plant 6. This will keep as much packing material as possible from becoming contaminated. Portland cement will be brought in by pneumatic truckload shipment and stored in a mobile cement silo located outside the Plant 6 building.

3.6.2 Prevention of Environmental Media Pollution

Potential discharges of pollutants to soil, surface water, groundwater, and the atmosphere will be minimized by the following measures. For soil and groundwater pollution prevention, project activities will be performed inside Plant 6. Bulk liquid storage areas inside the Exclusion Zone of Plant 6 will be provided with temporary secondary containment. Care will be exercised at all times to prevent spills from occurring inside or outside the Exclusion Zone. When spills or leaks do occur, prompt response action by the FEMP site labor force or the Perma-Fix team will be taken to contain and cleanup the spill, with all recovered materials being properly managed as recyclable materials or as wastes.

For water pollution prevention, every effort will be made to close the water balance by reusing all contaminated waters in the hydration of wastes and reagents during the treatment process. Contaminated water will be accumulated in the contaminated water holding tank until the water can be reused. When excess contaminated water is generated, it will be packaged, labeled, marked, and returned to the FEMP site RCRA inventory pending characterization.

Air pollution from the treatment process will be minimized by presoaking waste as necessary, and by providing dust suppression using water sprays at all likely fugitive dust emission points. Water will not be used for the suppression of magnesium wastes. Also, a negative pressure ventilation system of hoods, hoses and ducts will draw air from the fugitive dust zones and discharge it to the atmosphere outside the Plant 6 building via HEPA filters equipped with dust pre-filters.

3.6.3 Management of Facility Waste Containers

Primary wastes for this project will include the four specific waste categories, macro solids, and free water layers separated from these wastes during waste preparation. Secondary wastes will include used personal protective equipment which has exceeded its useful life, contaminated area isolation materials, decontamination water, HEPA filters, and uncontaminated solid wastes. The Perma-Fix Team will manage all waste materials in cooperation with FERMCO, to minimize hazards to the project personnel, other personnel on the Fernald Site, the public, and the environment. The team will assist FEMP site personnel in complying with all substantive requirements under the Federal and state regulations identified in Section 4.0 that relate to identification, characterization, labeling, marking, inspection, tracking and storage of hazardous wastes in containers or tanks. Also, the team

will comply with the 40 CFR 265 and OAC 3745-65 requirements for emergency preparedness and response. The following Fernald site procedures will be used to ensure compliance with these waste management requirements:

EW-0001	"Initializing Waste Characterization Activities using the Material Evaluation Form"
SOP-20-C-017	"Movement of RCRA and Hazardous Waste"
SOP-20-C-500	"Inspecting RCRA Waste Load/Unload and Staging Areas"
SOP-20-C-616	"Inspection of Hazardous Waste Management Units"
SOP-20-C-630	"Receipt Inspection and Placement of Hazardous, Mixed, PCB and Asbestos Wastes into Storage"
SOP-20-C-606	"Hazardous Materials Spill Clean-up"
SOP-0067	"Spill Incident Reporting and Clean-up"
EP-0005	"Controlling Aqueous Waste Water Discharges into the Waste Water System"

3.6.4 Facility and Container Inspections

Inspections of waste and holding containers, and equipment in the Plant 6 Exclusion Zone will be conducted weekly when maintenance and housekeeping activities are performed in the process area. Also, container storage and staging areas will be inspected weekly by FEMP site personnel. Inspections in container storage or staging areas will include, but not be limited to, inspection of containers for leaks, damage, indications of overpressure, loose or illegible labels, aisle spacing, and waste compatibility. The presence and accessibility of adequate quantities of emergency response equipment will be verified. The area in which waste materials are held in containers will undergo an inspection of the secondary containment for evidence of leakage from the container.

Process equipment will be inspected for any mechanical or electrical conditions which could cause an accident or emergency or render the equipment inoperable if not corrected. If such a condition is found, the equipment will be immediately tagged out of service, and maintenance or repairs will be initiated. Before maintenance or repair work can take place, the equipment must be de-energized and locked out by the person performing the work so that it cannot be re-energized until the lock is removed. The lock-out/tag-out procedures in place at the FEMP site will be used in these situations. If hot work (cutting, grinding, or welding) is required, the FEMP site hot work authorization procedure will be followed carefully to ensure that hot work is conducted safely.

3.6.5 Spill Response

In the event that the inspection tour reveals a leaking container or accumulations of dry or liquid mixed wastes in process equipment or on the floor, immediate action will be taken to contain, cleanup and package the materials in question. Perma-Fix team personnel will perform all spill response and related housekeeping within the Exclusion Zone. Spill kits containing dry

absorbent granules, pads and booms will be located in the Exclusion Zone close to areas of potential spills or leaks. In the event of a large spill or a spill that causes a condition immediately dangerous to life or health (IDLH), Perma-Fix and FEMP site personnel will evacuate the Exclusion Zone, notify the Fernald Assistant Emergency Duty Officer (AEDO) and stay outside the Exclusion Zone until allowed to return by Fernald site personnel.

3.6.6 Management of Contaminated Water

Wash water will be collected in the contaminated water holding container. Contaminated water is reused to slurry wastes and dissolve reagents. The objective is to operate the process with a zero discharge water balance if possible. The production rate of contaminated water from decontamination and housekeeping operations is managed in order to avoid exceeding the capacity of the waste to consume water. If excess water is produced, it will be packaged as directed by FEMP site personnel. Excess contaminated water will be returned to on-site RCRA inventory pending characterization and disposition.

3.6.7 Management of Secondary Waste

Secondary wastes listed in Table 3-1 will be segregated into separate containers by category so that they may be managed as efficiently as possible. The most significant secondary waste stream will be used personal protective equipment and protective clothing. At each break, personnel in the Exclusion Zone will pass through a dress-out area where personal protective equipment and clothing will be doffed. Respirators and cartridges will be replaced each time a seal is broken. Separate plastic-lined collection drums for protective clothing, used respirators, outer boots and disposable items (e.g., gloves, tape, cartridge wrappers) will be provided at the egress station. Fernald site personnel will manage these accumulated secondary wastes. Fernald site personnel will also manage the segregation and handling of all personnel protective equipment.

Spent die filters and HEPA filters removed from the negative pressure ventilation system will be hand fed into the shredder for size reduction. The shredded filters will be treated by the same technologies used to treat the waste which contaminated the filters.

3.6.8 Management of Miscellaneous Waste Materials

Miscellaneous secondary waste materials include contaminated polymeric sheeting and wipes used for decontamination. Contaminated plastic will be washed and/or vacuumed in place to remove potentially leachable waste constituents before the plastic is removed from the process area. Decontaminated polymeric sheeting will be bundled for disposal by Fernald site personnel. All reagent containers will be completely emptied before being staged for pick-up and disposal by Fernald site personnel.

3.6.9 Materials Management

Non-waste materials such as reagents, equipment spare parts, and consumable supplies will be managed to prevent emergency situations from spills or releases, and to prevent project delays due to shortages of critical supplies. The consumable supplies are vendor-supplied materials necessary to make the production process function. These include fuels, equipment maintenance supplies (e.g.: lubricants, hydraulic fluids, filters, etc.), hand tools, spare parts, quality control test supplies (such as distilled water and lead-acetate paper), housekeeping supplies, emergency or spill response supplies, and office supplies.

Reagents and supplies will be received, handled, processed, and stored in accordance with applicable procedures. Records of supplies are made and receipts are kept. The record shows the date received, quantity received, condition when received, and where the reagent or supplies are to be stored. Supplies are handled carefully. Operations are inspected to see if handling and use can be improved. Bulk materials should be moved pneumatically, with pallets, or other carriers whenever possible. All supplies rejected at inspection will be considered for rework unless they are irreparably damaged. Regular, periodic inspection of both the storage area and inventories will be made.

DOP tested HEPA prefilters for the negative pressure ventilation system will be provided from FEMP site inventory and installed by FEMP site personnel. Perma-Fix will provide replacement prefilters to replenish the FEMP site inventory. Replacement filters provided by Perma-Fix must be DOP tested by others before they are placed in on-site inventory.

The reagents certain to be used during this project include sodium sulfide, portland cement, gypsum, and ferrous sulfate. Other reagents that may be used are sodium bisulfate, blast furnace slag, quick lime and caustic soda. In addition to the process reagents, wash detergents, lubricants, greases, and hydraulic oils will be used to maintain and operate the equipment. Prior to mobilization, MSDSs are supplied for each of these materials and for any chemicals subsequently identified as being necessary to the project. The Worker Right-to-Know Program, files, and training are managed per the *Superfund Amendments and Reauthorization Act* (SARA) Title III requirements.

Material control for this project is the method by which all materials, supplies, and purchased parts are obtained and stored at the project site until they are used, and which inventories are controlled to prevent shortages. The quantity of each item that triggers the ordering of replenishment stocks is determined, considering lead time, supplier reliability, the value of the materials, the cost of storage, and risks of deterioration. Documentation concerning the quality of materials used in the process is retained with the project files. Typically, this documentation includes:

- Manufacturer and lot number for calibration standards.
- Certificates of analyses for chemicals used in decontamination.
- Certificates of decontamination furnished by the equipment manufacturer.
- Material certificates and lot numbers for construction materials.

Materials will be received in advance of scheduled production processing. A hand check of materials and supplies in stock is routinely made. Project personnel will determine when the reorder point is reached for bulk consumable items.

3.7 FACILITIES AND EQUIPMENT

This section describes the facilities and equipment to be used to treat the mixed waste. FEMP site will provide water, electricity, local phone service, and shelter for the waste treatment equipment. All tools, vehicles, and equipment will be inspected by Fernald Site personnel for radioactive contamination prior to initial entry and upon removal from the designated processing area. An accurate and up-to-date floor plan will be maintained in a current condition showing placement of equipment and work stations, as well as dimensions of work areas around equipment.

3.7.1 Processing Facilities

This treatment project will be performed at the Fernald site located near Fernald, Ohio, approximately 20 miles northwest of downtown Cincinnati.

All waste treatment operations will be performed in an Exclusion Zone inside Plant 6. The space requirements of the work area are a function of available space, operational requirements, critical equipment dimensions, maneuvering space, material storage, and equipment space. A single indoor work area totaling approximately 18,000 square feet is planned. Figure 3-5 is a Plant 6 layout drawing showing the process area. The following specific work/activity stations are shown inside the Exclusion Zone:

- Buffer zone (delivery of incoming waste drums)
- Incoming waste staging area
- Drum opening and inspection station
- Screen hopper (macro solids separation)
- Sorting belt (macro solids sorting)
- Shredder (macro solids size reduction)
- Mix units (stabilization treatment)
- Neutralization container
- Contaminated water holding container
- HEPA filtration units
- Decanting and curing area
- Cured waste staging area
- Tented soaking area

The portion of the building used for the process area has unrestricted overhead clearance of approximately 20 feet above floor level. The floor is capable of safely supporting the wheel load of a 8,000-pound rated capacity fork lift, fully loaded. Secondary containment pans and basins and Herculite™ floor coverings will be used as appropriate in locations where a high

potential exists for liquid spills or leaks. Otherwise the floors will remain uncovered. There are no floor drains in the area where the treatment process will take place. Any joints in the floor covering will be overlapped and sealed with Herculite™ bonding compound. Herculite™ may also be used as a tenting material in locations where barrier control of air exchange is required. A HEPA wet-vac will be used in daily housekeeping of the process area to prevent accumulation of contaminants on the floor. F-listed wastes generated during the processing cycle will be segregated from other wastes generated during the processing cycle.
The process area in Plant 6 already has substantial floor contamination which is subject to future decontamination and decommissioning requirements. Routine floor cleaning will be performed jointly by Perma-Fix and Fernald site personnel.

3.7.1.1 Decanting and Curing Area

Figure 3-5 shows the location of the decanting area and the curing area. The decanting area is approximately 375 square feet in size and is located near the mix unit to minimize travel distance. The curing area totals approximately 1,500 square feet and is located at the northern end of the process area. Individual 55-gallon mixing drums of treated waste will be brought to the decanting area where they will be upended and emptied into WMBs for setting and curing. The WMBs will remain in this area until they are full. Then each full WMB will be transported by lift truck to the curing area, where it will remain until setting and initial curing are complete, estimated at 48 hours. Then the WMBs will be move to a cured waste staging area outside the exclusion zone.

The only exception to the decanting and curing process just described may be for the thorium-bearing wastes in the oxidizer waste category. These wastes may be allowed to cure in the mixing drums, with closed drums being overpacked in WMBs. In this case, there will be no decanting.

3.7.1.2 Cured Waste Staging Area

The cured waste staging area is contiguous to the Process Area, but is located outside the exclusion zone along two major drive aisles of Plant 6. There is in excess of 8,000 square feet of space in this cured waste staging area. This portion of the work area has the same overhead clearance and floor load capacity as the process area.

3.7.1.3 Incoming Waste Staging Area

The incoming waste staging area is located inside the process area, inside the exclusion zone, and totals approximately 1,600 square feet.

3.7.1.4 Reagent Makeup Area

The reagent makeup area is located inside the process area, inside the exclusion zone and totals approximately 300 square feet. This is the area where individual charges of treatment reagents are prepared. Reagent charges will be either dry, or in aqueous solution. Primary reagents are

portland cement, sodium sulfide, and ferrous sulfate. Sodium bisulfate, sodium hydroxide, gypsum, and/or lime may be used for pH adjustment. Acids, caustics and potentially reactive reagents will be segregated from each other in storage.

3.7.1.5 Exclusion Zone

The exclusion zone is the area of Plant 6 that will be restricted to project personnel, authorized Fernald site personnel and visitors specifically authorized and qualified to enter in accordance with the Health and Safety Plan in Appendix A of this Work Plan. Personnel entering the exclusion zone must utilize the proper radiation work permit (RWP) and don the prescribed PPE, and must comply with all other posted entry requirements. The boundary of the exclusion zone is shown in Figure 3-5.

3.7.1.6 Emission Control and Off-gas Operations

Suppression of dust with water mists, and pneumatic collection and filtration of fugitive dusts in the process area is a key feature of the Health and Safety Plan for this project. At each location where dust generation is likely, the dust zone will be hooded, and a pneumatic intake will draw a flow of air sufficient to provide adequate capture velocity to capture dust, gases and vapors that may be generated by the processing activity. Each intake and its downstream duct network will be vented to a properly sized HEPA filter which will exhaust to atmosphere outside the Plant 6 building. Each HEPA unit will also be equipped with a pre-filter. The location of the HEPA filter(s) is shown in Figure 3-5. The water misting equipment will be installed around openings of the screen hopper where the drums will be dumped and above the shredder.

3.7.2 Processing Equipment and Maintenance

The processing equipment to be used for stabilizing the mixed waste is listed below.

- Contaminated Water Holding Container
- 1200 Gallon Cone Bottom Neutralization Container
- Portland Cement Silo
- Conveyor Systems
- Mixing Units
- Shredder
- Drum Lift
- Screen Hopper
- HEPA Units
- Sorting Table
- Chemicals
- Protective Equipment
- Spill Control
- Absorbents and Equipment
- Small Tools and Equipment for Processing and Sampling

Equipment to be added specifically for this project and the process control for this equipment consist of one 1,200-gallon cone bottom, polyethylene blending container with an electric-drive mechanical mixer in the top, appropriate air-driven double diaphragm pumps and hoses, and a pH/temperature monitor. All of the new equipment will be used in the neutralization of liquid waste from the corrosive category. The diaphragm pump and hoses will be used in transferring corrosive liquids into and out of the cone bottom container and possibly in providing agitation to the container via a pump-around loop. The pH/ temperature monitor will provide real-time pH and temperature measurements to guide the operators in controlling reagent additions, and in minimizing build-up of exothermic heat in the container, hoses, pumps, or piping. The container contents will be thoroughly agitated throughout the neutralization step so that the entire volume of liquid waste will act as a heat sink during the reaction. The rate of reagent addition will be controlled to prevent the temperature of the liquid from reaching a level that would threaten the integrity of the container, hoses, pumps, or piping. The container will be located inside the existing polyethylene secondary containment basin. The atmospheric vent of the neutralization container will be connected to the negative pressure ventilation system.

Before any waste is neutralized in the cone-bottom container, representative samples of the waste by MEF will be collected and subjected to bench-scale titration with the neutralization reagent to develop a titration curve for the waste. Also, acidic and basic wastes will be blended together to take advantage of their inherent neutralization capability. Titrations of those blends may also be performed. The derived titration curves will be used to calculate the approximate reagent amount and addition rate that will be needed to accomplish the desired neutralization. After the start of neutralization, the pH/temperature monitor will be used by the operators in controlling the reaction.

After monitoring data shows the neutralization of a specific batch to be complete and the heat of reaction has sufficiently dissipated, the agitation of the container will be stopped and any solids produced by the reaction will be allowed to settle into the cone section of the container. The clear supernate will be pumped into containers provided by FEMP site personnel and returned to the on-site RCRA inventory. The settled sludge layer will be drained into mixing drums for downstream handling and management. If it proves necessary to further concentrate the solids prior to stabilization treatment, the sludge will be pumped through a bag filter, with the filtrate combined with the clear supernate, and the filter cake being treated for stabilization, if appropriate.

3.7.2.1 Equipment Maintenance

Maintenance will be performed on all equipment as needed to keep all process operations going. There will be two aspects to preventive maintenance. First, routine maintenance such as lubrication and cleaning will be performed regularly by the operating crew members and in accordance with manufacturers instructions. For major corrective maintenance, a mechanic (other than a crew member) may be brought in. Every attempt will be made to anticipate the need for maintenance and repair. Key features of the plan are as follows:

- Critical spare parts will be kept on site in case of failure. Parts include mixer propellers, shredder knives, hydraulic fluid, air prefilter elements, HEPA filter elements, air and hydraulic hoses, and housekeeping supplies.
- Operating crew members are experienced mechanics who can work on all equipment used.
- Housekeeping will be performed daily.
- HEPA filter differential pressure will be monitored daily.
- Shredder blades will be replaced if and when they fail to perform their intended function.
- Cleanup will be performed using fresh water which is drained, collected with HEPA wet-vacs and recycled by being added to waste during treatment.
- National Electrical Manufacturer's Association (NEMA) frame motors for the shredder will be available within 24 hours.

3.7.3 Utilities

The following utilities will be required to efficiently perform the work. At the present time, all of these utility drops are in existence and connected to Perma-Fix equipment in Plant 6.

- Electric Power

40 HP shredder motor (1 each)	440 VAC, 3 phase, 52 amps full load
30 HP mixer drive motors (2 each)	440 VAC, 3 phase, 40 amps (each) full load
5 HP HEPA units (2 each)	440 VAC, 3 phase, 7.6 amps (each) full load
110 HP Total 440 VAC, 3 Phase Load	440 VAC, 3 phase, 147.2 amps full load
3 HP belt conveyor drive motor (1 each)	208 VAC, 3 phase, 11 amps full load
3 HP screw conveyor drive motor (1 ea.)	208 VAC, 3 phase, 11 amps full load
6 HP total 208 VAC, 3 phase load	208 VAC, 3 phase, 22 amps full load
3 HP total of miscellaneous utilities	120 VAC, 1 phase, 40 amps full load

. Potable water	15 gpm peak flow capacity
Compressed air	100 PSIG for air-power hand tools
Sewer connection	For hand wash and personnel showers only
Lighting	By FEMP site

3.7.4 Fernald Site Provided Services

In addition to the utilities listed above, the Fernald site will provide various services, equipment and materials for this project. The following specific items are included:

- An 18,000 square foot area inside Plant 6 for the process area.

- Waste operations personnel and equipment for drum staging, deheading, inspection, decanting, fork truck operation, and general area housekeeping.

- Laboratory analytical services for process feedback and waste acceptance analyses by the TCLP extraction procedure for comparison against the regulatory levels specified in 40 CFR 261.24, and applicable LDR requirements including the UTS specified under 40 CFR 268.48.

- Specification WMBs for packaging stabilized waste for disposal at the designated disposal site.

- On-site transportation services for incoming waste containers and WMBs filled with stabilized wastes.

- Removal, treatment and discharge of any excess free water or decontamination waters contained in the contaminated water storage tank.

- Removal and disposal of RCRA-empty containers and incompatible macro solids from the empty container staging area, or neutralization tank.

- FERMCO Radiological Control and industrial hygiene monitoring support.

- Removal, on-site management, recycle, and/or ultimate disposal of any project-generated secondary wastes which are not amenable to treatment and co-disposal with the treated primary wastes.

3.8 PROJECT SUMMARY SCHEDULE

A Project Summary Schedule showing major milestones of the project is in Figure 3-6. These milestones are regulatory requirements of the project. The Phase I Work Plan must be approved by the Ohio EPA and U.S. EPA before operations may proceed. Phase II activities cannot begin until the U.S. EPA and Ohio EPA approval is obtained. The project schedule requires DOE's Final CERCLA Technology Specific Work Plan to be submitted to the regulatory agencies by June 14, 1996, and agency approvals by July 10, 1996. This schedule will be maintained for the duration of the project and will provide the basis for progress tracking and reporting.

3.8.1 Project Delivery

The Perma-Fix team will meet all start and end dates specified by FERMCO. A contract was awarded April 26, 1996. The Perma-Fix team provided a draft documentation package to FERMCO. Consisting of the following materials, at a minimum:

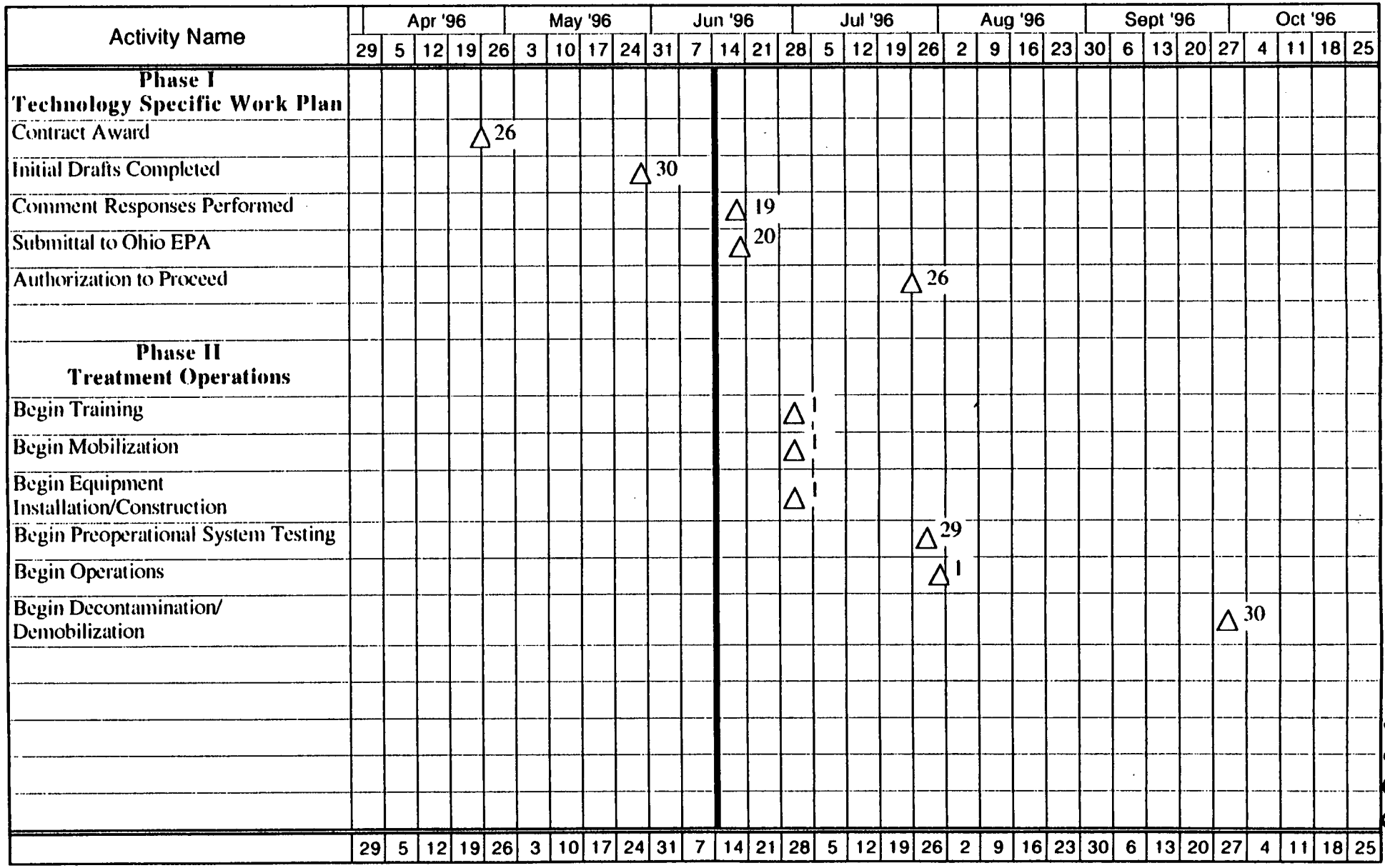

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Figure 3-6

Project Summary Schedule

Fernald Mixed Waste Chemical Treatment Project

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- Perma-Fix's Schedule
- Perma-Fix's Quality Assurance Plan
- Perma-Fix's Equipment Operating Procedures
- Perma-Fix's equipment layout drawings, including services requirements
- Perma-Fix's Technology Specific Work Plan
- Input for FERMCO's Health and Safety Plan
- Monthly Progress Reports

Following review of the draft documents by FERMCO, Perma-Fix will submit a final OEPA documentation package to FERMCO by June 20, 1996 which will include the following:

- Perma-Fix's Technology Specific Work Plan
- Perma-Fix's Schedule
- Perma-Fix's Quality Assurance Program Plan
- Perma-Fix's input to the Project Specific Health and Safety Plan
- Perma-Fix's equipment layout drawings including services requirements

This second package of documents will address comments received from FERMCO and DOE. When FERMCO provides notice to proceed with Phase II, the Perma-Fix team will proceed immediately with mobilization.

3.9 DECONTAMINATION ACTIVITIES

Decontamination activities are an integral part of this project. The primary method of decontamination will be performing surface wash and rinse of nonporous items using a soapy (dilute detergent solution) water wash followed by a clean water rinse. This method will also be applied to the decontamination of reusable equipment and tools and also will be used for area cleanup and housekeeping as appropriate. Recovered wash and rinse solutions will be reused directly in the preparation and treatment of waste or will be collected and transferred to the contaminated water holding container, for holding until reuse at a later time.

At the end of the project, the Plant 6 process area and all the equipment it contains will be decontaminated for closure. Dry vacuum, solution flush, triple-rinse, and surface wipe procedures will be used as appropriate in final decontamination of the reusable equipment and process area. Accumulated decontamination waters will be held in the contaminated water holding container or collected in the Plant 6 sump for waste characterization by FEMP site personnel. Decontamination activities will be performed in compliance with DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* and FERMCO site procedure RP-0009, *Radiological Requirements for the Release of Materials at the Fernald Environmental Management Project,* and OEPA draft *Closure Plan Review Guidance for RCRA Facilities.*

3.9.1 Decontamination of Equipment Prior to Use

New equipment is considered uncontaminated by hazardous or radioactive waste. No survey or measurements will be made unless requested by FERMCO. Before any previously used equipment is brought on site to be used on the project, it will be surveyed for contamination and decontaminated if necessary to protect against cross contamination and to avoid adding additional waste codes to the wastes.

3.9.2 Decontamination for Routine Good Housekeeping

FERMCO Radiological Control technicians make routine surveys of fixed or removable contamination in the facility. If removable contaminants in excess of posted values are detected on floors or work surfaces in the exclusion zones, then the surfaces will be promptly decontaminated as described above.

3.9.3 Decontamination of Macro Solids Found in Waste

Macro solids that prove to be unshreddable or incompatible with the waste treatment process will be separated from the waste in the screen hopper and sorted on the sorting table. Process-compatible, unshreddable macro solids will be surface decontaminated by the wash/rinse methods previously described. If these materials are porous, they will be packaged and managed in the Plant 6 process area as mixed wastes until they are returned to the Fernald site mixed waste inventory. If these materials are nonporous, then surface decontamination will reduce both hazardous and radioactive surface contaminants to insignificant levels. Nonporous, unshreddable macro solids will be taken to the decanting and curing area and sunk into the stabilized waste from the same CWG in the WMB. Any residual RCRA metal contamination on the surfaces of the nonporous macro solids will react with the excess reagent in the stabilized waste, causing precipitation of the metals in the same manner as the metals stabilized at the mix unit.

Porous macro solids that cannot be decontaminated, or macro solids that are on the prohibited items list (Table 3-2) will be packaged, labeled, marked and staged for disposition by FEMP site personnel.

Recovered wash and rinse solutions from surface decontamination of macro solids will be reused directly in the preparation and treatment of waste or will be collected and transferred to the contaminated water holding container until reuse at a later time.

3.9.4 Decontamination of Reusable Equipment and Process Area After Waste Processing

For the purposes of this Work Plan, most process equipment is considered to be reusable under OEPA Closure Plan Review Guidance for RCRA facilities. Once the waste is processed, equipment which has become contaminated with waste constituents will be decontaminated and managed as follows. Decontamination will consist of a high pressure rinse using a soapy water wash followed by a clean water rinse to remove all visual contamination. Equipment will be triple rinsed prior to being surveyed. Wastewater generated will be drummed for disposition pending characterization. The equipment will then be surveyed for radiological contamination by FERMCO Radiological Control for unrestricted free release. If equipment requires further decontamination, it will be steam cleaned, pressure washed, or scrubbed prior to resurveying.

Wipe methods may also be used to enhance the effectiveness of decontamination. Any used wipes will be double contained in taped plastic sheeting or plastic bags. Drop cloths used during decontamination activities will be rolled to the inside and taped for reuse. Visible material contamination will be removed by the wash and rinse methods, except that the wash and rinse solutions will be collected using HEPA wet-vacs. FERMCO Radiological Control technicians will confirm that the process operations have not significantly increased fixed or removable contamination levels above as-found levels by repeating the measurements made in the baseline survey. If contamination exceeds baseline levels, FERMCO Radiological Control personnel will assist the subcontractor in further decontamination efforts.

Equipment that cannot be radiologically decontaminated will be released to a Nuclear Regulatory Commission (NRC) or agreement state-licensed storage facility because contaminated equipment intended for further use in the processing of mixed or radioactive waste does not require decontamination to radiological limits for unrestricted use. Perma-Fix owns such a facility in Gainesville, Florida. Equipment to be shipped to Florida will be packaged in a Department of Transportation (DOT)-approved manner and surveyed to ensure that all external surfaces meet the DOT limits. Equipment stored in this manner is restricted to future use only in the treatment of mixed or radioactive wastes.

The release of any equipment for unrestricted use is considered on a case-by-case basis at the time that it is proposed for release. The following guidelines will apply:

- A reasonable effort will be made to eliminate residual contamination.
- Radioactivity on equipment surfaces shall not be covered by paint, plating, or other covering material unless contamination levels are determined by a survey to be below unacceptable limits.
- 100% survey will be required on all accessible equipment surfaces. Inaccessible surfaces will be surveyed or evaluated for release by an authorized FERMCO material release evaluator.

3.9.5 Equipment Demobilization

Demobilization activities include completion of the following checklist items prior to leaving the Fernald Site, and after decontamination.

- Empty and clean out lockers.
- Return FERMCO furnished radio (if applicable).
- Return FERMCO radio pass (if applicable).
- Sign medical termination form.
- Leave exit urine sample.
- Return Thermo Luminescent Dosimeter (TLD).
- Fill out request for final dosimetry reading.
- Take an exit INVIVO.
- Return identification badge.
- Provide forwarding address.
- Provide FERMCO with turnover debriefing information.

Upon completion of the work, the site will be restored where the equipment was installed to its prior condition. This includes, but is not limited to the removal of all equipment and supplies utilized in the processing and packing of the waste, anchor bolt removal, and pavement repairs. All restoration work will be completed to FERMCO's satisfaction. Table 3-3 identifies a sequence of actions which will be performed for closure of the Plant 6 process area.

Table 3-3

Sequence of Actions Required for Closure of Plant 6 Process Area
Fernald Mixed Waste Chemical Treatment Project

Equipment Item	Actions
Metal Duct Work	• Disassemble and remove • Decontaminate (rinse) • Sample rinseate for decontamination verification and manage wastes • Compact and manage scrap metal
Flexible Plastic Hose	• Disassemble and remove • Compact and manage scrap metal
HEPA Filtration Units & Wet-vacs	• Remove and Bag Filter Elements • Disassemble and survey • Decontaminate (rinse) • Sample rinseate for decontamination verification and manage wastes • Free release for unrestricted use or maintain on-site for restricted use • Spent HEPA filters will be shredded and stabilized
Contaminated Water Piping	• Flush to Contaminated Water Holding Container to decontaminate in-place • Disassemble and remove • Decontaminate (rinse) • Sample rinseate for decontamination verification and manage wastes • Compact and manage scrap metal
Tanks and Secondary Containment	• Decontaminate (rinse inside and outside and vacuum) • Decontaminate (wipe inside and outside if necessary • Sample rinseate for decontamination verification and manage wastes • Free release for unrestricted use or maintain on-site for restricted use

Equipment Item	Actions
Screen Hopper & Frame including drum lift	• Decontaminate (vacuum and/or wipe as appropriate) • Decontaminate (rinse inside and outside) if necessary • Manage wastes • Take wipe samples for decontamination verification • Sample rinseate for decontamination verification and manage wastes, if necessary • Free release for unrestricted use or maintain on-site for restricted use • Compact and manage scrap metal if necessary
Sorting Table & Chute	• Decontaminate (vacuum and/or wipe as appropriate) • Manage wastes • Take wipe samples for decontamination verification • Free release for unrestricted use or maintain on-site for restricted use • Compact and manage scrap metal if necessary
Shredder Motor & Frame	• Decontaminate (vacuum and/or wipe as appropriate) • Manage wastes • Take wipe samples for decontamination verification • Free release for unrestricted use or maintain on-site for restricted use • Compact and manage scrap metal if necessary
Shredder Knife Bed & Feed Hopper	• Decontaminate (rinse inside and outside) • Disassemble and remove knife blades for disposal • Decontaminate shafts (vacuum and/or wipe as appropriate) • Take wipe samples for decontamination verification • Sample rinseate for decontamination verification and manage wastes, if necessary • Free release machine without blades for unrestricted use or maintain on-site for restricted use • Compact and manage scrap metal (knife blades)
Macro Solids Belt Conveyor	• Decontaminate (rinse inside and outside) • Disassemble and remove belt and rollers for disposal (as necessary) • Decontaminate shafts, motor and frame (vacuum and/or wipe as appropriate) • Take wipe samples for decontamination verification • Sample rinseate for decontamination verification and manage wastes, if necessary • Free release machine without belt for unrestricted use or maintain on-site for restricted use • Compact and manage scrap materials (belt, and rollers as appropriate)

Equipment Item	Actions
Portland Cement Silo (located outside Plant 6 Process Area)	• Decontaminate (vacuum and/or wipe as appropriate) • Decontaminate (rinse inside and outside) if necessary • Take wipe samples for decontamination verification • Sample rinseate for decontamination verification and manage wastes, if necessary • Free release silo for unrestricted use or maintain on-site for restricted use
Portland Cement Screw Conveyor	• Decontaminate (vacuum and/or wipe as appropriate) • Decontaminate (rinse inside and outside) if necessary • Take wipe samples for decontamination verification • Sample rinseate for decontamination verification and manage wastes, if necessary • Free release machine for unrestricted use or maintain on-site for restricted use
Propeller Mix Units	• Disassemble and remove propeller shafts for disposal • Decontaminate (vacuum and/or wipe as appropriate) • Decontaminate (rinse inside and outside) if necessary • Take wipe samples for decontamination verification • Sample rinseate for decontamination verification and manage wastes, if necessary • Free release machine for unrestricted use or maintain on-site for restricted use • Compact and manage scrap metal
Lift Trucks & Attachments	If FERMCO supplies lift trucks: • Decontaminate (vacuum and/or wipe as appropriate) • Decontaminate (rinse inside and outside) if necessary • Take wipe samples for decontamination verification • Sample rinseate for decontamination verification and manage wastes, if necessary • Release machine for restricted use on-site
Area Isolation Materials & Floor Coverings	• Decontaminate (vacuum and/or wipe as appropriate) • Decontaminate (rinse inside and outside) if necessary • Take wipe samples for decontamination verification • Sample rinseate for decontamination verification and manage wastes, if necessary • Fold and compact plastic sheet materials • Survey and decontaminate supports as necessary • Compact and manage waste materials

Equipment Item	Actions
Hand Tools	• Decontaminate (vacuum and/or wipe as appropriate) • Take wipe samples for decontamination verification • Free release tools for unrestricted use or maintain on-site for restricted use
Used Drums & Buckets	• Decontaminate (vacuum and/or wipe as appropriate) • Decontaminate (rinse inside and outside) if necessary • Take wipe samples for decontamination verification • Sample rinseate for decontamination verification and manage wastes, if necessary • Compact and manage waste materials
Drum Roller Conveyers	• Decontaminate (vacuum and wipe as necessary) • Disassemble and remove rollers for decontamination and disposal (as necessary) • Decontaminate (rinse) rollers and frame as necessary • Take wipe samples for decontamination verification • Sample rinseate for decontamination verification and manage wastes if necessary • Free release conveyors for unrestricted use or maintain on site for restricted use • Manage scrap materials as appropriate

4.0 ENVIRONMENTAL COMPLIANCE, ARARS, AND SPILL RESPONSE

The Neutralization, Precipitation, Deactivation and Stabilization (NPDS) Project involves treatment of characteristic mixed waste solids, sludges, and liquids that contain waste constituents specified in EPA waste codes D001 through D043. The NPDS Project will proceed under RA No. 9 and the FFCAct STP negotiated between DOE and Ohio EPA. As such, the project will be exempt from the requirement to obtain formal permit approval under Section 121(e) of CERCLA and 40 CFR Part 300, provided the project complies with all Applicable or Relevant and Appropriate Requirements (ARARs) established under Federal and State environmental regulations. Table 4-1 of this section lists the ARARs for the NPDS Project and identifies the compliance strategy that will be followed to attain compliance with these requirements. A permit cross-walk, which relates specific RCRA requirements to the sections of this Technology Specific Work Plan where they are addressed, has also been included at the beginning of this document to facilitate agency review.

4.1 RCRA LDR COMPLIANCE REQUIREMENTS - UNIVERSAL TREATMENT STANDARDS

Approximately 360 containers of mixed waste contained within four mixed waste categories (barium chloride residues, reactives, oxidizers, and corrosives) will be treated under the NPDS Project. Three of the mixed waste categories (barium chloride residues, reactives, and oxidizers) will be treated at the Fernald Site to meet RCRA LDR treatment standards promulgated in 40 CFR 268.40 (OAC 3745-59) and the NTS WAC established under the Nevada Test Site - Defense Waste Acceptance Criteria, Certification, and Transfer Requirements (NVO-325. Rev. 1).

Mixed waste contained within the fourth waste category (corrosives) will be deactivated under the NPDS Project to remove the corrosivity characteristic in accordance with the 40 CFR 268.40 (OAC 3745-59) treatment standard for D002 wastes. The deactivated liquid waste will be retained for future bulking, shipment to and treatment at the TSCA incinerator under the Liquid Mixed Waste Project at a later date.

Of the four waste categories that will be treated under the NPDS Project, three (reactives, oxidizers, and corrosives) contain waste streams subject to compliance with Universal Treatment Standards for underlying hazardous constituents (UHCs) promulgated in 40 CFR 268.48. The fourth waste category (barium chloride residues) is only hazardous for TC metals (D005 and D008) and therefore, is not subject to UTS compliance in accordance with the treatment standards promulgated in 40 CFR 268.40 (OAC 3745-59). Table 4-2 lists the UHCs that will be considered for each MEF contained within the four project waste categories.

Table 4-2 was developed by applying process knowledge to identify those UHCs that would not reasonably be expected to be present in the process or routine operations that generated the mixed wastes that will be treated under the NPDS Project. Information on site-specific usage of potential UHCs was obtained from process descriptions, analytical data and source information for constituents analyzed in the OU3 and OU5 Remedial Investigation and Feasibility Studies.

Material Safety Data Sheets (MSDS) for various products used at the Fernald Site were also reviewed for this purpose. Information on commercial applications of UHCs was obtained from references such as the Merck Index, Kirk-Othmer and USEPA's electronic databases. Process knowledge documentation was also obtained from the MEF files for each waste category.

Each MEF in the NPDS Project was assessed on a case-by-case basis using information developed from the sources described above. Constituents were removed from consideration for NPDS Project wastes if 1) they were pesticides or herbicides (and thus not reasonably expected to be present in process or operations waste); 2) there was no documented usage of these constituents in on-site production or operations activities and the constituents had limited commercial application and/or were associated with wastes generated by processes not used at the Fernald Site; or 3) the results of analyses conducted during waste characterization indicated the concentration of a particular UHC was below its corresponding UTS value. Waste streams which may be added as the project progresses will also be evaluated in the same manner.

The rationale used to determine applicable UHCs for the NPDS Project is consistent with the methods described in the interim final rule for the treatment of certain ignitable (D001) and corrosive (DOO2) wastes (58 FR 29860) and the preamble to the final LDR Phase II rule which established treatment standards for D018-D043 wastes (59 FR 47982). In these rule makings, EPA supported the use of process knowledge to determine the applicability of UTS, realizing that it would be unnecessary and wasteful to require facilities to monitor for all UHCs when only a subset of these constituents would be expected to be present in a particular waste stream. As a result, 40 CFR 268.2(I) requires monitoring only for those constituents "reasonably expected to be present at the point of generation of the hazardous waste, at a concentration above the constituent specific UTS treatment standards." Accordingly, USEPA specified the determination of "reasonably expected to be present" for purposes of compliance may be based on knowledge of the raw materials used, the process, and potential reaction products, or the results of a one-time analysis for the entire list of underlying hazardous constituents (59 FR 48015). Additional detail on the Fernald Site's UTS compliance strategy is also provided in Table 4-1.

TABLE 4-1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARARS)	COMPLIANCE PLAN
National Emission Standards for Hazardous Air Pollutants - (NESHAP) - 40 CFR Part 61, Subpart H - Emissions of Radionuclides Other Than Radon From DOE Facilities	40 CFR 61.92: Radiological emissions (except radon-222 and radon-220) to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in an effective dose equivalent of 10 mrem in any one year. 40 CFR 61.07 and 61.96(b): An application for approval does not have to be filed for radionuclide sources if the effective dose equivalent caused by all emissions from the new construction or modification is less than 0.1 mrem per year. 40 CFR 61.93(b): Continuous emission monitoring is required for stacks and vents that have the potential, under normal operating condition, but without emission control devices, to release radionuclides in sufficient quantities to cause any member of the general public to receive an effective dose equivalent of 0.1 mrem/year or greater.	The dose resulting from the proposed project will be included in the annual Fernald Site NESHAP, Subpart H report. Emissions from the project will not result in exceedance of the annual standard. Radionuclide emissions from the project are not expected to cause any member of the general public to receive an effective dose equivalent of 0.1 mrem/year or greater. CAP88PC modeling will be conducted to determine compliance with the 0.1 mrem/year notification and continuous stack monitoring standards.

PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARARS)	COMPLIANCE PLAN
National Pollutant Discharge Elimination System (NPDES) Permit - OEPA NPDES Permit No. 1IO00004*ED (OAC 3745-33-05)	Wastewater discharges must not cause a violation of effluent limitations or loading rates at NPDES permitted outfalls. Discharges must be conducted in accordance with applicable terms and conditions of the site NPDES permit. These include compliance with any notification requirements promulgated in 40 CFR 122.42, and OEPA water quality standards established under OAC 3745-1.	Discharges associated with the project will comply with the current NPDES Permit. All excess wastewater that is not consumed during the stabilization process will be containerized and managed as hazardous waste until characterization indicates these wastewaters are nonhazardous and can be discharged to the Fernald Site wastewater treatment system in accordance with site procedure EP-0005 "Controlling Aqueous Wastewater Discharges into the Wastewater Treatment System." If excess wastewater is determined to be RCRA hazardous through characterization, it will be placed back into the site's RCRA inventory pending disposition under subsequent treatment projects.
Atomic Energy Act (10 CFR 835)	Radiation doses, levels, and concentrations in restricted and unrestricted areas.	Emissions from this removal action will not result in the radiation limits being exceeded in restricted and unrestricted areas in accordance with the Project Specific Health and Safety Plan.
Air Pollution Control - Permits to Install & Permits to Operate (OAC 3745-31 and OAC 3745-35)	OAC 3745-31-05(A) Permits to Install: Installation of the proposed solidification equipment must not prevent or interfere with the attainment or maintenance of applicable ambient air quality standards; and must not result in a violation of any applicable laws; and must employ the Best Available Technology (BAT) to control emissions. OAC 3745-35-02(C) Permits to Operate: The solidification equipment must be operated in compliance with applicable air pollution control laws; must be constructed, located, or installed in compliance with the substantive requirements of the permit to install; and must not violate NESHAP standards adopted by the Administrator of USEPA.	The proposed project will not interfere with the attainment or maintenance of any applicable air quality standards or cause a violation of any applicable laws. BAT will be implemented in the form of HEPA filtration to control radiological particulate emissions from the precipitation, deactivation, and stabilization treatment processes. BAT for the neutralization treatment process will consist of submerged fill. Air contaminant sources will be operated in compliance with applicable air pollution control laws and will not violate applicable NESHAP Standards.

PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARARS)	COMPLIANCE PLAN
Safe Drinking Water Act (42 U.S.C. 300G; PL 93-523)	National Primary Drinking Water Regulations (40 CFR 141). National Revised Primary Drinking Water Regulations (40 CFR 141.60 through 141.63) Ohio Primary Drinking Water Regulations (OAC 3745-81)	Compliance will be demonstrated by site-wide environmental monitoring, including air, soil, and groundwater. Reports summarizing the site-wide monitoring results will be submitted to EPA. Surface water discharges will be conducted in accordance with the site NPDES permit and are not expected to impact groundwater quality. Engineering controls and best management practices will be used to mitigate the potential discharge of contaminated wastewater to the underlying aquifer. The Fernald Site will ensure groundwater is not adversely impacted through continued monitoring under its existing Groundwater Monitoring Program.
Radiation Exposure to the Public	Radiation Dose Limit (40 CFR 192.02[b]) Radiation Dose Limit (Drinking Water Pathway) (10 CFR 834)	The project will be designed and operated to minimize the releases of radionuclides. Compliance will be demonstrated by site-wide environmental monitoring, including air, soil, and groundwater. Reports summarizing the site-wide monitoring results will be submitted to the EPA.
Resource Conservation and Recovery Act (U.S.C. 6901 et. seq.)	Hazardous Waste Determinations (OAC 3745-52-11) (40 CFR 262.11)10	Project wastes have been characterized as containing RCRA constituents regulated under EPA waste codes D001, D002, D003, D004-D043. Wastes generated from the project will be characterized in accordance with site procedure EW-0001 and the FEMP Waste Analysis Plan. Samples of treated material will be collected and analyzed to verify that the solidified material is nonhazardous and meets LDR requirements and disposal facility WACs.
	Preparing and Transporting Hazardous Waste Off-site (OAC 3745-52-20 through 31) (OAC 3745-52-40 and OAC 3745-52-42) (40 CFR 262.20 though 262.23 and 40 CFR 263.20)	Any generator who transports hazardous waste for off-site treatment, storage, or disposal must originate and follow-up a manifest for off-site shipments. Pre-transport requirements include appropriate packaging, labeling, marking, and placarding. Off-site shipments of hazardous waste generated from this project will be manifested, packaged, labeled, marked, and placarded in accordance with regulatory requirements.

PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARARS)	COMPLIANCE PLAN
Resource Conservation and Recovery Act (U.S.C. 6901 et. seq.)	Interim Status: Treatment, Storage, and Disposal General Facility Standards (OAC 3745-65-13 through 17) (40 CFR 265.13 through 265.17)	The project will operate in accordance with RCRA regulations. Existing site security measures will be utilized. Inspections will be conducted in accordance with site procedures. Personnel will be trained in accordance with Fernald Site requirements. Ignitible and reactive wastestreams will be managed to prevent accidental ignition or reaction of ignitible or reactive wastes. These wastes will be separated and protected from sources of ignition or reaction. Appropriate warning signs will be posted in all waste processing areas associated with the project. Any mixing or commingling of incompatible wastes, or incompatible wastes and materials will be conducted to prevent the generation of fumes, dust, violent reactions, or damage to the structural integrity of the device or facility containing the waste.
	Interim Status: Treatment, Storage, and Disposal Facility Preparedness and Prevention (OAC 3745-65-31 through 35, 3745-65-37) (40 CFR 265.31 through 265.35, 265.37)	Preparedness and prevention equipment, as specified in regulations, will be on-site, available, and in operating condition throughout the duration of the project. The existing site-wide internal communications/alarm systems will be used. Portable fire extinguishers and spill control equipment will be placed in accessible locations to assist in emergency response. Plant 6 is also equipped with a dry pipe sprinkler system. Warning signs are posted at all entrances to Plant 6. The site emergency preparedness and spill response procedures will be followed in the event of a spill or release.
	Interim Status: Treatment, Storage and Disposal Facility Contingency Plan and Emergency Procedures (OAC 3745-65-51 through 56) (40 CFR 265.51 through 265.56)	The existing RCRA FEMP Contingency Plan and Emergency Procedures will be followed for any hazardous waste emergency associated with the project. In the event of an off-normal event or spill, Fernald Site personnel will take appropriate actions with input from the Perma-Fix Team, as directed by the Assistant Emergency Duty Officer (AEDO).

PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARARS)	COMPLIANCE PLAN
Resource Conservation and Recovery Act (U.S.C. 6901 et. seq.)	Container Storage (OAC 3745-52-34, 3745-66-70 through 77) (40 CFR 262.34, 265.170 through 265.177)	Containers of hazardous waste will be managed and inspected in accordance with regulatory requirements. Secondary containment will be provided for the 5000-gallon contaminated water container, the 1200-gallon neutralization container, and at the drumming stations and staging areas. Containers will be handled in a manner to prevent rupture, leakage, or spillage. The containers will be compatible with all stabilized material and will remain closed during storage.
	Residue of Hazardous Waste in Empty Containers (OAC 3745-51-07) (40 CFR 261.7)	Containers used for the project will be considered empty in accordance with the requirements of this rule.
	Closure Performance Standards (OAC 3745-66-11, 3745-66-14) (40 CFR 265.111, 265.114)	Decontamination of the treatment system will be conducted to meet closure performance standards as specified in Section 4.8. Equipment contacting waste will be decontaminated in accordance with OEPA Closure Plan Review Guidance.
	Land Disposal Restrictions (40 CFR 268) (OAC 3745-59)	Wastes treated under the NPDS Project will be treated to meet applicable treatment standards found in the 40 CFR 268.40. Underlying hazardous constituents will be treated to meet Universal Treatment Standards found in 40 CFR 268.48. Compliance with applicable treatment standards will be measured by analysis of grab samples of the treated waste. Appropriate certifications will be made in accordance with the provisions of this regulation. Copies of all notices, certifications, demonstrations, waste analysis data, and other documentation produced during the project will be maintained in accordance with the provisions of 40 CFR 268.7. Additional information on compliance with UTS requirements is provided in Section 4.1 and Table 4-2 of this Technology Specific Work Plan.
CERCLA Off-site Rule (40 CFR 300)	On-site response and remedial actions must comply with the substantive requirements of applicable or relevant and appropriate requirements mandated under existing federal and/or state environmental regulations.	All material removed from the Fernald Site will be managed in compliance with applicable provision of RCRA and other federal and state requirements including EPA's off-site rule and the FEMP Waste Analysis Plan.
DOT Requirements for Transportation of Hazardous Materials (49 CFR 171 - 173 and 40 CFR 177 - 179)	No one may transport hazardous materials on public highways except in accordance with these regulations.	Off-site shipments of hazardous wastes will be conducted in accordance with these requirements. Shipping papers, marking, labeling, placarding, and emergency response information will be prepared for off-site shipments.

PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARARS)	COMPLIANCE PLAN
Occupational Worker Protection & Training (29 CFR 1904 & 1910)	All facility personnel will be trained. Employers will develop and implement a written safety and health program for employees involved in hazardous waste operations.	This removal action will be conducted in accordance with the provisions of the Project Specific Health and Safety Plan.
National Environmental Policy Act (NEPA) (10 CFR 1021)	Ensure that all federal agencies (including DOE) consider environmental impacts in the planning and decision-making phases of their projects.	In June 1994, DOE issued a revised policy on compliance with the National Environmental Policy Act (NEPA), which allowed DOE to rely on the CERCLA process to meet the procedural requirements of NEPA. Because the NPDS Project is being conducted under RA No. 9 formal NEPA documentation will not be required for the project..
DOE Orders	To be considered.	All project design activities shall be implemented according to the DOE-FN procedures.

Representatives from DOE-FN and FERMCO will conduct inspections during the performance of this response action to ensure that the actions are conducted consistent with the discussions in the PSP. The inspections will ensure that the equipment associated with the project is properly cleaned and decontaminated and that all wastes resulting from the project are properly stored, labeled, and characterized.

TABLE 4-2
UNDERLYING HAZARDOUS CONSTITUENTS

MEF #	WASTE DESCRIPTION	EPA WASTE CODE	UTS RATIONALE	UNDERLYING HAZARDOUS CONSTITUENT
OXIDIZER CATEGORY				
1949	Draw Temp 275	D001	Unused chemical from laboratory. Based on MSDS, Draw Temp 275 is an oxidizer and does not contain any underlying hazardous constituents (UHCs).	None
20145	Decant water from sump/filter cakes	D002, D007	Decant water from drums of sump/filter cake from Hanford. PK indicates filter cake generated from U pickling or cleaning operations. Wastes left to settle, forming a sludge or were treated with an alkali to precipitate uranium compounds. Analytical results for TCLP metals indicate that chromium is the only TC metal present in concentrations above TCLP and UTS limits. No other inorganics UHCs should be present, with the exception of beryllium and nickel which could have leached from stainless steel in tanks and lines from pickling operations. Analysis of Total VOAs indicates acetone also present in concentrations above the UTS limit. No other inorganic or organic constituents are expected to be present in concentrations above the UTS limit.	Beryllium Chromium Nickel Acetone

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TABLE 4-2
UNDERLYING HAZARDOUS CONSTITUENTS

MEF #	WASTE DESCRIPTION	EPA WASTE CODE	UTS RATIONALE	UNDERLYING HAZARDOUS CONSTITUENT
30080	Black sludge and green liquid	D002, D004, D007, D008, D011	Process knowledge indicates that the sludge material is comprised of digester solids which settled in the bottom of Plant 2/3 digester tanks. The solids were periodically removed and drummed. Analytical results indicated TC metals all below TCLP values and UTS limits except those for which the waste exhibits the toxicity characteristic. Analysis of Total VOAs indicates trace amounts of acetone, benzene, ethyl benzene, tetrachloroethane, toluene, xylene, and methyl ethyl ketone, however, the concentrations of these parameters are below their UTS limits based on analytical results conducted during waste characterization. No other inorganic or organic constituents are expected to be present in concentrations above UTS limits in this waste stream.	Arsenic Chromium Lead Silver
30081	Discarded Process Residues and Slurries	D002	Process knowledge indicates waste consists of discarded process residues, trailer cake, waste slurries, or raffinates generated at the Plant 2/3 Hot Raffinate Building. Analytical results indicate TC metals below TCLP values and UTS limits. Analysis of Total VOAs indicates trace amounts of tetrachloroethane, toluene, methyl ethyl ketone and 1,1,1 - trichloroethane are present within the waste at concentrations below their UTS limits. No other inorganic or organic constituents are expected to be present in concentrations above UTS limits in this waste stream.	None

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TABLE 4-2
UNDERLYING HAZARDOUS CONSTITUENTS

MEF #	WASTE DESCRIPTION	EPA WASTE CODE	UTS RATIONALE	UNDERLYING HAZARDOUS CONSTITUENT
40122	Thorium Trailer Cake	D002, D005, D009	Process knowledge indicates waste consists of trailer cakes, waste slurries, and raffinates not meeting discard specifications. The generation source of this waste is the analytical lab. The waste consists of lab samples from the processing of thorium material. Analytical results indicated toxicity characteristics (TC) metals all below UTS limits except those for which the waste exhibits the toxicity characteristic. All organics analytes were below their corresponding UTS limits. Based on process knowledge obtained during the Thorium Nitrate Project, beryllium is expected to be present in thorium waste at concentrations greater than the UTS limit. No other inorganic or organic constituents are expected to be present in concentrations above UTS limits in this waste stream.	Barium Beryllium Mercury
40152	Thorium Oxide/Fluorides	D005	Waste exhibits toxicity characteristic for TC metal (D005) only and therefore, UTS compliance not applicable pursuant to 40 CFR 268.7 and 268.40.	Not Applicable
40181	Thorium nitrate solutions	D002, D005, D007, D008	Impure thorium nitrate solution generated from ore and from reuse of thorium metals. Unconfirmed sampling of other thorium materials indicates barium, beryllium, lead, chromium may be present at concentrations greater than the TCLP regulatory limit. Other UTS metals noted as impurities in ore are cadmium, nickel, selenium, and silver. Mercuric nitrate also used in reaction process. Process knowledge indicates no organic UTS constituents are present in concentrations above UTS limits.	Barium Beryllium Cadmium Chromium Lead Selenium

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TABLE 4-2
UNDERLYING HAZARDOUS CONSTITUENTS

MEF #	WASTE DESCRIPTION	EPA WASTE CODE	UTS RATIONALE	UNDERLYING HAZARDOUS CONSTITUENT
40185	Thorium nitrate solid	D001, D005, D007, D008	Solid impure thorium nitrate from tanks and filters. Sampling or other thorium materials indicates barium, beryllium, lead, and chromium may be present at concentration greater than the TCLP regulatory limit. Other UTS metals noted as impurities in ore are cadmium, nickel, selenium, and silver. Mercuric nitrate was also used in reaction process. Process knowledge indicates that no organic UTS constituents are present in concentrations above the UTS limit.	Barium Beryllium Cadmium Chromium Lead Selenium
40186	Impure thorium nitrate (solid)	D001, D007, D008	Solid impure thorium nitrate from tanks and filters. Sampling of other thorium materials indicates barium, beryllium, lead, and chromium may be present at concentration greater than the TCLP regulatory limit. Other UTS metals noted as impurities in ore are cadmium, nickel, selenium, and silver. Mercuric nitrate was also used in reaction process. Process knowledge indicates that no organic UTS constituents are present above the UTS limits.	Beryllium Cadmium Chromium Lead Selenium
40192	ThO2 Powder, Refinery Feed	D008	Waste exhibits toxicity characteristic for TC metal (D008) and therefore, UTS compliance not applicable pursuant to 40 CFR 268.7 and 268.40.	Not Applicable

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TABLE 4-2
UNDERLYING HAZARDOUS CONSTITUENTS

MEF #	WASTE DESCRIPTION	EPA WASTE CODE	UTS RATIONALE	UNDERLYING HAZARDOUS CONSTITUENT
60095	Contaminated TBP and/or Kerosene Mixtures	D002, D005	Process knowledge indicates the material is residual UNH solution blended with TBP/kerosene from the extraction process. The material was ordinally coded as TBP/kerosene from the Oliver Filter in the Metal Digester of Plant 5, however, the low pH value observed in this waste matrix is not indicative of TBP/kerosene alone. Analytical results indicate TC metals all below TCLP and UTS regulatory values except barium (125 ppm). Analytical results reported detection of acetone, MEK, and methylene chloride at concentrations below UTS limits. No other inorganic or organic constituents are expected to be present in the waste stream.	Barium
60160	Impure uranyl or thorium nitrate solids	D001	Enriched uranyl nitrate from Safe Geometry Evaporator Calciner (Plant 2/3) and 2 off-site labs. UNH from Plant 2/3 leaked from process pipes, crystallized and was drummed - may have come in contact with floor sweepings and debris. Off-site lab likely produced the UNH liquors from uranium metal. Waste may have been stored in stainless steel drums so could contain nickel and chromium at concentrations above UTS limits. Process knowledge indicates that no organic UTS constituents should be present.	Chromium Nickel
60193	Uranyl or thorium nitrate solution	D002	Waste is purified uranyl nitrate solution from Fernald Site Lab and is not expected to contain inorganic UHCs at concentrations above UTS limits. Process knowledge indicates that no organic UTS constituents are present in concentrations greater than UTS limits.	None

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TABLE 4-2
UNDERLYING HAZARDOUS CONSTITUENTS

MEF #	WASTE DESCRIPTION	EPA WASTE CODE	UTS RATIONALE	UNDERLYING HAZARDOUS CONSTITUENT
CORROSIVE CATEGORY				
816	Oily water from Drum Bailer Sump in Drum Reconditioning Area of Drum Bailer in Plant 1, Building 66	D002, D018, D019, D039, D040	Waste consists of oily water from the Drum Bailer Sump. The material may also contain sump cleanout material, hydraulic oil from the Drum Bailer, and residues from drum reconditioning. No solvents were known to have been used in the Drum Bailing Area. The exact source of solvent found in the sump waste is unknown. Analytical results show low levels of TC metals barium and mercury are present in concentrations below their UTS limits. Organic constituents detected by Total Organic Analysis include methylene chloride, acetone, 1,1,1-trichloroethane, carbon tetrachloride, trichloroethylene, benzene, tetrachloroethylene, toluene, and ethyl benzene. Organic consistents exceeding TC regulatory limit include benzene, carbon tetrachloride, tetrachloroethylene, and trichloroethylene. Of the organics reported, 1,1,1-trichloroethane is the only UHC that is present in concentrations above the UTS limit.	Benzene Carbon Tetrachloride Tetrachloroethylene Trichloroethylene 1,1,1 - Trichloroethane

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TABLE 4-2
UNDERLYING HAZARDOUS CONSTITUENTS

MEF #	WASTE DESCRIPTION	EPA WASTE CODE	UTS RATIONALE	UNDERLYING HAZARDOUS CONSTITUENT
1604	Contaminated Reagent Constituents from the Analytical Laboratory, Building 20. Based on visual inspection, the waste consists of brown (yellow) liquid without a sludge layer.	D001, D002, D006, D007, D009, D011	Process knowledge indicates that this material contains reagent constituents concentrations that will require hazardous waste designations for the characteristics of ignitability, corrosivity, and metals. TC metal analyses were not requested due to insufficient sample volume. Process knowledge indicates the following TC metals are present in concentrations above the TCLP regulatory limits: cadmium, chromium, mercury, and silver. Based on process knowledge, no other TC metals are present in concentrations above the UTS limits. Process knowledge indicates no TC organics are present in the waste. Cyclohexane and methanol were used for sample preparation, however, process knowledge indicates these constituents are present below UTS limits.	Cadmium Chromium Mercury Silver
1707	Lab Generated Waste, Acid Digestates	D002, D007, D008, D018, D019, D028, D039, D043	Material consists of lab generated wastes and acid digestates. Analytical results indicate TC metals all below TCLP regulatory values and UTS limits except chromium (D007) and lead. (D008). Total organic analysis indicates benzene (D018), carbon tetrachloride (D019), 1,2-dicholorethane (D028), tetrachloroethylene, and vinyl chloride (D043) exceed their respective regulatory limits. In addition, methylene chloride, acetone, 1,1,1-trichloroethane, and tetrachloroethylene were detected at concentrations below the UTS limit. Process knowledge indicates no other inorganic or organic constituents are present in concentrations above UTS limits.	Chromium Lead Benzene Carbon Tetrachloride 1,2-Dichloroethane Tetrachloroethylene Vinyl Chloride
1709	Lab Generated, Flammable Organic Extracts	D001, D002	Waste consists of flammable organic extracts mixed with metals waste from extraction of FERMCO samples for herbicide analysis. No inorganic or organic constituents are expected to be present in concentrations above UTS limits.	None

TABLE 4-2
UNDERLYING HAZARDOUS CONSTITUENTS

MEF #	WASTE DESCRIPTION	EPA WASTE CODE	UTS RATIONALE	UNDERLYING HAZARDOUS CONSTITUENT
1711	Metals, Extracts and Digests	D001, D002, D008, D009, D010, D018, D019, D028, D040, D043	This waste stream consists of spent acid from the laboratory analysis of FERMCO samples. The samples were from various projects and consisted of soil, water, and waste material. Only those constituents for which the waste exhibits the toxicity characteristic are expected to be present in concentrations above the UTS limit.	Lead Mercury Selenium Benzene Vinyl Chloride
2362	Radioactive Acid Lab Wastes	D002, D007, D008, D018, D019, D021, D022, D028, D029, D035, D039, D040, D043	This waste stream was generated through analysis of samples taken from various locations at the Fernald Site. Only those constituents for which the waste exhibits the toxicity characteristic are expected to be present in concentrations above the UTS limit.	Chromium Lead Benzene Carbon Tetrachloride Chlorobenzene Chloroform 1,2-Dichloroethane 1,1-Dichloroethylene Methyl Ethyl Ketone Tetrachloroethylene Trichloroethylene Vinyl Chloride
2425	TC Corrosive Waste	D002	This waste stream consists of one drum of acid digests from the analysis of samples at the Clemson Technical Center. Analytical results show TC metals and organics are below TCLP and UTS limits. Based on process knowledge and analytical data, acetone is the only other organic constituent expected to be present in the waste at concentrations greater than UTS limits.	Acetone

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TABLE 4-2
UNDERLYING HAZARDOUS CONSTITUENTS

MEF #	WASTE DESCRIPTION	EPA WASTE CODE	UTS RATIONALE	UNDERLYING HAZARDOUS CONSTITUENT
2690	Acidic Extract Waste	D002	This waste stream consists of acid waste from analysis of FERMCO samples at Ceinture Labs. Analytical results indicate TC metals and inorganics are present in concentrations below TCLP and UTS limits. Based on process knowledge and analytical results, methylene chloride is the only organic constituent present in concentrations greater than the UTS limit.	Methylene Chloride
2692	Corrosive/Flammable Lab Waste	D001, D002, D007, D018	This waste was generated from the analysis of FERMCO samples. Analytical results for TC metals indicate only chromium (D007) was detected in concentrations greater than the TCLP regulatory limit. Benzene (D018) was also detected at a concentration greater than the TCLP regulatory limit. The following constituents exceed their respective UTS limits: vinyl chloride, 1,1-dichloroethylene, methyl ethyl ketone, carbon tetrachloride, benzene, 1,1-dichloroethane, chlorobenzene, trichloroethylene, tetrachloroethylene, methanol, n-butyl alcohol, isobutanol, acetone, carbon disulfide, cyclohexanone, ethyl acetate, ethyl ether, ethylbenzene, methylene chloride, methyl isobutyl ketone, total xylene, 1,1,2-trichloroethane, toluene, 1,1,1-trichloroethane, trichlorofluoromethane, and 1,1,2-trichloro-1,2,2-trifluoroethane.	vinyl chloride, 1,1-dichloroethylene, methyl ethyl ketone, carbon tetrachloride, benzene, 1,1-dichloroethane, chlorobenzene, trichloroethylene, tetrachloroethylene, methanol, n-butyl alcohol, isobutanol, acetone, carbon disulfide, cyclohexanone, ethyl acetate, ethyl ether, ethylbenzene, methylene chloride, methyl isobutyl ketone, total xylene, 1,1,2-trichloroethane, toluene, 1,1,1-trichloroethane, trichlorofluoromethane, and 1,1,2-trichloro-1,2,2-trifluoroethane.
2825	Nitric Acid from Zirnlo Processing Area in Plant 9	D002, D007	This waste stream contains nitric acid from safe-shutdown activities in Plant 9. Analytical results indicated arsenic, cadmium, copper, nickel, barium, chromium, lead, and silver are present in the waste stream. Of these, chromium is the only TC metal present above the TCLP regulatory limit. Based on analytical data nickel and lead are also present in concentrations above UTS limits.	Chromium Lead Nickel

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TABLE 4-2
UNDERLYING HAZARDOUS CONSTITUENTS

MEF #	WASTE DESCRIPTION	EPA WASTE CODE	UTS RATIONALE	UNDERLYING HAZARDOUS CONSTITUENT
REACTIVE CATEGORY				
700	Magnesium metal contaminated with oily rags	D001	This waste consists of magnesium metal with oily rags from the blenders in the Plant 5 Metal Reduction Area. No inorganic or organic constituents are expected to be present in concentrations greater than the UTS limit based on process knowledge.	None
40137	Unfired reduction charge plus CaF2	D001, D003	Unfired reduction charge containing thorium fluoride, calcium fluoride, calcium metal, and zinc fluoride. Fluoride is the only underlying hazardous constituent that is reasonably expected to be present; however, per 40 CFR 268.2(I) fluoride not considered for purposes of UTS compliance.	None
50089	Contaminated magnesium	D001	MEF indicated waste primarily contains magnesium powder, flasks and turnings. May also contain small quantities of magnesium fluoride, uranium, and uranium tetrafluoride. Historical analysis of similar waste indicates TCLP metals present in concentrations well below regulatory and UTS limits. Process knowledge indicates no organic UTS constituents present.	None
BARIUM CHLORIDE RESIDUE CATEGORY				
10002	Scrap Salts	D005, D008	Waste exhibits toxicity characteristic for TC metal (D005 and D008) and therefore, UTS compliance not applicable pursuant to 40 CFR 268.7 and 268.40.	Not Applicable
10025	Contaminated Soil and Rocks	D005	Waste exhibits toxicity characteristic for TC metal (D005) and therefore, UTS compliance not applicable per 40 CFR 268.7 and 268.40.	Not Applicable

TABLE 4-2
UNDERLYING HAZARDOUS CONSTITUENTS

MEF #	WASTE DESCRIPTION	EPA WASTE CODE	UTS RATIONALE	UNDERLYING HAZARDOUS CONSTITUENT
60306	Sludges, Salt, Soft, Chloride	D005	Waste exhibits toxicity characteristic for TC metal (D005) and therefore, UTS compliance not applicable pursuant to 40 CFR 268.7 and 268.40.	Not Applicable
60306	Hardened Salt Bath Sludge From RMI	D005	Waste exhibits toxicity characteristic for TC metal (D005) and therefore, UTS compliance not applicable pursuant to 40 CFR 268.7 and 268.40.	Not Applicable
60307	Furnace Salt, Solidified, Chloride	D005, D008	Waste exhibits toxicity characteristic for TC metals (D005 and D008) and therefore, UTS compliance not applicable pursuant to 40 CFR 268.7 and 268.40.	Not Applicable
60307	Salt and Furnace Brick	D005, D008	Waste exhibits toxicity characteristic for TC metals (D005 and D008) and therefore, UTS compliance not applicable pursuant to 40 CFR 268.7 and 268.40.	Not Applicable

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5.0 HEALTH AND SAFETY

Perma-Fix will comply with the FERMCO project-specific health and safety plan for this project. A Project Specific Health and Safety Plan is included at Appendix "A" of this plan. This plan complies with all applicable Occupational Safety and Health Administration (OSHA) regulations, as well as applicable DOE, RCRA, and CERCLA regulations. Project personnel will be briefed on the Project-Specific Health and Safety Plan prior beginning work in the project exclusion zone.

In addition to the Project Specific Health and Safety Plan, personnel involved with the project will receive an appropriate level of training on the site documents listed in Table 5-1, "Site Plans, Manuals, and Standard Operating Procedures" dependent upon their specific job. This training includes general employee training, on-the-job training, and radiological worker training, in addition to training for specific tasks.

TABLE 5-1
SITE PLANS, MANUALS, AND STANDARD OPERATING PROCEDURES

NUMERICAL DESIGNATION	TITLE
SE-0001	Access to the FEMP
PL-3020	FMPC Emergency Plan
None Assigned	FEMP RCRA Contingency Plan
RM-0021	Safety Performance Requirements Manual
PL-2194	FMPC Spill Prevention Control & Countermeasure Plan
RM-0007	FMPC Respiratory Protection Program
RM-0012	FERMCO Quality Assurance Program Plan
FMPC-0516	Control of Permits for Accomplishing Hazardous Work
PT-001	On-Site Transportation of Radioactive & Nonradioactive Hazardous Materials
RM-0005	FEMP Lot Marking and Color Coding System
SSOP-0089	Personnel Accountability
EM-0018	Spill Incident Reporting and Cleanup
EM-0002	Processing Site Wide Analysis Request/Custody Record for Sample Control
SOP 20-C-606	Hazardous Waste Spill Cleanup
EQP-12.06	Certification of Hazardous Waste Loading, Examination of Transport Vehicle/Trailer for Off-Site Shipment
SOP 20-C-017	Movement of Hazardous Waste
SOP 20-C-630	Storage of Hazardous Waste
EW-0001	Initiating Waste Characterization Activities Using MEF
EM-2-013	Environmental On-Site Media Sampling
SP-P-35-028	Inspection & Performance Testing of Portable Radiation Survey Instruments
PT-0008	Packaging, On-Site Movement and Off-Site Shipment of Material
EW-0017	Management of Hazardous Waste

6.0 PROJECT MANAGEMENT

6.1 ORGANIZATION

Figure 6-1 shows how the Perma-Fix team is organized and interfaces with FERMCO Project Management. Figure 6-2 describes the organizational structure of the FERMCO team assigned to this project. The Perma-Fix team is staffed by personnel from both Perma-Fix and PDC as indicated. The organization will function as a unit under the leadership and direction of the project manager in response to guidance and direction from the FERMCO designated technical manager and the FERMCO contracting officer.

Perma-Fix corporate responsibility for this project is assigned to Mr. Lou Centofanti, who is Perma-Fix Corporation's Chief Executive Officer. Subunits of the organization will have mission and functions as follows:

6.1.1 Project Manager

The Project Manager will serve as a senior technical advisor to the project and is also responsible for leading and directing all activities of the project. These include:

- Being the focal point of project activities and ensuring that all technical, quality, cost, and schedule requirements are met.
- Directing the preparation and maintenance of project plans and procedures.
- Directing the acquisition or otherwise securing of materials, equipment, and services necessary to prepare the facility for process operations.
- Directing production operations and maintenance in accordance with customer and corporate requirements including applicable laws, regulations, standards, and specifications to achieve required results.
- Communicate formally and informally with the client.
- Plan, schedule, review, coordinate, and integrate the work of the project team to produce deliverables that accomplish project milestones and objectives.
- Planning and administering project procurement and property management activities.

6.1.2 Project Management Coordinator

The Team's Project Management Coordinator is responsible for assisting the Project Manager in planning and administering project activities. These include:

- Preparing and maintaining project plans and procedures.
- Preparing and maintaining project schedules.
- Preparing and maintaining the project cost estimate, cost controls, and tracking and reporting cost to the Project Manager and corporate management.
- Tracking project progress and preparing and providing project progress and status reports.
- Collecting project documents, data, and records, and maintaining documentation and records required for management and satisfying customer requirements.

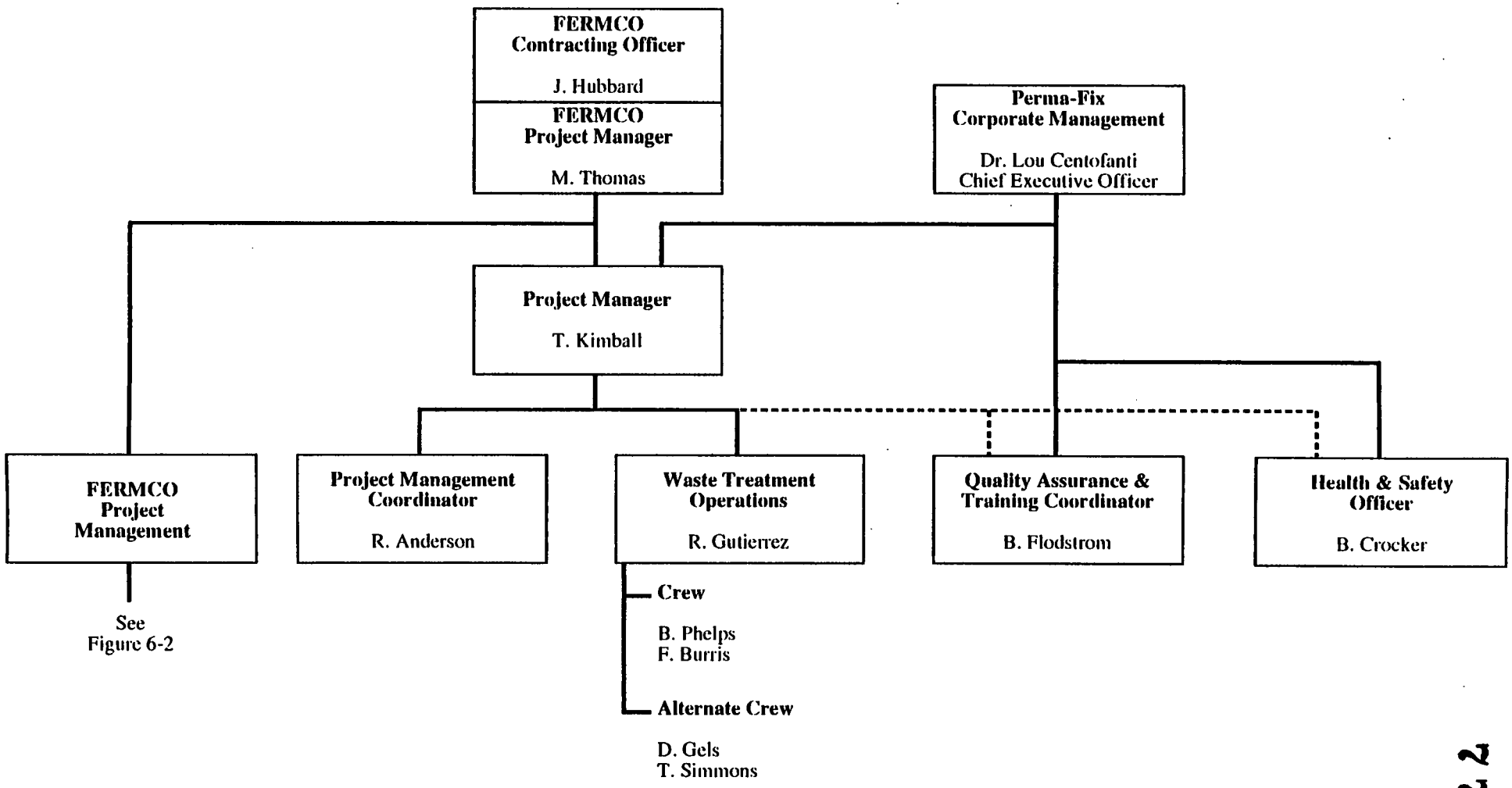

Figure 6-1
Project Organization
Fernald Mixed Waste Chemical Treatment Project

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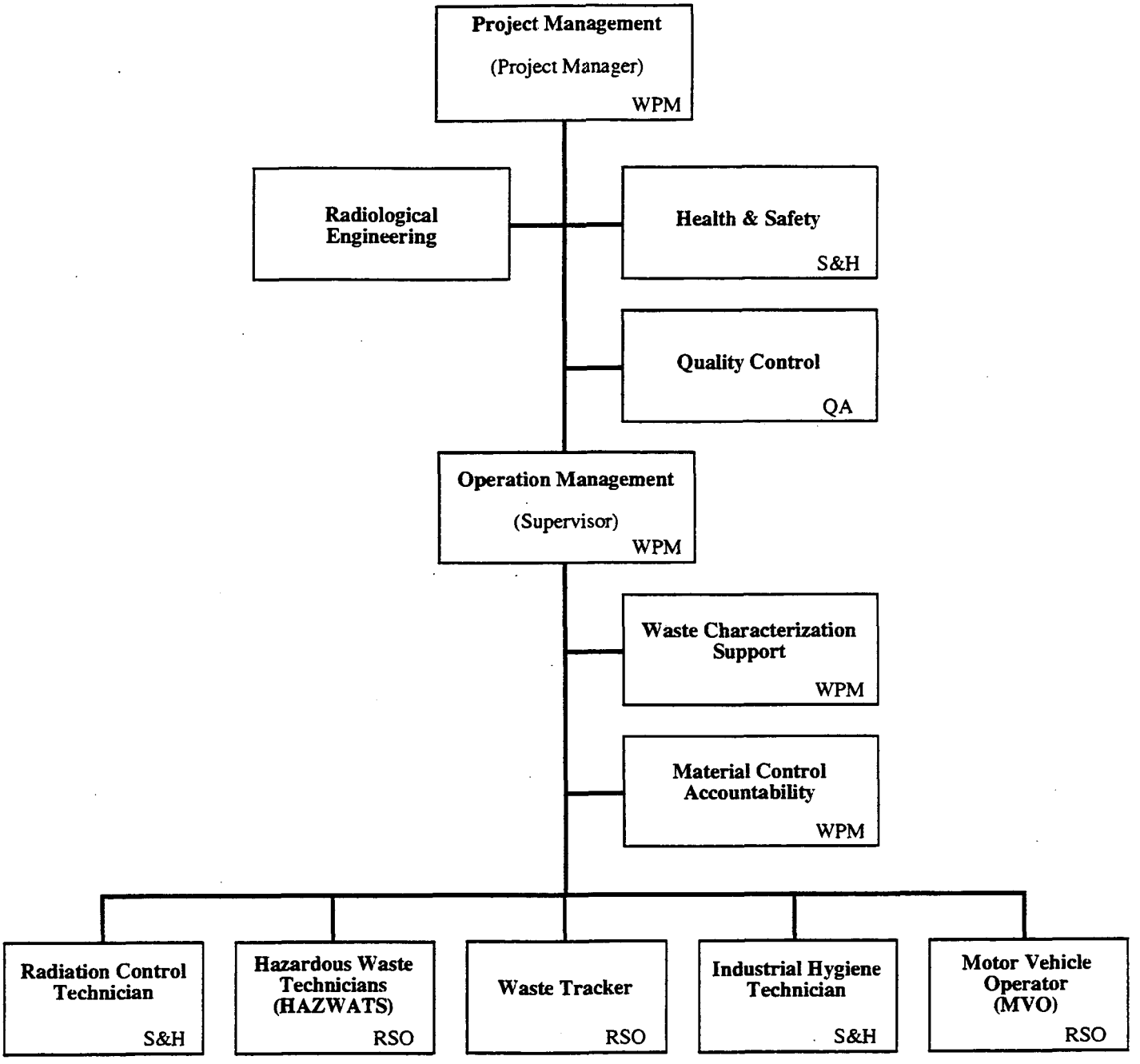


FERMCO Division:

WPM - Waste Program Management
SH - Safety and Health
RSO - Remedial Support Operation
QA - Quality Assurance

Figure 6-2
FERMCO Organizational Structure
Decontamination Process

- Planning, administering, and overseeing personnel selection, training, and certification.

- Tracking and expediting the resolution of problems and issues that could threaten project success.

6.1.3 Waste Treatment Operations Manager

The Team's Operations Manager is responsible for organizing and directing production operations. This includes:

- Organizing production crews and ensuring the adequacy of their training and qualifications.
- Ensuring the operational readiness of equipment and personnel and taking any actions necessary to achieve and maintain readiness.
- Planning and supervising production campaigns and the staging of waste product and its transfer back to FERMCO.
- Planning and supervising feed and reagent materials, receipt, logging, storage, handling, tracking, and transferring activities.
- Planning and supervising the collection of samples and their identification, tracking, and control.
- Planning and supervising production inspections, and tests to ensure process control and product quality.
- Planning and supervising housekeeping and maintenance activities of the facility and its equipment.

6.1.4 Quality Assurance and Training Coordinator

The Team's Quality Assurance and Training Coordinator is responsible for assisting the Project Manager in developing and implementing the projects QA program and ensuring its adequacy and effectiveness. This includes:

- Preparing and recommending program plans and implementing procedures.
- Planning, coordinating and conducting project-specific training and orientation in QA activities.
- Planning and performing evaluations and assessments adequate to inform team, corporate, and customer managers concerning the adequacy and effectiveness of project activities and results.
- Identifying QA problems or potential problems and taking the lead in securing and expediting their resolution.
- Evaluating project experience and determining, coordinating, and expediting improvement activities.
- Providing a point of contact for interface and coordination between the project QA activities and similar programmatic activities of the customer.
- Keeping the Perma-Fix Project Manager currently informed on any QA concerns with project activities.
- Interfacing with the PDC Corporate QA Advisor on concerns relating to quality.

6.1.5 Health and Safety Officer

The Team's Health and Safety Officer is responsible for assisting the Project Manager in developing and implementing the project's Health and Safety Program and ensuring its adequacy and effectiveness. This includes:

- Preparing and recommending program plans and implementing procedures.
- Planning and performing evaluations and assessments adequate to inform team, corporate, and customer managers concerning the adequacy and effectiveness of the Health and Safety Program.
- Planning, coordinating, and conducting project-specific health and safety training and orientation.
- Identifying health and safety problems or potential problems and taking the lead in securing and expediting their resolution.
- Providing a point of contact for interface and coordination between the project health and safety activities and similar programmatic activities of the customer.
- Keeping the Perma-Fix Project Manager currently informed on any health and safety concerns with project activities.

6.2 STOP WORK ACTION

All project team personnel have the authority to stop work for a significant condition adverse to safety, quality in which continued work could prevent repair, or in which there is a major programmatic breakdown that impacts a major portion of the work being performed. Stop Work Orders, as authorized by the Quality Assurance Coordinator, will be issued through the Project Manager.

6.3 WORK BREAKDOWN STRUCTURE

The Project Work Breakdown Structure (PWBS) is shown in Figure 6-3. At the first level of the breakdown, it reflects the two main elements of the job. These are Phase I and Phase II. In Phase I, Work Element 1.0, the ultimate product is a set of approved job plans, specifications, and procedures. In Phase II, Work Element 2.0, the ultimate product is boxes of waste resulting from treating, stabilizing, and solidifying 350 drums of Fernald chemical waste that are certifiable and acceptable for disposal.

6.4 LOGIC DIAGRAMS

The progression of work activities and their interrelationship are shown on the logic diagram shown in Figure 6-4. The logic illustrated provides the basis for project schedules and resource needs for accomplishing the job as required.

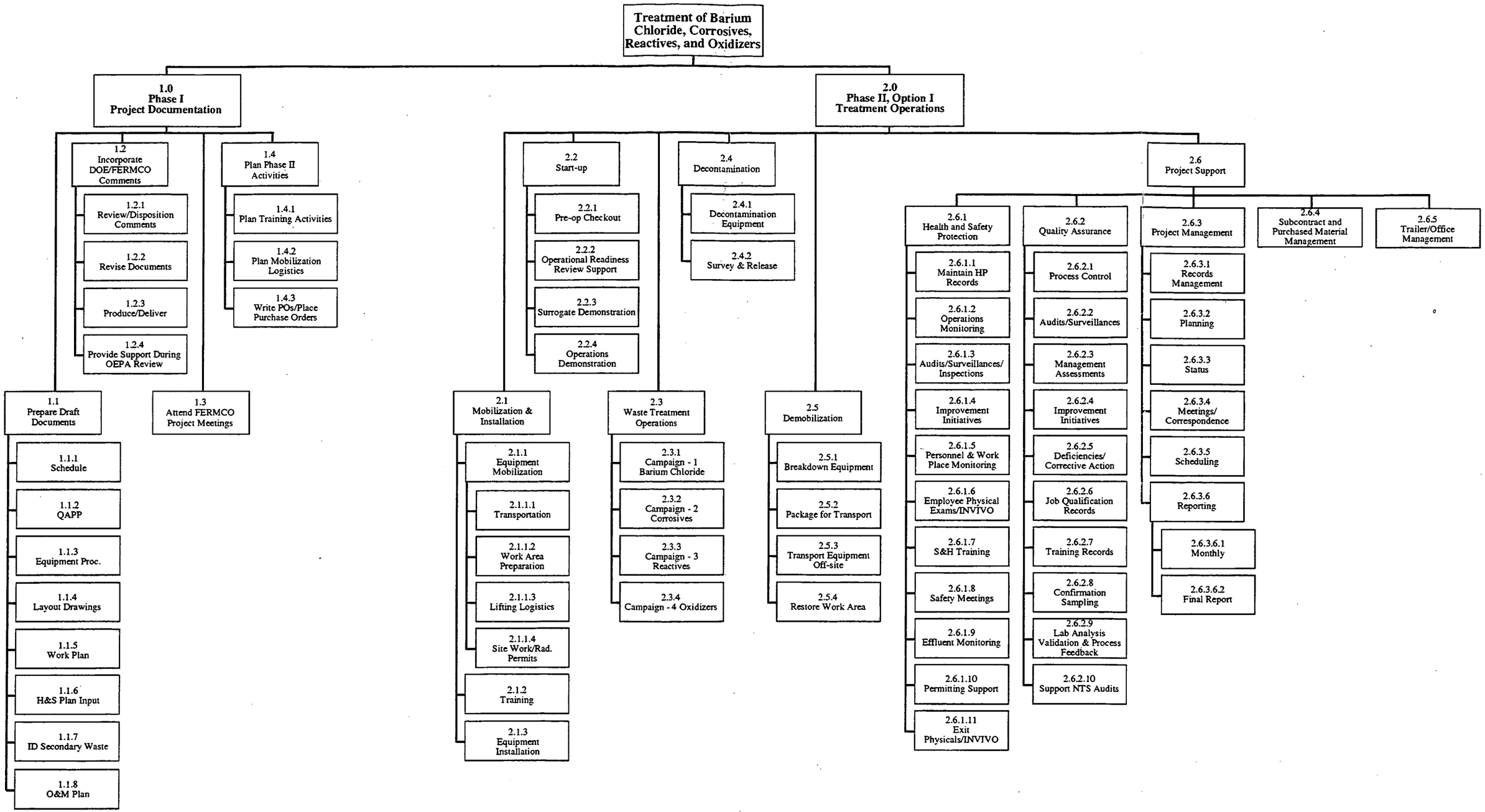
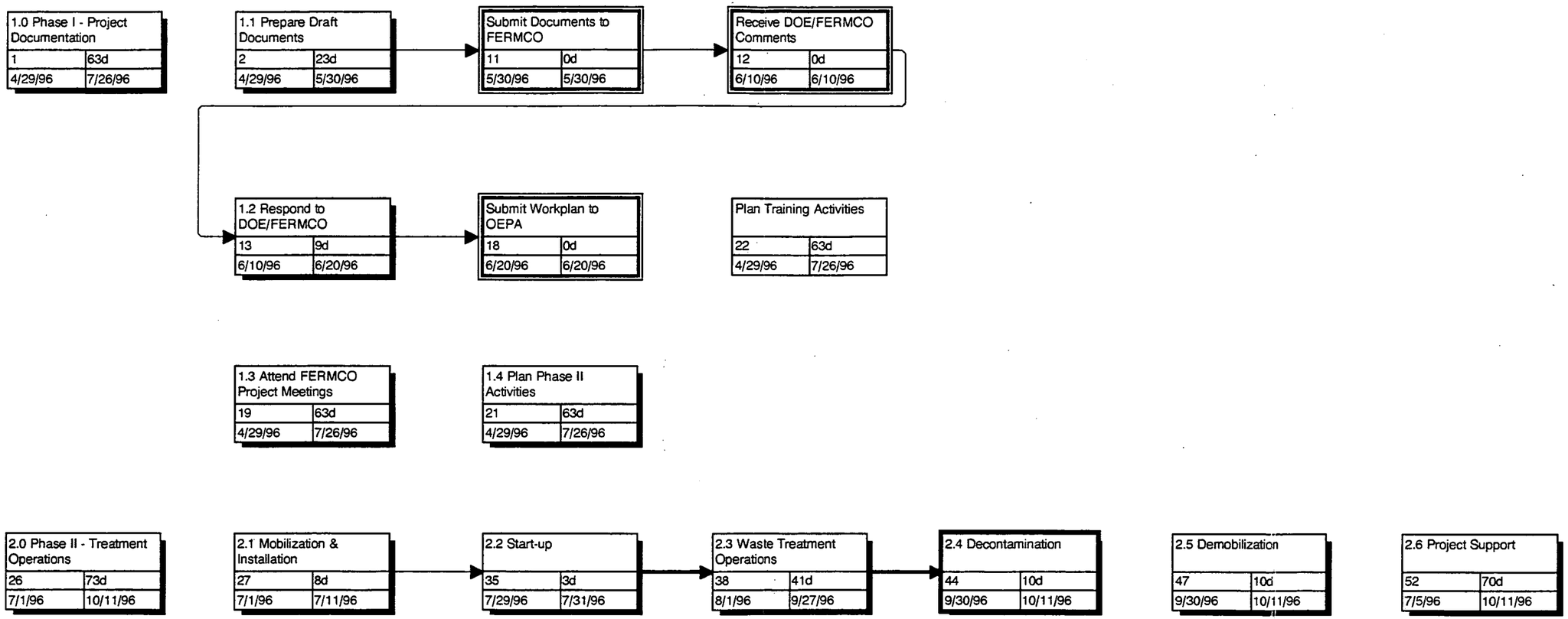


Figure 6-3
Project Work Breakdown Structure
Fernald Mixed Waste Mobile Chemical Treatment Project



Name	
ID	Duration
Start	Finish

Critical | Subproject | Critical Milestone | Critical Summary

Noncritical | Marked | Noncritical Milestone | Noncritical Summary

000088

6.5 DATA QUALITY CONTROL LEVELS

The purpose of data control is to specify the requirements for the control of accuracy, precision, and completeness of data. Data control is exercised from the point of sample collection, through the laboratory analysis, and transmittal and validation of generated data. Data quality objectives (DQOs) represent a formal decision process which establishes the level of uncertainty FERMCO is willing to accept in analytical results derived from process data. The DQO process must strike a balance between time, cost, and data quality. The criteria for DQOs are the end use of data to be collected and the cost to produce the data.

Analytical support levels (ASLs) provide data reliability. The ASLs apply to all of the techniques and methods that contribute to the generation of analytical data. ASLs A through E are described in DOE-FN/EPA 200 Report, Site-wide CERCLA *Quality Assurance Project Plan,* Volume I. The choice of levels is based on the type of site to be investigated, the level of accuracy and precision required, and the intended use of the data. Table 6-1 outlines the ASLs.

TABLE 6-1
EPA QC Levels

ANALYTICAL SUPPORT LEVEL (ASL)	EXAMPLES OF DATA USES
A Qualitative Field Analysis	Preliminary site characterization Real-time monitoring of implementation Field screening
B Qualitative, Semi-Quantitative, and Quantitative Analyses (Sublevel 1 or 2)	Site characterization Evaluation of alternatives Engineering design Real-time Monitoring of implementation Field screening
C Quantitative with Fully Defined QA/QC	Risk assessment Site characterization Evaluation of alternatives Engineering design Real-time Monitoring of implementation
D Confirmational with Complete QA/QC and Reporting	Risk assessment Vertical & horizontal extent Evaluation of alternatives Engineering design Evaluation of remediation results
E Non-Standard	Risk assessment Evaluation of alternatives Engineering design Vertical & horizontal extent Evaluation of remediation results

6.5.1 Analytical Support Levels

Three separate ASLs are hereby adopted for this project in accordance with the Site-Wide CERCLA Quality Assurance Project Plan (SCQ). Real-time testing will be performed at ASL A. The lead acetate paper test for the sulfide reaction end point is a nonquantitative measurement using a colorimetric indicator to provide information conforming to ASL A criteria. The measurements of slump provides numerical data which is compared with previously established norms for those parameters, and thus conforms to ASL A. The spectrophotometric analysis for barium also provides numerical data which is compared with previously established norms and thus conforms to ASL A. The analytical data generated from process feedback sampling and analysis activities will conform to ASL level B (sublevel 1). In cases where TCLP extraction and analysis of process feedback samples is required, ASL C will be used. The laboratory data produced for proof of LDR Treatment Standard compliance and NTS waste acceptance conform to ASL C. Field and laboratory QC standards will be complied with to assure that field and laboratory activities are consistent with the specified ASL.

6.5.2 Project Documentation and Data

Project documentation will be maintained in dual storage per the requirements of NQA-1. These locations will include PESI's project office at the Fernald site and PDC offices in Oak Ridge, Tennessee. This documentation will include contractual records, official correspondence, operations logs, waste logs, sampling and analysis logs, self assessments, audits, and record's of FERMCO product acceptance.

6.5.3. Sample Control

Sampling and analysis will be performed according to NVO-325, *Training,* and specific sampling plans provided by FERMCO.

7.0 QUALITY ASSURANCE

The quality assurance program for this project is intended to provide the project team, the project team's corporate management, and Fernald management with confidence that project objectives will be, are being or have been achieved. The program plan has been prepared as a project quality assurance plan and is contained in Appendix B of this volume. The program is designed and will be implemented to satisfy the requirements for quality assurance specified by FERMCO in their Quality Assurance Program (RM-0012) for quality level three. It will interface with and compliment the FERMCO overall project quality assurance program for mixed waste chemical treatment and disposal. The project quality assurance program is also designed to implement applicable requirements of ASME NQA-1, EPA QAMS-005/80, DOE Order 5700.6C, and 10 CFR 830.120.

The project quality assurance program will be implemented by the project team with roles and responsibilities as described in the plan.

8.0 ALARA CONSIDERATIONS

The Perma-Fix process and the various material handling methods proposed for this project are designed and selected to minimize the potential for spread of hazardous and radioactive contamination, and to keep worker exposures "As Low As Reasonably Achievable" (ALARA) in compliance with DOE Order 5480.11, *Radiation Protection and Occupational Workers.* The process and project design have the following features to aid in ALARA compliance.

Containment and Shielding: Waste and waste constituents will be handled in steel containers as much as possible (process equipment, mixing drums, and FERMCO containers). Treated waste will exhibit a significant degree of self-shielding due to the mass of reagents added in the treatment step.

Exclusion Zone: All critical treatment activities will be conducted within an exclusion zone. Only authorized personnel who have completed the required training and are properly suited out in personal protective equipment will be permitted to enter the exclusion zone. Appropriate impervious coverings will be used to prevent penetration of contaminants into the floor.

Protective Equipment: All personnel working within the exclusion zone will wear anti-Cs prescribed on the PPE page of the appropriate RWP.

Mechanized Handling: Most waste transport, lifting and dumping outside the process area will be done with fork lift trucks fitted with hydraulically-actuated drum tippers. Movement of drums inside the process area will be manually by gravity roller conveyor. Lifting and dumping of drums will be engineered equipment designed for that purpose. Contact handling of waste is limited to debris sorting and the actual mixing step of the Process.

Wet Dust Suppression: At locations where dust evolution is anticipated, atomizing water sprays will be used as needed to minimize dust generation.

Pneumatic Dust Collection: Above the spray zone in areas of potential dust generation, we will use flexible point source dust collection ducts to capture dust from the air and convey it to a central prefilter/HEPA filtration system. The discharge of the HEPA filtration system will be outside the building.

Daily Housekeeping: We will perform daily housekeeping in the work area at the end of each shift. This will include wet cleanup of visible material on equipment surfaces and floors. We will use a minimum of water, and recovered contaminated water will be stored in the contaminated water storage tank and reused in the treatment process. HEPA wet vacs will be used instead of brooms for floor cleanup.

9.0 REFERENCES

Comprehensive Environmental Response, Compensation, and Liabilities Act

Amended Consent Agreement Between DOE and U. S. EPA - 1991

U. S. EPA Best Demonstrated Available Technology/Resource Conservation and Recovery Act

Nevada Test Site - *Defense Waste Acceptance Criteria, Certification, and Transfer Requirements* (NVO-325, Rev. 1)

Solubility/pH Curves for Metal Hydroxides and Sulfides - Source: U. S. EPA Federal Register 52(155):29999 (August 12, 1987)

Federal Facility Compliance Act - Agreement Between DOE, U. S. EPA, and Ohio EPA

Federal Facility Compliance Act - Site Treatment Plan

DOE Order 5400.5, *Radiation Protection of The Public and the Environment*

Superfund Amendments and Reauthorization Act - 1986

U. S. EPA Toxicity Characteristic Leaching Procedure (TCLP)

40 CFR 262.5, Waste Management Requirements

Ohio Administrative Code (OAC) Chapters 3745-49 through 3745-69

Emergency Planning and Community Right-To-Know Act (EPCRA)

40 CFR 355, Emergency Notifications

U. S. EPA, *Quality Objectives for Remedial Response Activities Development Process*, OSWER Directive 9355.0-7B, March 1987

FERMCO *Quality Assurance Program* (RM-0012)

ASME NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities*, 1989 Edition

DOE Order 5700.67 C, *Quality Assurance*

EPA QAMS - 005/80

10 CFR 830.120, *Quality Assurance*

Occupational Safety and Health Administration Regulations

ANSI/ANS-40.37-1993, Mobile Radioactive Waste Processing System

ANSI Standard 288.2-1980, *American National Standards Practices for Respiratory Protection,*

National Institute of Occupational Safety and Health Publication No. 84114, *Personal Protective Equipment for Hazardous Materials*

51 Federal Register 45654, December 19, 1986

29 CFR 1910.120(b), *Hazardous Waste Operations and Emergency Response*: Interim Final Rule, Department of Labor

EPA Manual, "Test Methods for Evaluating Solid Waste" (SW-846)

APPENDIX A

HEALTH AND SAFETY PLAN

FERNALD ENVIRONMENTAL

RESTORATION MANAGEMENT CORPORATION

PROJECT SPECIFIC HEALTH & SAFETY PLAN FOR FERNALD MIXED WASTE CHEMICAL TREATMENT PROJECT

Neutralization/Precipitation/Deactivation/Stabilization

June 1996

REV 0

EMERGENCY PHONE NUMBER 648-6511 RADIO: "CONTROL"

APPROVALS:

Melissa Thomas, Project Manager — Date

Jack Craighead, Construction Safety & Health Manager — Date

Carla Hood, FERMCO Health & Safety Officer — Date

HEALTH AND SAFETY PLAN

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HEALTH AND SAFETY PLAN

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B. Personnel Environmental Monitoring and Action Levels
C. FEMP Rally Points
D. Location of FEMP Medical Facility
E. Work Area Material Safety Data Sheets (MSDSs)
F. Work Area Map
G. OSHA and DOE Employee Rights Poster
H. Acknowledgement Form

1.0 INTRODUCTION

This Project-Specific Health and Safety Plan (PSHSP) is for the Fernald Environmental Restoration Management Corporation (FERMCO) Mixed Waste Chemical Treatment Project, Neutralization/ Precipitation/Deactivation/Stabilization (NPDS). Compliance with this plan is required by all personnel who perform waste treatment and support activities in association with this project.

All personnel who enter the Exclusion Zone for this project must be orientated to the requirements of this PSHSP and the Project-Specific Health and Safety Requirements Matrix (PSHSRM), Attachment A. After orientation, personnel must sign an Acknowledgement Form (Attachment H) stating they understand and will abide by the conditions of this plan. Acknowledgment Logs will be controlled by FERMCO health and safety personnel.

1.1 Work Area Characterization

The project involves mobilization of skid mounted treatment equipment in the southwest portion of Plant 6 at FEMP (Appendix F). The equipment will be used to physicochemically treat approximately 360 containers of mixed waste. The waste will be of four general waste categories, barium chloride residues, corrosives, reactives, and oxidizers. The treatment will involve precipitation, neutralization, deactivation, and stabilization. The treated waste will be packaged and will be in a chemical and physical form which meets the waste acceptance criteria (WAC) for disposal at the Nevada Test Site (NTS) or Envirocare of Utah, or for further treatment within other FERMCO activities.

1.2 Work Description

The following subsections describe the treatment schemes anticipated for each of the identified primary wastes. Please refer to the process flow diagrams of Figure 1 during review of each treatment scheme.

The treatment scheme for these wastes will include screening and sorting of the waste to remove any disposal site prohibited items, size reduction in the shredder, slurrying with water, measurement and adjustment of pH (slightly acid conditions are required), precipitation of barium with sulfate, (ferrous, sodium, or aluminum sulfate) upward pH adjustment and precipitation of lead with sodium sulfide (if necessary), solidification treatment with portland cement, and decanting of the treated waste into white metal boxes (WMBs). Because the barium content of these wastes is high, a commensurately high dosage of sulfate will be used. Also, an overnight soaking of the waste may be utilized to ensure adequate time for the reaction of the sulfate.

For the waste having barium only, the stabilizing agent will be sulfate, with the dosage manipulated up or down as appropriate to match the reagent demand of the waste. For the waste having barium and other RCRA metals, a synergistic recipe using both sulfate and sodium sulfide will be used.

As shown in Figure 1, the treatment scheme for most of the corrosive liquid wastes will include bulking in a cone bottom container, followed by elementary neutralization of the acids with sodium hydroxide, followed by settling of solids. The neutralized supernate will be decanted into drums or tanks provided by FERMCO and returned to FERMCO custody. The goal of the elementary neutralization step will be to make the waste non-corrosive.

As shown in Figure 1, the treatment scheme for the oxidizing wastes include in-drum reduction using ferrous sulfate as the reducing agent. At the conclusion of the reduction step, a test with potassium starch paper will be used to verify that reduction has taken place. A positive test result (black stain) indicates that the waste has not been completely reduced. If significant concentrations of other RCRA metals besides barium and chromium are present, the synergistic recipe (sulfate and sodium sulfide)

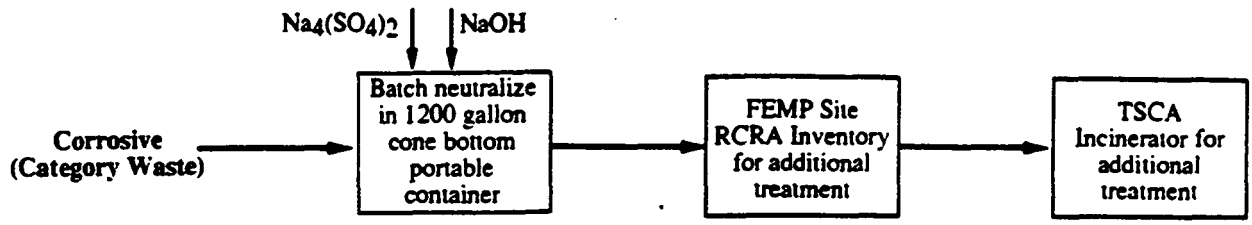
described earlier may be used. For dry or water-based wastes, the solidification reagent will be portland cement. For wastes having significant oil contamination, gypsum may be used as the solidification agent. Immediately after the treatment of each mixing drum is complete, the treated sludge will be decanted into a WMB for curing.

For solid oxidizer waste streams (except thorium bearing wastes), the contents of the original container will be emptied through the screen hopper to remove large solids and allow inspection for disposal site prohibited items. Prohibited items will be removed and repackaged, and the remaining acceptable solids will be size reduced in the shredder. (When exposure to air in the screen hopper would represent an auto-ignition risk, the reducing agent will be added to the waste drums and allowed to soak before they are emptied into the screen hopper.) Treatment off-gas will be collected and routed through HEPA filtration and exhausted out of the building. Some treatment activities will be performed using supplied air respirator (see H&S requirements matrix). Additional ALARA issues associated with this waste stream will be addressed by thorium wastes either being mixed in the drum and screened into the WMB, or by placing solidified drums in WMBs.

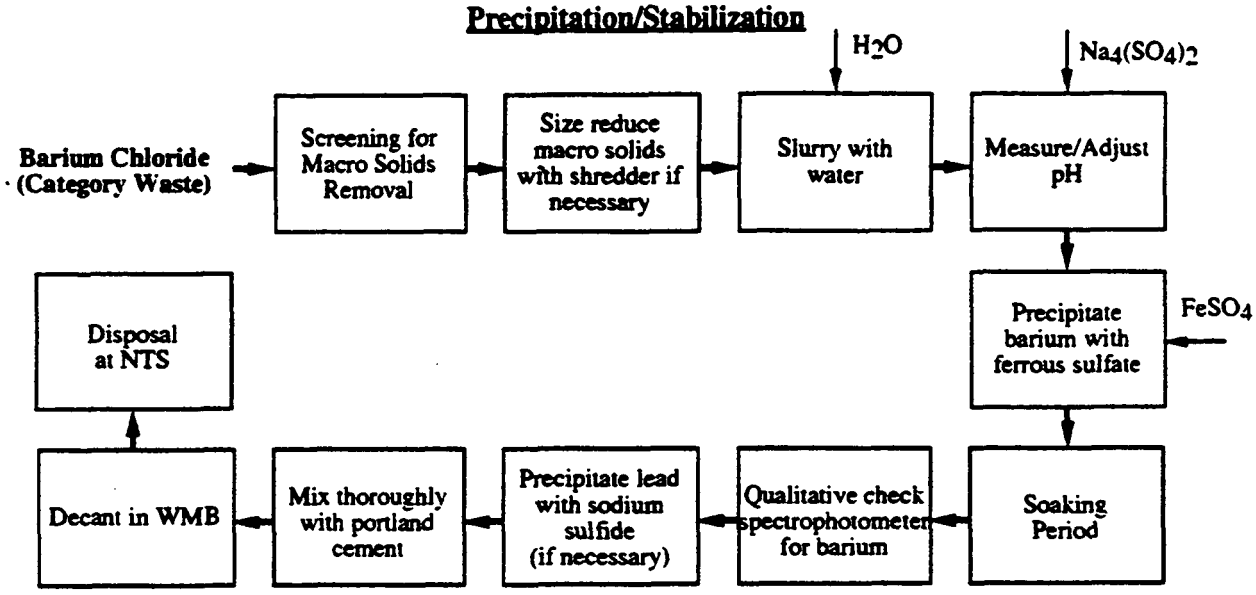
Of the 25 drum equivalents of reactive waste identified, approximately 24 drum equivalents are composed of magnesium metal having the waste code for ignitability (D001). The other drum equivalent has high fluoride streams which could release hydrofluoric acid if acidified, thus resulting in the reactive waste code D003. Ignition and acid gas production are the main safety concerns that will be addressed in processing these reactives.

As shown in Figure 1, the treatment scheme for the magnesium wastes will include in-drum slurrying with mineral oil and treatment including saturation with mineral oil followed by mixing with plaster (gypsum) as an inerting material. This is a method previously demonstrated in the treatability study performed by Nuclear Fuel Services (NFS). For the other two drums of fluoride materials, treatment will take place at an alkaline pH in order to prevent generation of hydrogen fluoride gas. The treatment reagent in these cases will be portland cement. All treatment activities on reactive wastes will be performed under a high degree of emergency alert while deactivating with mineral oil and gypsum.

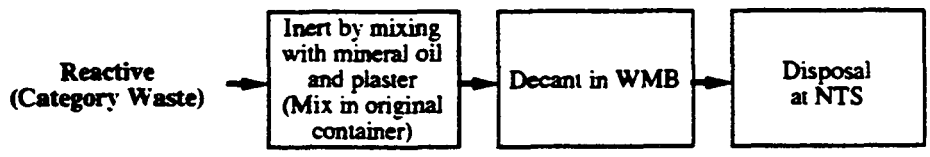
Neutralization



Precipitation/Stabilization



Deactivation of Reactive and Ignitable Metals



Deactivation/Stabilization

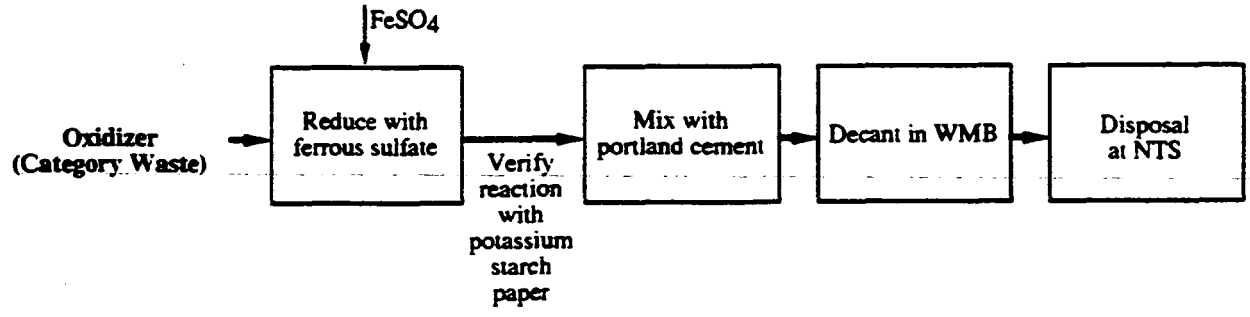


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Figure 1
Process Flow Diagrams
Fernald Mixed Waste Chemical Treatment Project

2.0 ORGANIZATION STRUCTURE AND KEY PERSONNEL RESPONSIBILITIES

The following table shows key personnel, including primary and alternates, for performance of this project.

TITLE	PRIMARY	ALTERNATE
FERMCO		
Manager, Construction Safety and Health Compliance	Jack Craighead	David Jackson
Health & Safety Officer	Carla Hood	Jack Craighead
Project Manager, Mixed Waste Treatment Project	Melissa Thomas	Larry Honigford
Subcontractor		
Project Manager	Tim Kimball	Ben Crocker
Process Supervisor	Ray Gutierrez	TBD
ES&H Coordinator	Ben Crocker	Bob Flodstrom
Quality Assurance Advisor	Bob Flodstrom	Ben Crocker

3.0 SITE CONTROL

Prior to actual treatment of waste, the subcontractor's project manager will notify the FERMCO Project Manager that (1) staging is complete, (2) that equipment and chemicals have been received, and (3) that operations can commence. At that time a walkdown of the project work area will be performed. FERMCO staff who will participate in this walkdown include representatives from Industrial Hygiene, Radiological Control, the Process Supervisor, and the Mixed Waste Treatment Project Health and Safety Officer/Assistant or designee. During the location walkdown, any specific hazards not previously identified will be noted. Hazards will be identified and explained to the project staff during project training.

The location for the Mixed Waste Treatment Project is the Southwest corner of Plant 6, Appendix F.

3.1 Radiological Areas

Entrances to and perimeters of radiological areas will be defined by yellow and magenta rope or, where practical, by physical structures such as fences or buildings. All radiological areas will be identified by signs having the standard radiation symbol, the magenta trifoil on a yellow background.
The following radiological areas may/will be encountered in the performance of the work in Plant 6:

- Controlled Area
- Fixed Contamination Area
- Soil Contamination Area
- Contamination Area
- Airborne Radioactivity Area
- High Contamination Area

All areas inside the security fence are considered Controlled and Soil Contamination Areas. Plant 6 is a Contamination Area. To enter the Contamination Area (Plant 6) personnel must be briefed and sign off on the Radiological Work Permit (RWP) at the radiological control point.

Radiological areas are established based on the contamination levels in Attachment B.

3.2 Exclusion Zone

The Exclusion Zone for the project is shown in Figure F-1 of Appendix F. The Exclusion Zone shall have one ingress and egress point. Access to the Exclusion Zone will be limited to treatment process technicians, project management staff, FERMCO HSO, IH Technicians, and Radiological Control Technicians (RCTs). All other personnel will be considered visitors.

Exclusion Zone barricades will consist of safety fence. The signs specifying the operation will be posted every twenty five (25) feet around the zone.

Prohibited items or conduct in the Exclusion Zone include:

- Eating, drinking, smoking, or any other activity which could lead to the possibility of hand to mouth exposure of contaminants
- Working when ill or when taking unapproved prescription medication
- Not having the required safety and health training
- Not meeting any other requirement specified in Section 4.0.

4.0 TRAINING

All personnel working in the Contamination and Exclusion Zone will be Radiological Worker II trained. Radiological Worker II trained personnel will have taken General Employee Training (GET), Site Worker Training, Radiological Worker II Training, Radiological Worker II Practical, Construction Rules and Regulations, Respirator Training, Respirator Fit Test, and have 24 hours of supervised field experience.

4.1 Hazard Communication

4.1.1 Material Safety Data Sheets (MSDSs)

MSDSs for stabilization chemicals and for waste to be handled are included in Attachment E. Additional FEMP MSDSs are available through the FERMCO Health and Safety Officer or can be obtained by calling (648)-4000 as needed.

Employees are required to review the MSDSs for products they are using and comply with the health and safety requirements on the MSDSs.

Depending on bench tests as the project progresses, all expected chemicals may not be present. Chemicals which are expected to be present for treatment or as components of the waste and include sodium sulfide, ammonia, type 1 portland cement, ferrous sulfate, sodium sulfate, aluminum sulfate, Nu-Sal, uranium salts, hydrogen sulfide, sodium bisulfate, caustic soda, quick lime, gypsum, nitric acid, tributyl phosphate, uranyl nitrate, thorium nitrate, and lead. Propane will be used to fuel the fork lift and carbon monoxide will be generated as a result of fork lift operation.

MSDSs will be posted conspicuously in the work area in accordance with worker's Right-to-Know rules.

4.1.2 Safety Briefings and Meetings

All personnel involved in this project will be given orientation on the PSHSP prior to receiving authorization to begin work. Also, personnel will be briefed on Radiological Control and RWP requirements by an RCT prior to commencement of activities.

Management is to review work tasks with project workers daily and when new tasks are started. The worker is to be informed of the hazards and safety controls for the work being performed.

Workers are to attend weekly safety meetings conducted by their supervisors or HSO. Written documentation of the briefings and tailgate meetings, in the form of attendance sheets, will be maintained, and retained as part of the project's permanent record. File copies will be forwarded to the FERMCO Project Manger.

Whenever a revision or change is made to the PSHSP, or a change is made to existing work activities, the change shall be reviewed with project workers at a job briefing and documentation of the briefing and attendance shall be maintained as part of the project file.

All personnel involved in routine daily operations of this project are required to attend all project training sessions and safety briefings.

4.2 Records

Verification of project staffs' attendance of required OSHA and FERMCO site training courses consists of employee training records on file within the FERMCO Training Department, FERMCO Medical Services, the FERMCO Project Manager, and the FERMCO Environmental Division Training Coordinator. Employees will keep their respirator fit test card and pink training verification card with them at all times.

4.3 Visitors

A visitor to the work site covered by this PSHSP is defined as anyone coming to the work site with the sole purpose of observation or viewing the activity in progress (hands-off inspection). Visitors are not allowed to operate equipment, perform manual labor or supervise work activity.

Visitors that are Radiological Worker II trained are to be oriented to the work site by:

- Briefing on this PSHSP
- Shall contact the site supervisor for briefing on the current site activities and the associated hazards

Visitors that are not Rad II trained entering Plant 6 shall:

- Receive authorization from the Manager of Radiological Control and the FERMCO HSO.
- Be escorted by a person who has all the required training for the area to be toured.
- Wear a Thermoluminescent Dosimeter (TLD) radiation badge and view the Visitor Orientation Video.
- Wear the required PPE specified on the posted FERMCO Work Permit.

5.0 MEDICAL MONITORING AND SURVEILLANCE

5.1 Requirements

All personnel engaged in the performance of project field activities and on site more than five days, are required to participate in the FEMP medical monitoring program. This program shall include in-vivo whole body monitoring, fecal baseline for thorium, and the routine urine monitoring program.

Incident bioassay samples, initial (end of shift) and post (start of next shift) urine samples for uranium concerns will be required if radiological conditions indicate potential exposures to personnel during the performance of the project. If any confirmed positive results occur, a 24-hour follow-up sample will be initiated by Dosimetry for the affected individual.

Employees who receive radio pharmaceutical or become pregnant are to report this information to the FERMCO Medical Services Department.

Employees in the following certification programs are required to have medical certification to perform their duties:

- DOT driver
- Respirator user
- Forklift operator

5.2 Records

The FERMCO Medical Services Department maintains copies of all employee medical records which employees have access to.

6.0 HAZARD ASSESSMENT

This section addresses health and safety hazards which have been identified as being associated with the activities covered by this PSHSP.

Potential hazards to project stabilization process personnel may originate from the chemical, physical, radiological, electrical, and other safety hazards known or suspected to be present in the treatment process area, the waste, and the stabilization chemicals.

6.1 Radiological Issues

Uranium and thorium are the radioactive elements of concern for this project. The external dose associated with the uranium component is small. The external dose associated with thorium is above limits for radiation areas (>5 mrem/hr). Initial surveys of a representative sample of uranium contaminated wastes indicate an external dose rate up to 3 mrem/hr at 30 cm from the drum. Initial surveys of the WMBs containing the thorium wastes indicate an average dose rate of 25 mrem/hr at 30 cm from the container. Each WMB contains up to 7 containers. Internal dose can occur through inhalation of uranium or thorium. Engineering controls will be utilized extensively to mitigate the airborne potential. Secondary worker protection in the form of respiratory protection will be incorporated. Dose assessment projections for this project are included in the ALARA Design Review document.

Since inhalation of uranium potentially poses both radiological and toxic hazards, determinations must be made about which is most limiting, and in what situations one hazard or the other can be neglected. When radiological hazards are limiting, chemical hazards can generally be neglected except in overexposure situations. When chemical hazards are limiting, radiological hazards (i.e. organ doses and effective dose equivalents) can be neglected only if radiation doses are below regulatory concern as defined by DOE Order 5480.11, Operations Offices implementing order, or other guidance from DOE or internal dosimetry.

6.1.1 Uranium

Uranium is a radioactive material, and in its soluble forms, is highly toxic to the kidneys. Soluble uranium compounds such as uranyl nitrate, uranyl fluoride and uranyl acetate are absorbed through the skin. Non-soluble forms of uranium, such as uranium octaoxide (black oxide), uranium dioxide (brown oxide), uranium tetrafluoride (green salt), and uranium trioxide (orange oxide) are not absorbed through the skin, but constitute a radioactive inhalation hazard to the lungs.

6.1.2 Thorium Nitrate

Thorium nitrate is considered a health hazard, is noncombustible, and slightly reactive. With skin or eye contact, it can cause irritation and dermatitis. Ingestion of large amounts can be carcinogenic, but this is highly unlikely. It should be sufficient to use good industrial hygiene and safety practices, avoid unnecessary exposure, and wash contaminated clothing before reuse.

In case of inhalation, contact RCT, AEDO, Dosimetry and Medical, remove person to fresh air. Report to Medical. In case of eye contact or skin contact, notify RCT immediately. Report to Medical and have RCT contact AEDO. The residue on evaporation is an oxidizer, therefore strong reducing agents and excessive evaporation should be avoided.

6.2 Industrial Hygiene Issues

6.2.1 Heat Stress

All processing area personnel could potentially be affected by heat stress. In addition to the overall physical condition of processing personnel, other factors such as temperature, relative humidity, work function, intake of fluids, PPE and duration of time exposed to elevated temperatures can greatly affect the degree of heat stress on an individual.

All project personnel will be able to identify the four stages of heat stress, and to be aware of the warning signs and symptoms. The four stages of heat stress, descriptions and symptoms are as follows:

Heat Rash - Often referred to as "prickly heat," is characterized by tiny, raised vesicles on the skin, or blister-like eruptions under the skin. Treatment includes the application of a mild drying lotion to the skin, and seeking medical attention.

Heat Cramps - Characterized by painful muscle spasms. Treatment includes administering liquids, and seeking medical attention.

Heat Exhaustion - Symptoms include pale, cool, moist, skin, heavy sweating, dizziness, nausea, and fainting. Treatment includes rest in a reclining position until water balances are restored, the administration of fluids (no caffeine) and seeking immediate medical attention.

Heat Stroke - By far the most dangerous, and potentially deadly stage of heat stress, is recognized by red, hot, dry skin, a lack of perspiration, nausea, dizziness and confusion, and a strong, rapid pulse. Treatment includes seeking immediate medical attention, and cooling down the affected person by immersion in cool water or by wrapping in a wet sheet with vigorous fanning with cool, dry air.

Fluid Intake During Hot/Humid Workplace Conditions - During hot weather, everyone needs to consciously increase their fluid intake to compensate for increased losses of body water primarily through sweating. Many fluid types can help, however, the National Institute for Occupational
Safety and Health (NIOSH) and most scientific studies have determined the best way to maintain hydration and help prevent heat-related illnesses is the frequent consumption of water.

6.2.2 Chemical Hazards

Chemical hazards will originate from the following sources:

- Waste chemicals
- Waste (radiologically "stable") heavy metals
- Processing chemicals
- Radionuclides (e.g., uranium and thorium compounds)

The subsections below describe some of the primary expected hazardous materials and some of their potential effects:

6.2.2.1 Sodium Sulfide (flake)

Sodium Sulfide (flake) is rated as a moderate health hazard, is slightly combustible, and is nonreactive. Acute inhalation results in irritation of nasal and respiratory passages. Sodium sulfide

is very toxic when swallowed. Ingestion may result in decomposition to hydrogen sulfide in the stomach with systemic poisoning, and may cause nausea, vomiting, diarrhea, and gastrointestinal irritation. Sodium sulfide is a severe skin and eye irritant, causing chemical burns. Target organs and systems include the respiratory tract, the central nervous system, and the gastrointestinal system. In case of inhalation, remove to fresh air, give artificial respiration if not breathing, and get medical aid. In case of swallowing, do not induce vomiting. Dilute stomach with a large amount of water or milk and get medical aid. In case of skin contact, remove contaminated clothing, rinse skin with running water for at least 15 minutes, and get medical aide. In case of eye contact, flush eyes at once with water for at least 15 minutes and get medical aid. Sodium sulfide is received in flake form and premixed to a 5% solution. It will not be stored in proximity to strong acids.

6.2.2.2 Type I Portland Cement

Type I Portland Cement is rated as a moderate health hazard and is a corrosive and an irritant. It is noncombustible and nonreactive. Inhalation can irritate the upper respiratory system. Wet cement may cause chemical burns. Direct contact with eyes can cause irritation. The cement chemically burns with little warning—little heat is sensed. Wet cement—especially as an ingredient in plastic (unhardened) concrete, mortar, or slurries—can dry the skin and cause chemical burns from inhalation, skin contact, or eye contact. cement dust can cause inflammation of the mucous membranes of the nose and inflammation of the cornea. Hypersensitive individuals may develop an allergic dermatitis. In case of inhalation, remove to fresh air and give artificial respiration if not breathing. Get medical aid. In case of swallowing, do not induce vomiting. Dilute the stomach content with a large amount of water or milk and get medical aid. In case of skin contact, remove contaminated clothing, rinse the skin with running water for at least 15 minutes, and get medical aid.

6.2.2.3 Gypsum

Gypsum is rated as a slight health hazard, nonflammable and nonreactive. The health hazards from gypsum are due to inhaling the dust which may impair breathing or irritate the lungs. Chronic exposure may lead to cancer as gypsum contains silica which is listed as a lung carcinogen.

If gypsum is ingested, call a doctor immediately; if it is inhaled, remove the victim to fresh air and support breathing. If eyes or skin are irritated by contact flush with water.

Respiratory protection is recommended if dust levels warrant. Safety glasses or goggles if dusty and impervious gloves are recommended.

6.2.2.4 Ferrous Sulfate, 7-Hydrate

Ferrous sulfate is rated as a slight health hazard, is not combustible, and is not reactive. Inhalation can irritate the respiratory system. Direct contact with the eyes/skin can cause irritation. Ferrous sulfate should be handled in an area with adequate general or local exhaust ventilation to keep fume or dust levels as low as possible. If airborne concentration is high, use a dust mask or respirator. In case of inhalation, move the exposed person to fresh air and get medical attention. In case of ingestion, give large amounts of water and get medical attention. Ferrous sulfate will decompose in a fire or explosion to produce toxic sulfur oxide gases. Firefighters should wear proper protective equipment and self-contained breathing apparatus with full face piece operated in positive pressure mode.

6.2.2.5 Barium Chloride

Barium Chloride is rated a severe health hazard (poison), is nonflammable and nonreactive. It is considered a slight contact hazard. Contact with skin or eyes may cause irritation. Ingestion may be fatal. Chronic effects of barium compounds may include bronchial irritation, degeneration of central nervous system, and damage to spleen liver, and bone marrow. If swallowed, immediately induce vomiting (if conscious). In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes.

When working with barium chloride, personal protective equipment should include safety goggles, uniform, apron, and rubber gloves.

6.2.2.6 Uranyl Nitrate

Uranyl Nitrate is considered a health and fire hazard, and a moderate reactivity hazard. Although uranyl nitrate is noncombustible, it is a strong oxidizer, and the heat of reaction with reducing agents or combustibles may cause ignition. There is a possibility of explosion if exposed to heat, flame, or friction.

Uranyl nitrate is an eye, skin, and mucous membrane irritant, and may cause damage to eyes, lungs, kidneys, skin, liver, lymphatics, blood, and bone marrow. Chronic exposure of the eyes may lead to conjunctivitis. Acute ingestion could cause gastrointestinal discomfort and diarrhea--toxic amount could cause early symptoms of nitrate poisoning and delayed symptoms of uranium toxicity. Although uranyl nitrate has not been identified as a carcinogen, long term exposure to uranium salts has been reported to cause an increase in cancer of lymphatic and blood-forming tissue of man. For inhalation, contact RCT, AEDO, Dosimetry and Medical and immediately remove person to fresh air (give oxygen for stopped breathing) keep warm, and rest. In case of ingestion, contact RCT, AEDO, Dosimetry, and medical, and give two to four glasses of water and induce vomiting (if conscious). In case of eye and/or skin contact, notify RCT, Medical, and have RCT contact AEDO, and immediately flush eyes or skin with plenty of water for at least 15 minutes. In all cases get immediate medical attention, and advise medical personnel that victim may be contaminated with radioactive material and have chemical burns.

Personal protective equipment for working with uranyl nitrate should include appropriate protective clothing, gloves, and chemical workers goggles and face shield to prevent skin/eye contact.

6.2.2.7 Calcium Fluoride

Calcium fluoride is rated a slight health hazard, nonflammable, and nonreactive. Dust may irritate skin or eyes. Ingestion may cause gastrointestinal pain and can be fatal. Target organs are eyes, skin, respiratory system, central nervous system, and kidneys.

In case of inhalation, remove person to fresh air and get medical attention. In case of ingestion, give large amounts of water and get medical attention. In case of eye contact, flush with water for at least 15 minutes and get medical attention. For skin contact, wash with soap and water for at least 15 minutes

The project waste stream containing calcium fluoride also contains thorium fluoride, calcium metal, and zinc fluoride. Personal protective equipment for working with calcium fluoride should include proper gloves and safety glasses with side shields.

6.2.2.8 Magnesium Turnings and Powder

Magnesium turnings and powder are rated as moderate flammability and reactivity hazards, with slight health hazards. Magnesium reacts violently with water, producing highly flammable vapors. Dust may form an explosive mixture with air. Contact with strong oxidizers may cause fire or explosion. It must therefore be kept away from strong oxidizing agents, strong acids, water, halogens, cyanides, and sources of heat, flame, or ignition.

Inhalation of dust may cause irritation to upper respiratory tract, tightness and pain in chest, coughing and difficulty breathing. Inhalation of magnesium oxide fumes may result in leukocytosis. Contact may irritate eyes, skin, and mucous membranes. If ingested, do not induce vomiting - give large quantities of water. For skin or eye exposure flush with water for at least 15 minutes with large amounts of water. For inhalation, move the victim to fresh air, give artificial respiration or oxygen, if necessary.

To keep fume and airborne dust levels as low as possible, adequate ventilation must be provided. Safety glasses with side shields gloves are recommended.

6.2.2.9 Tributyl Phosphate

Tributyl phosphate is rated a slight hazard for health, flammability, and reactivity. It may be irritating to skin, eyes, and mucous membranes; ingestion can cause nausea, vomiting, and headaches.

If large amounts are inhaled, move exposed person to fresh air and get medical attention. If swallowed, immediately give large amounts of water and get medical attention. For eyes immediately flush with large amounts of water for at least 15 minutes and get medical attention. For skin contact wash immediately with plenty of soap and water for at least 15 minutes.

Safety goggles, uniform, apron, and proper gloves are recommended personal protective equipment.

Tributyl phosphate should be kept away from heat, flame, other sources of ignition, and water.

6.2.2.10 Nitric Acid

Nitric acid is rated as an extreme contact hazard, severe health and reactivity hazard, and nonflammable. It is a strong oxidizer and contact with other material may cause fire. Inhalation of vapors can cause severe irritation to the respiratory system, nausea, vomiting, lightheadedness, or unconsciousness, and may cause delayed lung injury. Contact with liquid or vapor may cause severe irritation of eyes, skin, and mucous membranes. If swallowed it may cause severe burns to mouth, throat, and stomach, may have an adverse effect on kidney function, and may be fatal.

If swallowed, do not induce vomiting, give water, milk, or milk of magnesia. If inhaled remove to fresh air; give artificial respiration or oxygen if necessary. In case of contact flush with plenty of water for at least 15 minutes.

Safety goggles and face shield, uniform, protective suit, and acid-resistant gloves are recommended personal protective equipment.

Nitric acid should be stored separately and away from flammable and combustible materials.

6.2.2.11 Nitrogen

Nitrogen is rated a moderate health hazard, nonreactive, and nonflammable. Nitrogen is a simple asphyxiant. As it displaces oxygen, adequate ventilation is critical. In case of overexposure, victims should be quickly removed to fresh air, and if unconscious should be resuscitated.

Nitrogen should be stored in a cool, dry, well-ventilated area, away from heavily trafficked areas and emergency exits. Cylinders should be protected from damage.

6.2.2.12 Sodium Hydroxide

Sodium hydroxide is a severe health hazard and a slight reactivity hazard. It is essentially nonflammable. Inhaling dust or mist can result in mild irritation to severe pneumonitis. Skin contact can result in mild irritation to complete destruction of skin. Contact with eyes can result in mild irritation to blindness. Ingestion can result in irritation to severe corrosion of lips, mouth, and digestive tract. Asphyxia can result from swelling of throat. The severity of the effects depends on concentration and duration of exposure.

For inhalation, remove victim to fresh air and give artificial respiration or oxygen if needed. For skin contact wash with soap and large amounts of water, bandage burns as appropriate. For eye contact flush eyes with large amounts of water until no chemical remains, then irrigate with saline until pH returns to normal. In case of ingestion dilute with water or milk immediately, and allow vomiting to occur. Maintain airway and treat shock. For any significant exposure, get medical attention immediately.

Personal protective equipment includes splash proof or dust resistant safety goggles and a face shield, impervious protective clothing, and gloves to prevent contact with this substance, and a respirator sufficient for the contamination level.

Sodium hydroxide is a strong base which reacts exothermically with water producing alkaline corrosive solutions. It reacts with numerous other materials in ways ranging from simple corrosion to explosions and may decompose to release toxic fumes. Contact or storage with water, acids, or other incompatible chemicals should be avoided. Flammable and poisonous gases may form in tanks and hopper cars.

6.2.2.13 Carbon Monoxide

Carbon monoxide is a minor constituent of exhaust gas produced by the fossil-fueled fork lift (carbon dioxide is the more prevalent constituent). Carbon monoxide is classified as a moderate health hazard. It is flammable and produces asphyxiation when inhaled.

6.2.2.14 Hydrogen Sulfide

Hydrogen sulfide is a potential byproduct of sodium sulfide use. It poses a high health hazard if present. The most likely route of exposure is by inhalation, and at low concentration, the central nervous system and cardiovascular systems are targeted.

6.2.2.15 Sodium Bisulfate

Sodium bisulfate is a non-to-slightly combustible concrete hardening additive which is classified as a moderate health hazard. Upon inhalation, it effects the respiratory system and subsequently, the central nervous and immune systems.

6.2.2.16 Heat Treat Salt

Furnace salt was used in uranium metal heat treating and is present in the waste. The salt waste stream or concern for this project is barium chloride. Routes of entry are inhalation and ingestion.

6.2.2.17 (Sodium Hydroxide) Caustic Soda

Sodium Hydroxide may used during processing as a pH adjuster. Inhalation of low concentrations of sodium hydroxide vapor may cause sore throat and labored breathing and subsequently lung damage. Direct skin contact can produce severe chemical burns with ulceration.

6.2.2.18 Quick Lime (Calcium Hydroxide)

Quick lime may be used as a pH adjuster. Inhalation of suspended dust in low concentrations may cause respiratory distress or lung damage. Direct skin contact may produce acute dermatitis or burns. Considerable heat is liberated when quick lime hydrates on contact with water or available moisture.

6.2.2.19 Ammonia

Ammonia is present in the waste and tends to off gas during treatment. The health effects of ammonia range from mild irritation to severe corrosion of sensitive membranes. In the concentration expected based on bench testing, irritation would be mild even without engineered controls. Ammonia has great affinity for water and generates significant heat as it dissolves. Therefore, ammonia is particularly irritating to moist skin.

6.2.2.20 Heavy Metals

Lead is present in several waste streams. Lead dust and pieces of lead metal may be present.

Other heavy metals (barium and chromium) are also present in the waste streams in small amounts. Barium is a toxin to the eyes, respiratory system, heart and central nervous system. Symptoms of barium exposure may include irritation, burns and slow pulse. Chromium is a toxin to the eyes and skin. Symptoms of chromium exposure may include irritation and sensitization dermatitis. Hexavalent chromium compounds are human lung carcinogens.

6.2.2.21 Other Chemical Hazards

Other hazards associated with the chemicals discussed above are identified in greater detail in the MSDSs in Attachment E to this PSHSP.

6.3 Safety Issues

The following safety issues have been evaluated during the preparation of this PSHSP.

6.3.1 Physical Hazards

6.3.1.1 Lifting

All employees are trained to use the proper posture when lifting in order to minimize the probability of a lifting accident or injury. Lifting on the project will comply with all OSHA requirements. The ES&H Coordinator will monitor lifting of heavy unshreddable objects, buckets of waste, jack hammered rubble, and other heavy loads and will ensure that more than one worker or hoisting equipment is used to assist in lifting loads greater than 50 lbs.

6.3.1.2 Fork Lift

A propane gas powered fork lift will be used to lift heavy items such as loaded waste packages. To the extent practical, process treatment technicians will maintain safe clearance from the fork lift when it is in operation. All fork-lift operators will have received fork-lift operations training.

The fork lift will be inspected by FERMCO before entering the FEMP site and daily and periodically by the operator. All inspections will be conducted in accordance with the DOE Hoisting and Rigging Manual and are to be documented on Form FS-F-2414, "FEMP Gas, LPG Electric or Diesel Fueled Equipment Operator's Checklist." Prior to use, the path of transfer will be walked down to minimize hazards. The ES&H Coordinator will observe all transfers made with the fork-lift truck to ensure that adequate clearances to objects and personnel are maintained. Site hoisting and rigging procedures will be strictly adhered to.

6.3.1.3 Mixer

Because the mixing unit has powerful rotating parts, only trained operators will be permitted in close proximity during operation. To minimize the likelihood of a projectile such as shredded macro solids penetrating the mixing drum, drums of wall thickness equivalent to 17-C or better will be used for mixing. During certain operations and during maintenance, the mixer will be locked out both electrically and hydraulically.

6.3.1.4 Heavy Objects

Waste packages, chemical packages, waste macro solids and other heavy objects will be handled under direct supervision of the Subcontractor's Process Supervisor. A sorting table will be used to minimize dropping macro solids during sorting. A combination of safety shoes and good housekeeping practices will be employed to minimize the hazard of lighter objects that may be dropped. Macro solids exceeding shreddable dimensions and buckets of waste will be limited to 50 lbs per individual lifting. The ES&H Coordinator will verify enforcement of this limit.

6.3.1.5 Pressurized containers (drums)

Pressure may build up in some tightly sealed, unvented drums due to the decomposition of contents. Organic materials, especially in the presence of water, can produce methane or other gases which could cause the container to bulge and/or the lid to blow off when loosened. These gases could be flammable.

6.3.1.6 Shredder and Jack Hammer

Respirator face shields are required to protect workers from flying debris in proximity to the shredder and to an operating jack hammer. The shredder requires electrical lockout/tagout during maintenance.

6.3.1.7 Neutralizing Reactor

A 1200 gallon cone-bottom container will be used as a neutralizing reactor for corrosive liquids. Sodium hydroxide will be added to the corrosive waste to neutralize it and render it nonhazardous. Potential hazards include excessive exothermic reaction, gas evolution, spills, work inhalation, and direct contact with skin. These hazards will be minimized by using proper PPE by maintaining a buffer area around the tank, providing secondary containment, and by controlling the chemical reaction at a conservative rate.

6.3.1.8 Other Physical Hazards

Additional physical hazards are identified for specific tasks in Attachment A, the PSHSRM.

6.3.2 Electrical Hazards

The GFCI are to be placed at the source of the electrical service to protect both the cord and the devices connected.

Because the portable HEPA units, HEPA vacuums, shredder, mixer power supply, drill, and other equipment require maintenance and repair and depend on electrical power for operation, the potential for electrical shock exists. The likelihood of electrocution is minimized by proper lockout/tagout of power sources during maintenance as shown in Attachment A.

6.3.3 Sanitation

Toilets, showers, and washing facilities have been provided in the clean area, outside the Exclusion Zone. Drinking water is provided within the site building outside the Exclusion Zone. No eating, drinking or smoking is permitted within the Exclusion Area. A safety shower and eye wash are provided within the processing area for emergency use.

If an employee discovers evidence of contamination during frisking, he or she will notify the RCT present. The RCT will supervise and assist in decontamination.

6.4 Fire Protection

The potential for explosion during the performance of project work is minimal. Any welding or work with an open flame will require a FERMCO Open Flame and Welding Permit. To minimize the potential of explosion during electric deheader operation, an LEL head space survey is required to confirm sufficient inertness of head space gas. The fork lift is powered by scented propane to facilitate leak detection and insure ambient concentrations below LEL.

There is potential for fire resulting from magnesium power and turnings contained in the reactive waste stream to be treated during this project. To mitigate this risk, these wastes will be saturated with mineral oil and then deactivated by mixing with plaster (gypsum).

7.0 HAZARD CONTROL

7.1 Engineering/Administrative Controls

When feasible, engineering controls will be used to control physical, chemical and radiological hazards. Engineering controls anticipated during the work covered by this PSHSP include the following:

- Mixer speeds be limited to reduce splash or spinout of materials.
- The use of localized ventilation that will be HEPA filtered and exhausted out of the workplace.
- Drums suspected of being pressurized will be vented prior to opening

Administrative controls anticipated during the work covered by this PSHSP include the following:

- Limited ingress and egress to the waste processing area.
- Decontamination of equipment and personnel genuinely or potentially affected by the presence of inorganic contamination.
- The requirement that only qualified operators are assigned to operate the fork lift, jib crane, mixer, and shredder.
- The requirement that process chemicals will be added in volumes and at rates which limit heat and fume generation.
- The requirements for LEL survey prior to electric deheader operation.
- Lockout both hydraulically and electrically of the mixer during maintenance and certain operations.
- Lockout/tagout of the HEPA units during filter changes.
- Lockout/tagout of various electrically powered equipment during maintenance.
- Sodium sulfide (solid and solutions) will be physically separated from acids during storage and handling so that mixing of the materials does not occur.
- Reactive wastes will be treated (deactivated) by saturation with mineral oil and mixing with gypsum to inert the material.
- No processing of wastes if HEPA ventilation not operable.

7.2 Personal Protective Equipment (PPE)

All persons entering the Contamination Area and Exclusion Zone must wear all PPE requirements specified in the FERMCO Work Permit and comply with the applicable Radiological Work Permit (RWP). Outer layer of PPE (Saranex sleeve apron) shall be doffed prior to leaving the exclusion zone. During thorium waste processing, the outer layer of PPE shall be doffed prior to transiting to the control point. Appropriate respiratory requirements will be identified on the Work Permit PPE page.

The levels of PPE and respiratory protection (PPE/RP) in the PSHSRM and the FERMCO Work Permits have been based on characterization data and regulatory requirements. Modification to the level of PPE/RP may be required based on field monitoring of conditions or changes to regulatory requirements.

The modification of PPE/RP level due to changes in safety or chemical hazards (non-radiological) may be conducted by the FERMCO HSO or IH Technician with concurrence of Perma-Fix safety personnel, for the hazard being controlled. When changes are required, the following steps will be taken:

1. Contact the HSO and all other affected S&H Departments (Industrial Hygienists and IH Technicians, Radiological Engineering and Control) to determine if the change affects their controls.

2. IH Technicians will complete a new PPE page of the FERMCO Work Permit and inform the FERMCO Permit Group.

3. The FERMCO HSO will change the PPE section of the PSHSRM.

The modification of the PPE/RP level due to changes in radiological hazards requires the following steps be taken:

1. Consult with the Industrial Hygienist, Radiological Engineer, Perma-Fix safety personnel, and the HSO.

2. Radiological Control shall document the changes by revising and/or reissuing the affected field FERMCO Work Permits.

3. The FERMCO HSO will change the PPE section of the PSHSRM.

All personnel working under this PSHSP are responsible for reviewing currently posted PPE/RP requirements and adhering to those requirements. All personnel must stay abreast of changing work area conditions and requirements. This will be facilitated by pre-job briefings, daily tailgate safety briefings, and weekly safety meetings.

7.3 Monitoring and Sampling

This section explains the general concepts of an air monitoring program and specifies the surveillance activities that will take place during the project. Specific air monitoring requirements are outlined in Attachment B.

Air monitoring will consist of project air monitors located throughout the exclusion zone and at the boundaries. During processing of uranium contaminated wastes, the boundaries shall stay below 10% DAC during operation. During thorium waste processing, the boundaries shall remain below 2% DAC over a weekly average and cannot exceed 10% on any processing day. If these limits are exceeded, all work within the exclusion zone shall stop. Work will not resume until adequate measures are taken to eliminate the airborne source. Radiological Control Manager/Radiological Engineering will determine adequacy of action taken to mitigate airborne sources and approve work restart.

Air monitoring identifies and quantifies airborne contaminants to determine the need for and to verify the effectiveness of worker protection. Initial screening for contaminants is often qualitative (i.e., the contaminants, or classes of contaminants, are identified, but their concentration is determined after general airborne levels exceed predetermined limits). Two approaches may identify and/or quantify airborne contaminants:

- Using direct reading instruments on site.

- Collection and laboratory analysis of air samples obtained by gas sampling bags, collection media (filters, tubes), and/or bulk contaminant collection methods (sending solid or liquid samples to the laboratory).

8.0 DECONTAMINATION

8.1 Radiological Decontamination Requirements

When leaving the Contamination Area in Plant 6, workers are to perform whole body monitoring for radiological contamination by entering the PCMs at the control point. Should the PCM alarm contact the FERMCO RCT immediately.

Any circumstance which could have resulted in an intake of radioactive materials by inhalation, ingestion, or absorption shall be immediately reported to a supervisor. The supervisor shall immediately report the circumstance of possible radioactive materials intake to S&H Radiological Control Department for evaluation. When the suspect isotope is uranium, the involved employee(s) shall also report to the Urine Sampling Station at the start of their next shift to submit a follow-up urine sample. When the suspect isotope is other than uranium the involved employee(s) shall report to the Radiological Control Dosimetry Department for further determination of actions. Employees are responsible for complying with additional requirements as specified by the Radiological Control Department.

8.1.2 Equipment Decontamination Requirements

Equipment for decontamination of radiological or chemical hazards shall be kept available in the area surrounding the work area exclusion zone. Workers will doff outer layer of PPE when leaving the exclusion zone. Personnel monitoring utilizing an alpha monitor is required during thorium processing when exiting the exclusion zone prior to proceeding to the control point.

Equipment must be monitored by a RCT prior to removal from a radiologically controlled area. Should the subcontractor's tools, material, or equipment become contaminated, they will have to be decontaminated by the subcontractor at its expense, before removal from the area. If decontamination becomes necessary, FERMCO will provide instructions for decontamination. Activities to ensure proper decontamination are expected to include disassembly as required. Tools detected to have fixed contamination may continue to be used in a Contamination Area, though certain conditions regarding allowable usage may be required by the FERMCO Radiological Control Department.

8.2 Chemical Decontamination Requirements

Questions concerning chemical contamination and potential exposure should be directed to FERMCO IH at 648-4000.

9.0 EMERGENCY/CONTINGENCY PLANS

9.1 Reporting

9.1.1 Emergency Numbers

Report all accidents and injuries to the Assistant Emergency Duty Officer (AEDO).

NAME	FEMP TELEPHONE NUMBER	RADIO CONSTRUCTION
Ambulance	648-6511	CONTROL
Hospital		
Fire		
Security		
Emergency Response		
FERMCO HSO	648-4262	394
Assistant Emergency - Duty Officer (AEDO)	648-4749/4444	202
Accountability	648-4111	Control

9.1.2 Site Notification Procedures

All FEMP emergencies shall be reported to the FERMCO Communication Center to ensure rapid response. A means to report an emergency shall be available at all work locations whenever personnel are working. This may be accomplished by one of the following methods:

- Phone 648-6511
- Radio to **"Control"**

Employees working will be notified of emergency or abnormal conditions by the plant-wide alarm system and radio announcements. This announcement follows the sounding of the site alarm horn signal (3-3s).

9.1.3 What to Report

The following are examples of emergencies that would justify calling and reporting an emergency:

- Serious injury
- Injury complicated by contamination
- Chemical/radiation release
- Chemical splash (eye and/or skin)
- Fire
- Major property damage
- Unusual occurrence(s)
- Explosion Emergencies

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When an emergency or abnormal condition is observed, personnel shall contact the FERMCO Communications Center at extension **6511** or via radio **(CONTROL)** for emergencies. **Stay on the phone line until the dispatcher hangs up.**

The following information must be given to the FERMCO Communications Center operator:

- Name and badge number
- Location where emergency has occurred
- Nature of the emergency
- Number of personnel with injuries
- Unusual conditions (odors, symptoms, vapors, smoke)
- Current status of the emergency

9.2 Evacuation Routes/Accountability

Rally Point Accountability

Should a situation require an emergency evacuation of the work area, all equipment should be turned off (if possible) and left in place. All personnel are to proceed to Rally Point 5 located at the corner of 1st and D streets. (See Attachment C.)

9.3 Emergency Equipment

The FERMCO site has the capability and equipment to respond to medical, fire, chemical, and radiological emergencies.

9.4 Emergency Response

FEMP Emergency Services will handle all on-site emergencies. Any request for emergency help should be requested by telephone at (648-) **6511** or on any FEMP frequency by calling **"CONTROL."**

9.4.1 Medical Emergency

Any injury, no matter how minor, shall be reported immediately to the FERMCO Medical Department for evaluation or treatment. The injured employee shall be accompanied to medical for evaluation and treatment by the employee's supervisor.

The FERMCO Medical Department is located at the east end of the first floor of the S&H building (Building 53), see Attachment D.

The FERMCO Medical Department and emergency site ambulance shall serve as the first-aid responder.

Monitoring for personnel contamination shall not delay prompt medical attention. Deviation from procedures governing personnel monitoring is permitted under medical emergency situations.

9.4.2 Fire Emergencies

All work sites shall maintain effective communication to summon fire fighting assistance. Access to the work area shall be maintained at all times to permit fire trucks and fire fighting crews to safely approach the fire emergency.

Only trained personnel shall attempt to operate fire fighting equipment and only when the fire is clearly within the capability of the fire fighting equipment.

The FEMP Emergency Response Team (ERT) will also respond to all on-site fire emergencies. For any fire emergency at the FEMP, call (648-) **6511** or radio **"CONTROL."**

9.4.3 Explosion Emergencies

The reactives waste stream on this project has the potential for combustion or explosion. During this activity, the site will be put on the highest alert for emergency preparedness. To mitigate and eliminate this potential hazard, treatment will take place in a reduced oxygen environment and a blanket of nitrogen will be maintained int he headspace during the inerting treatment.

9.4.4 Chemical Emergencies

9.4.4.1 Personal Contamination

Due to the limited nature of project field activities, equipment, and materials involved, personal contamination from either caustic or corrosive materials is highly unlikely.

9.4.5 Releases

The supervisor-in-charge, AEDO, RCT, and the FERMCO HSO shall be notified of the release.

10.0 CHANGES/AMENDMENT TO THE PSHSP

This PSHSP for field activities is based on information available at the time of preparation. Provisions of this plan are to be reassessed quarterly by the FERMCO HSO or when conditions/events arise that require reassessment of health and safety issues. PPE requirements, including respiratory protection requirements, will be reevaluated when air sampling data are available, and changing trends in airborne levels are observed. Amendments/revisions of this PSHSP must go through formal review and approval by all departments included in the original review cycle.

10.1 Control of Health and Safety Plan

For the purpose of ensuring that all personnel are informed of any changes in the scope of this PSHSP, CONTROLLED copies of this document shall be maintained by ES&H Document Control. Only essential personnel shall maintain controlled copies of this document. The following table is the list of personnel with the controlled copies of this PSHSP.

TITLE	INDIVIDUAL
Field Copy	Carla Hood
Project Manager	Melissa Thomas
Project Manager, PESI	Tim Kimball
Construction Safety	Jack Craighead
FERMCO Health and Safety Officer	Carla Hood
Radiological Control Technicians	Andy Holstein
Radiological Engineering	Mike Jernigan
Director FERMCO Medical Department	Doran Christensen
Supervisor, Industrial Hygiene Technicians	Jack Patrick
Manager, Industrial Hygiene	Dave Jackson

Changes, corrections, and/or additions not directed through S&H Document Control will not be considered "controlled and approved." Operations conducted under such plans will be subject to work stoppage until control numbers are assigned.

PROJECT SPECIFIC HEALTH AND SAFETY REQUIREMENTS MATRIX

PROJECT: MIXED WASTE CHEMICAL TREATMENT PROJECT (Neutralization/Precipitation/Deactivation/Stabilization)

The requirements listed in Section 1 of this matrix apply to all activities addressed on this matrix

ACTIVITY (TASKS)	HAZARD IDENTIFICATION	FREQUENCY & TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING & SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE & ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION & DISPOSAL PROCEDURES
1 General Project minimum requirements to access work site **NOTE: These general requirements apply to all sections of this matrix**	Work on a CERCLA\RCRA\TSDF site Work in radiological Contamination area (uranium contamination) Plant 6 Exclusion Zone **Not all hazards are specified on this matrix.** Thorium contamination	Thermoluminescent Dosimeter (TLD) All personnel must perform whole body monitoring for uranium contamination prior to exiting the Contamination and Controlled area 25% of workers will wear BZs for uranium monitoring 100% BZ SRPD RWG Dosimeter	• Steel toed safety shoes • Safety glasses w/rigid side shields • FERMCO issued clothing • Cloth Anti-Cs with hood • Full face respirator with combination cartridges • Rubber shoe covers • Surgical gloves • Double set Anti-Cs with hood air line or PAPR	• Site GET Training • Site Worker Training • Rad Worker II Training • 24 Hr. Supervised Field Experience • Respirator training and fit test • Orientation on PSHSP and PSHSRM • Orientation on Project Specific MSDSs • Construction Rules & Regulations Additional for Supervisors: • OSHA Construction Outreach	Medical surveillance exam: baseline, annual, and termination Initial, annual, and termination in-vivo exam (whole body count) Initial, bi-monthly, annual and termination urinalysis Report all injuries to FERMCO Medical Department Medically approved for respirator use	Attend a pre-work kickoff/safety meeting Daily specific task review of matrix	FERMCO Work Permit Radiological Work Permit (RWP)	Personnel and material monitoring required to exit Contamination and Controlled areas.
	Hands off inspections or visiting the work site (Plant 6)	Thermoluminescent Dosimeter (TLD) All personnel must perform whole body monitoring for uranium contamination prior to exiting the Contamination and Controlled area	• Steel toed safety shoes • Safety glasses w/rigid side shields • Smock • Rubber shoe covers • Surgical gloves	Briefing by site supervisor or HSO on current activities, hazards and controls using the PSHSP and PSHSRM Sign the acknowledge form for PSHSP and standing permits		Inspectors and visitors to be escorted by person with Radiological II training unless they are trained to level of workers Visitors must have written permission of FERMCO Radiological Engineering and HSO unless trained to level of workers Prior to entering exclusion zone must contact supervisor		
	Lifting injuries			Safety briefing on proper lifting	Report back problems to FERMCO Medical Department	Loads weighing more than 50 lbs. to be moved by more than one person and with mechanical assistance Perma-Fix ES&H Coordinator will monitor heavy lifting		

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2 Working with barium chloride residues	Barium Chloride	General area monitoring	Rubber Gloves	Orientation on MSDS		Perma-Fix ES&H Coordinator to ensure proper placement and use of localized portable ventilation		
	Inhalation					Local ventilation and containment will be used to control dust		
	Direct exposure to waste on skin							
3 Working with corrosive liquids	Nitric acid, sodium hydroxide NO_2	General area monitoring	Rubber Gloves	Orientation on MSDS		Perma-Fix ES&H Coordinator to ensure proper placement and use of localized portable ventilation and containment Buffer area around neutralization tank		
	Inhalation	General area monitoring		Supplied air respirators		Misting with water will be used to control dust		
	Direct exposure to waste on skin							
4 Working with oxidizing wastes	Thorium nitrate, uranyl nitrate	General area monitoring	Rubber Gloves Double PPE	Orientation on MSDS	Feces sampling for thorium	Perma-Fix ES&H Coordinator to ensure proper placement and use of localized portable ventilation and containment		
	Inhalation		Supplied air respirator for thorium contaminated wastes			Misting with water will be used to control dust		
	Direct exposure to waste on skin							
5 Working with reactive waste	Combustion, explosion	General area monitoring	Leather gloves	Orientation on MSDS		Saturation with mineral oil		
	Inhalation		Supplied air respirator					
	Direct exposure to waste on skin							

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6 Transporting drums by fork-lift truck	Collision or impact with transported load or vehicle			Fork lift driver training and certification		• Operator checks path prior to transport • Operator lifts load only as high as needed • Operator ensures slow transport • Operator sounds alarm during movement • Operator ensures visibility or uses signal man • Operator follows DOE and site hoisting and rigging requirements		
7 Removing lids from drums (manual or impact wrench) and cutting drum liners	Inhalation of NH_3, CO, or other accumulated offgas of waste	Work place air monitoring for NH_3, H_2, organic vapor		TSM on lid removal		Perma-Fix ES&H Coordinator to ensure proper placement and use of localized portable ventilation Contact FERMCO IH when CO, NH3 exceed action levels		
	Cuts and abrasions		Leather gloves			Contact FERMCO HSO		
	Pressurized drum		Leather gloves	TSM on pressurized drum opening		Punch drum with non-sparking tools Use remote punching device Ground drum		
	Inhalation of airborne particulate from drum	Workplace air for uranium				Perma-Fix ES&H Coordinator to ensure proper placement and use of localized portable ventilation Misting with water will be used to control dust		

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8 Removing lids from drums	Explosion burns, explosion pressure concussion, impact of projectile or flying debris	Drum headspace survey for LEL		TSM or electric deheader operation	Report injury to FERMCO Medical Department	Operator uses non-sparking punch tool to penetrate lid Perma-Fix ES&H Coordinator monitors headspace gas prior to deheading		
9 Lifting drums with jib hoist	Crushing from drum dropped on foot or other part of body			TSM on use of jib hoist	Report injury to FERMCO Medical Department	Perma-Fix ES&H Coordinator monitors compliance with DOE and site hoisting and rigging procedures Rigging fixtures approved by FERMCO HSO		
	Direct exposure to waste on skin in case of drop and rupture					Contact FERMCO IH and RCT upon exposure		
	Inhalation of airborne particulate or gases in case of drum drop and rupture					Perma-Fix ES&H Coordinator ensures placement of localized ventilation		
10 Decanting or transferring liquid drum to drum (or to overpack with bucket)	Crushing from bucket dropped on foot or other part of body			TSM on decanting	Report injury to FERMCO Medical Department	Perma-Fix ES&H Coordinator ensures buckets are less than 50 lbs.		
	Back injury or slip and fall				Report injury to FERMCO Medical Department	Loads weighing more than 50 lbs. to be moved by more than one person and with mechanical assistance Perma-Fix ES&H Coordinator will monitor heavy lifting		
	Direct exposure to waste on skin		Water resistant protective clothing in place of cloth anti-c's		Report injury to FERMCO Medical Department	Contact FERMCO HSO, IH or RCT upon exposure		
11 Rinsing drums, buckets, tools, etc. with hose	Direct exposure to waste on skin		Water resistant protective clothing in place of cloth anti-c's	TSM on rinsing		Contact FERMCO HSO, IH and RCT upon exposure		
12 Operating air-driven diaphragm pump	Direct exposure to waste as a result of splash			TSM on pump operation		Contact FERMCO HSO, IH and RCT upon exposure		

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13 Lift drum with drum rotator	Crushing foot or other body parts upon drop			TSM on rotator use	Report injury to FERMCO Medical Department	Operator lifts and transports slowly Operator follows observer's hand signals Operator limits lift to required height Operator ensures good grip and positioning		
14 Visually checking tipped drums to confirm material release	Crushing or impalement by falling debris			TSM on tipped drum release	Report injury to FERMCO Medical Department	Operator uses mirror to avoid placing head under waste container		
15 Manually assisting release of waste from tipped drums	Crushing foot or other body parts upon drop				Report injury to FERMCO Medical Department	Operator lifts and transports slowly Operator follows observer's hand signals Operator limits lift to required height Operator ensures good grip and positioning		
	Inhalation of NH_3, CO or other accumulated off gas	Work place air monitoring for NH_3, CO, organic vapor				Perma-Fix ES&H Coordinator ensures placement of localized ventilation		
	Release of dust (uranium)					Misting with water		
	Direct exposure to waste as a result of rupture or splash				Report injury to FERMCO Medical Department	Contact FERMCO IH or HP upon exposure		
16 Manually separating waste from debris on bar screen with pry bars, etc.	Slip and Fall Back injury or sprain			TSM on bar screen operations	Report injury to FERMCO Medical Department	Perma-Fix ES&H Coordinator ensures compliance with OSHA and site requirements on ladder or steps		
	Release of dust (uranium)					Misting with water		

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17 Mixing waste using hydraulic powered mixer	Direct exposure due to splashing		Water resistant anti-c's inplace of cloth anti-c's			Contact FERMCO IH & HP upon exposure Operator lowers RPM if splashing observed		
	Inhalation of CO, NH_3, rad or chemically toxic particulate, or treatment reagent due to splashing and off gassing	Ammonia four times daily				Perma-Fix ES&H Coordinator ensures placement and proper use of localized ventilation		
	Operator contact with rotating blades					Add materials only when mixing blades are stopped & safety pin is put in place		
18 Removal of mixer assembly from waste	Direct exposure of skin to waste or treatment reagents due to centripetal slinging on removal		Water resistant anti-c's inplace of cloth anti-c's			Operator is sure mixer has ceased rotation prior to lifting		
19 Addition and mixing of sodium bisulfate	Inhalation of sodium bisulfate			TSM on MSDS for $NaHSO_4$		Perma-Fix ES&H Coordinator ensures placement and proper use of localized ventilation		
	Skin exposure to sodium bisulfate		Rubber gloves			Contact FERMCO IH & HP upon exposure		
20 Addition and mixing of ferrous sulfate	Inhalation of ferrous sulfate			TSM on MSDS for $FeSO_4$		Perma-Fix ES&H Coordinator ensures placement and proper use of localized ventilation		
	Skin exposure to ferrous sulfate		Rubber gloves			Contact FERMCO IH & HP upon exposure		
21 Addition and mixing of unslaked lime	Inhalation of lime			TSM on MSDS for CaOH		Perma-Fix ES&H Coordinator ensures placement and proper use of localized ventilation		
	Skin exposure to lime		Rubber gloves			Contact FERMCO IH & HP upon exposure		

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22 Handling of caustic soda (addition and mixing)	Inhalation of caustic soda			TSM on MSDS for NaOH		Perma-Fix ES&H Coordinator ensures placement and proper use of localized ventilation		
	Skin exposure to caustic soda		Rubber gloves					
23 Handling (addition and mixing) of sodium sulfide flake or liquid	Inhalation of sodium sulfide powder or hydrogen sulfide gas	Monitor for H_2S during mixing		TSM on NaS and H_2S		Perma-Fix ES&H Coordinator ensures placement and proper use of localized ventilation		
	Skin exposure to sodium sulfide powder or liquid, hydrogen sulfide gas, or sulfuric acids		Rubber gloves					
24 Slaking Lime	Inhalation of unslaked or slaked lime			TSM on MSDS for lime		Perma-Fix ES&H Coordinator ensures placement and proper use of localized ventilation		
	Direct skin contact with unslaked or slaked lime		Rubber gloves	TSM on lime slaking				
25 Addition and mixing of Type I Portland Cement	Inhalation			TSM on Portland Cement		Perma-Fix ES&H Coordinator ensures placement and proper use of localized ventilation		
	Skin exposure to Portland Cement							
26 Addition and mixing of gypsum	Inhalation			TSM on Gypsum		Perma-Fix ES&H Coordinator ensures placement and proper use of localized ventilation		
	Skin exposure to gypsum							
27 Checking pH, slump, specific gravity, and checking sulfide end point with lead acetate paper	Skin exposure to waste		Rubber gloves	TSM on field checks				
28 Hand addition of shredded waste into mix unit	Impalement by projectile laceration, or by slip and fall		Leather gloves	TSM on handling shredded waste		Add materials only when mixing blades are stopped and safety pin is put in place		

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29 Cleaning mixer blades with spatula	Collision, crushing, dismemberment, or decapitation from accidental start of unit			TSM on blade cleaning		Clean blades only when mixing blades are stopped and safety pin is put in place		
30 Transferring oversize debris to White Metal Box	Back injury and slip and fall			TSM on White Metal Box loading		Loads weighing more than 50 lbs. to be moved by more than one person and with mechanical assistance Perma-Fix ES&H Coordinator will monitor heavy lifting		
31 Bailing unset waste from White Metal Box	Back injury and slip and fall		Water resistant anti-c's inplace of cloth anti-c's Rubber gloves	TSM on bailing				
32 Mixing unset waste in White Metal Box with hand held drill and paddle	Wrist sprain		Water resistant anti-c's inplace of cloth anti-c's Rubber gloves	TSM on drill mixing				
33 Breaking up TCLP rejected waste in White Metal Box with jack hammer	Inhalation of airborne particulate			TSM on jack hammering waste		Perma-Fix ES&H Coordinator ensures proper placement and operation of localized portable ventilation Misting with water will be used to control dust		
	Noise	FERMCO evaluation	Hearing protection (ear plugs/muffs) shall be worn for exposures $\geq$ 85 dBA and exposures $\geq$ 85 dBA 8 Hr. TWA	Employees exposed to sound levels $\geq$ 85 dBA 8 hr. TWA shall in a Hearing Conservation Program	Employees exposed to sound levels $\geq$ 85 dBA 8 hr. TWA shall be in a Audiometric testing program	Post area as hazardous noise area - hearing protection required.		
34 Load drums with jack-hammered waste using shovels	Back injury, slip and fall			TSM on unloading boxes		Loads weighing more than 50 lbs. to be moved by more than one person and with mechanical assistance Perma-Fix ES&H Coordinator will monitor heavy lifting		

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35 Shred TCLP-rejected jack-hammered waste in shredder	Inhalation of airborne particulate			TSM on shredding reject waste		Perma-Fix ES&H Coordinator ensures proper placement and operation of localized portable ventilation Misting with water will be used to control dust		
	Noise	FERMCO evaluation	Hearing protection (ear plugs/muffs) shall be worn for exposures ≥ 85 dBA and exposures ≥ 85 dBA 8 Hr. TWA	Employees exposed to sound levels ≥ 85 dBA 8 hr. TWA shall in a Hearing Conservation Program	Employees exposed to sound levels ≥ 85 dBA 8 hr. TWA shall be in a Audiometric testing program	Post area as hazardous noise area - hearing protection required.		
36 Maintenance of shredder	Dismemberment, shredding of limbs, etc., on accidental start			TSM on shredder		Perma-Fix ES&H Coordinator to ensure lockout/tagout Perma-Fix ES&H Coordinator to supervise use of localized ventilation and continuously supervise work		
	Equipment start-up from stored energy			Involved personnel to be trained to FERMCO OP-0008		Lock and Tag to be conducted in accordance with FERMCO OP-0004	Energy Isolation Plan	
37 Maintenance of portable HEPA unit	Collision or dismemberment on accidental start			TSM on HEPA				
	Inhalation of resuspended particulate					Perma-Fix ES&H Coordinator to supervise use of localized ventilation and continuously supervise work		
	Equipment start-up from stored energy			Involved personnel to be trained to FERMCO OP-0008		Lock and Tag to be conducted in accordance with FERMCO OP-0004	Energy Isolation Plan	
38 Maintenance of HEPA Vacuum	Collision or dismemberment on accidental start			TSM on HEPA Vacuum				
	Inhalation of resuspended particulate					Perma-Fix ES&H Coordinator to supervise use of localized ventilation and continuously supervise work		

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38 Maintenance of HEPA Vacuum (cont'd)	Equipment start-up from stored energy			Involved personnel to be trained to FERMCO OP-0008		Lock and Tag to be conducted in accordance with FERMCO OP-0004	Energy Isolation Plan	
39 Maintenance of mixer	Collision, dismemberment, or decapitation on accidental startup					Lock and tag to be conducted in accordance with FERMCO OP-0004		
40 Maintenance of drill	Electrocution			TSM on drill				
	Equipment start-up from stored energy			Involved personnel to be trained to FERMCO SSOP-0719		Lock and Tag to be conducted in accordance with FERMCO SSOP-0719	Energy Isolation Plan	
41 Maintenance of jack hammer	Foot or hand injury from dropped part			TSM on jack hammer				
	Equipment start-up from stored energy			Involved personnel to be trained to FERMCO SSOP-0719		Lock and Tag to be conducted in accordance with FERMCO SSOP-0719	Energy Isolation Plan	
42 Maintenance of fork lift	Crushing injury, or injury from fire or explosion			TSM on fork lift				
	Equipment start-up from stored energy			Involved personnel to be trained to FERMCO SSOP-0719		Lock and Tag to be conducted in accordance with FERMCO SSOP-0719	Energy Isolation Plan	
43 Maintenance of electric deheader	Equipment start-up from stored energy			Involved personnel to be trained to FERMCO SSOP-0719		Lock and Tag to be conducted in accordance with FERMCO SSOP-0719	Energy Isolation Plan	
44 Maintenance of pneumatic operated pump	Foot or hand injury from dropped part			TSM on pump				
	Equipment start-up from stored energy			Involved personnel to be trained to FERMCO SSOP-0719		Lock and Tag to be conducted in accordance with FERMCO SSOP-0719	Energy Isolation Plan	
45 Filter or pre-filter changeout or portable HEPA units	Inhalation of resuspended particulate			TSM on filter changeout		Perma-Fix ES&H Coordinator to supervise use of localized ventilation and continuously supervise work		
46 Decontamination and demobilization	Personnel Injury		Leather gloves					All debris created during activities to be removed

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ATTACHMENT B

PERSONNEL ENVIRONMENTAL MONITORING ACTION LEVELS

RADIOLOGICAL CONTROL ACTION LEVEL

MEASUREMENT	*LEVEL*	*ACTION/RESPIRATORY PROTECTION* NOTE 1,2,3
Alpha Probe	*1000 dpm/100cm²* *(Uranium loose limit)20dpm/100cm²* *(Thorium loose limit)*	*Contact Radiological Control Technician @ ext. 9244.*
Beta/Gamma Probe	*1,000dpm/100cm²*	*Contact Radiological Control Technician @ ext. 9244.*
U-238, Th-230, and Th-232	*> 0.10 x DAC*[note 4]	*Weekly average, Post area as Airborne Radioactaivity Area*
U-238, Th-230, and Th-232	*> 1.0 x DAC*	*Respiratory Protection Required*

1. Area shall be posted as an **"Airborne Radioactivity Area"**, based on air sample results, by the Radiological Control Technician.

2. Air sample results which indicate that individuals may have been exposed to 4 DAC-hours or more per week shall trigger internal dosimetry assessment (e.g. invitro and/or invivo assessments).

3. Invitro and/or invivo assessments may be required at levels less than 4 DAC-hours per week, if deemed necessary by the Radiological Control department.

4. Respiratory requirements will be established based on air sample results, protection factors of the respiratory protection and stay time in the affected area as determined by Radiological Engineering.

5. Derived Air Concentrations (DAC) for radionuclide(s) of interest.

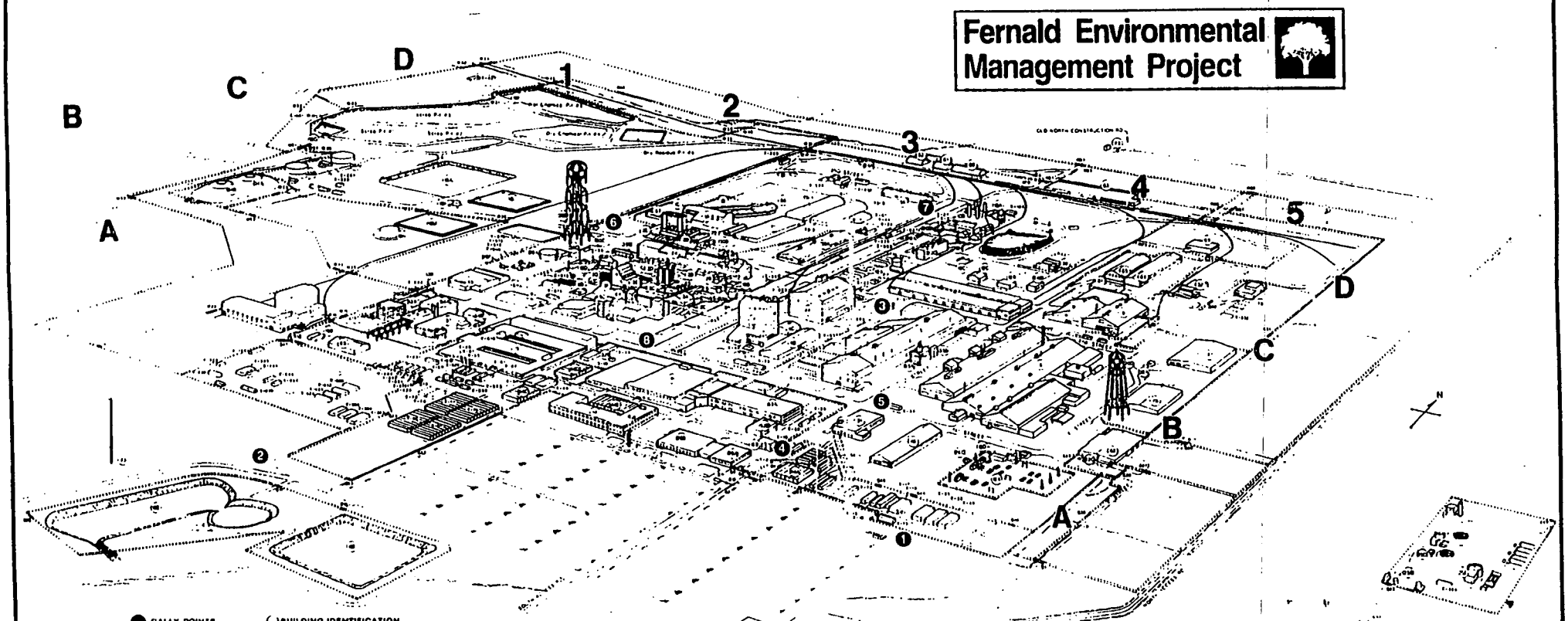
INDUSTRIAL HYGIENE AND ENVIRONMENTAL MONITORING ACTION LEVELS

MEASUREMENT	LEVEL	ACTION
Organic vapors	Detection to 25 ppm	• Use air purifying respirator • Contact FERMCO IH if >10 ppm
	> 25 ppm	• Contact FERMCO IH • Use air supplied respirator • Check engineering and administrative controls • Obtain personal samples to characterize contaminant and concentration. Establish measurement methods, action levels, and actions for the contaminants.
Total dust	> 0.02 mg/m^3	• Contact FERMCO IH • Use air purifying respirator • Check engineering and administrative controls • Identify contaminant by air sampling or by process knowledge. Establish measurement methods, action levels, and action for the contaminant found.
Explosive gases	>25% LEL	• Contact FERMCO Fire and Safety
	100% LEL	• Withdraw from area and re-evaluate activities
Ammonia	>10 ppm	• Use air purifying respirator • Contact FERMCO IH • Check engineering and administrative controls
	>25 ppm	• Withdraw and re-evaluate activities
Hydrogen Sulfide	Detection to 5 ppm	• Contact FERMCO IH • Check engineering and administrative controls
	>10 ppm	• Withdraw and re-evaluate activities
Carbon monoxide	Detection to 10 ppm	• Contact FERMCO IH • Check engineering and administrative controls
	>25 ppm	• Withdraw and re-evaluate activities
NO_2	0.1 - 0.4 ppm	• Contact FERMCO IH • Check engineering and administrative controls
	0.5 ppm	• Use air supplied respirator
Barium	0.2 mg/m^3	• Air purifying respirator • Contacta FERMCO IH • Check engineering and administrative controls
Other Chemicals and metals	Contact FERMCO IH	• Contact FERMCO IH for requirements

ATTACHMENT C

FEMP RALLY POINTS

Fernald Environmental Management Project



● RALLY POINTS

( ) BUILDING IDENTIFICATION

Building No.	Grid Location	Title
DC		Gardens
1a	C-3	Production Plant
1c	C-3	Plant 1 Storage Building
2a	B-3	Old Refinery Plant
2b	B-3	Lime Handling Building
2c	B-3	Bulk Lime Handling Building
2d	B-3	Water Softener Building
2e	C-3	NH3 Storage and Pump House
3a	B-3	Maintenance Building
3b	B-3	Ozone Building
3c	B-3	Control House
3d	B-3	NHR Towers
3e	B-3	Hot Refinate Building
3f	B-3	Digestion Sump Recovery
3g	B-3	Refrigeration Building
3h	B-3	Refinery Sump
4a	B-4	Green Salt Plant
4b	B-4	Plant 4 Warehouse
4c	B-4	Plant 4 Maintenance Building
5	B-4	Metals Production Plant
6	B-3	Metals Fabricating Plant
7	B-4	Plant 7
8a	B-3	Recovery Plant
8b	B-3	Maintenance Building
8c	B-3	Restroom Decontamination Building
8d	C-3	Special Products Plant
10a	D-4	Boiler Plant
10b	D-4	Boiler Plant Maintenance Building
11	A-4	Service Building
12a	C-4	Maintenance Building (Main)
12c	C-4	Cylinder Storage Building
12d	C-4	Lumber Storage Building
20a	B-3	Plant Plant Warehouse
20b	A-3	Plant Plant Maintenance Building
20c	A-3	Sump Pump House
20d	A-4	Administration Building
20e	A-3	Laboratories
22a	B-3	Main Electrical Station
22b	A-3	Electrical Substation
22c	A-3	Surge Lagoon
23	B-3	Cement Silos
24a	C-4	East Pine Runoff Basin
24b	C-4	Reversed Engine Building
25a		Storm Water Retention Basin
25b	C-3	PA 5 Sludge Gate
25c	A-3	Cleanman Pump House
25d	B-3	BDN Effluent Treatment Facility
25e	B-2	Wastewater Tank
26	C-3	Low Noise Tank
26a	B-3	Pump House - HP Fire Protection
26b	B-3	High Nitrate Tank
26c	B-3	High Nitrate Storage Tank
26d	C-4	Main Water Tank Farm
26e	A-4	Pilot Plant Ammonia Tank Farm
30a	A-3	Pump Station and Power Center
30b	C-4	Water Plant
30c	C-3	Cooling Towers
30d	A-3	Elevated Storage Tank (Potable Water)
30e	B-3	Main House #1
30f	B-3	Main House #2
30g	B-3	Main House #3
30h	C-3	Process Water Storage Tank
30i	B-2	Lime Slurry Pits
30j	C-4	Gas Meter Building
31a	B-3	Stormsewer Lift Station
31b	B-3	Truck Scale
31c	B-3	Meteorological Tower
31d	A-3	Rainbow Scale House
31e	C-4	Reversed Engine Building
31f		Chlorination Building
31g		Site 6101
31h	A-3	Sanitary Lift Station Building
31i		UV Disinfection Building
31j		Digester Control Building
31k	B-3	Pump House - HP Fire Protection
31l	B-3	Elevated Water Storage Tank
31m	A-3	Main Electrical Stormer House
31n	A-4	Security Building
31o	A-3	Human Resources Building
31p	C-3	Chemical Warehouse
31q	C-3	Drum Storage Warehouse
31r	A-3	Engine House - Garage
31s	D-3	Magnesium Storage
31t	D-3	K-65 Storage Tank - North
31u	D-3	K-65 Storage Tank - South
31v	C-3	Water Dome Storage Tank - North
31w	B-3	Water Dome Storage Tank - South
31x	A-3	Plant Plant Annex
31y	C-4	Propane Storage
31z	B-3	Incinerator Building
31aa	B-3	Shelter Storage Building
31ab	B-3	Incinerator Building Sanitary Sewer House
31ac	A-3	Trench Composter - 6-Pack - East
31ad	A-3	Trench Composter - 7-Pack - South
31ae		Trench Composter - 7-Pack - North
31af		Trench Composter - 10-Pack
31ag	A-3	Plant Engineering Building
31ah	A-3	Heavy Equipment Garage
31ai		UF6 to UO2 Reduction Facility
31aj	A-3	Occupational Safety & Health Building
31ak		Drivers Building
31al	A-3	Plant Plant Warehouse
31am	A-3	Decontamination Building
31an	C-3	Generation Process Storage Warehouse
31ao	C-3	Drum Storage Building
31ap		Fire Brigade Training Center Building
31aq	C-3	Finished Products Warehouse
31ar	D-3	New DBD Facility
31as	B-3	Plant 8 Warehouse
31at	B-3	Plant 8 Warehouse
31au	C-3	Plant 8 Warehouse
31av	B-3	Receiving & Incoming Materials Inspection Area

May 1992

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Recycled and Recyclable

ATTACHMENT D

LOCATION OF FEMP MEDICAL FACILITY

ATTACHMENT E

WORK AREA MATERIAL SAFETY DATA SHEETS (MSDSs)

7730

MATERIAL SAFETY DATA SHEET

MSDS CODE NO. 5B81-83 ORIGINAL ISSUE DATE: 8/85 REVISED 2/94

I. IDENTIFICATION

24 HOUR EMERGENCY TELEPHONE NUMBER
CHEMTREC 800-424-9300

RODUCT NAME: Anhydrous Ammonia
OMMON NAME: Ammonia
HIPPING NAME: Ammonia, Anhydrous, Liquefied, 2.2
UN 1005, RQ, Inhalation Hazard.

MANUFACTURER AND/OR DISTRIBUTOR:
LaRoche Industries Inc.
1100 Johnson Ferry Road N.E.
Atlanta, GA 30342
(404) 851-0300; (404) 491-7987 after hours
Prepared By: R. C. Cannon

II. INGREDIENTS AND RECOMMENDED OCCUPATIONAL EXPOSURE LIMITS

MATERIAL	FORMULA	CAS. NO.:	%WT.		EXPOSURE LIMITS		
					OSHA-PEL	ACGIH	
			C-Grade	P-Grade		TLV	STEL
Ammonia	NH_3	7664-41-7	99.5	99.995	50 ppm	25 ppm	35 ppm
Water	H_2O	7732-18-5	0.4	33 ppm	None Established	None Established	
Oil	—	—	0.1	2 ppm	5mg/M³	5mg/M³	—

III. PHYSICAL DATA

OILING POINT (°F) —28.1°

SPECIFIC GRAVITY (H_2O=1) 0.62 @ 60°F

ELTING POINT (°F) —107.9°

PERCENT VOLATILE BY VOLUME (%) 100

APOR PRESSURE (mm Hg.) 4802.9 (94 psi) @ 60°F

pH Approx. 11.6 for 1 N Soln in water

APOR DENSITY (AIR=1) 0.60 @ 32°F

SOLUBILITY IN WATER 33% (Wt.) @ 68°F

PPEARANCE AND ODOR: Colorless gas or liquid with extremely pungent odor.

IV. FIRE AND EXPLOSION HAZARD DATA

LASH POINT (method used) Not Applicable
LAMMABLE LIMITS 16-25% in air

NFPA HAZARD RATING			
HEALTH	3	(High)
FIRE	1	(Slight)
REACTIVITY	0	(Least)

XTINGUISHING MEDIA: With a source of ignition, ammonia will burn in the range of 16-25% in air. Use water fog or spray to extinguish flames.

PECIAL FIRE FIGHTING PROCEDURES: Stop flow of gas; move containers from fire zone if possible. Stay clear of tank heads. Use water cool fire-exposed containers and protect personnel. Use water spray to control vapors. Personnel must be equipped with appropriate protective lothing and respiratory equipment. Do not put water on liquid ammonia.

V. REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID: Heating above ambient temperatures causes the vapor pressure of ammonia to increase rapidly.
	Unstable		
	Stable	X	

NCOMPATIBILITY: Ammonia can react violently with strong acids. Under certain conditions, ammonia reacts with bromine, chlorine, fluorine iodine to form compounds which explode spontaneously. Reactions of ammonia with gold, silver or mercury to form explosive fulminate-like ompounds have been reported.

AZARDOUS DECOMPOSITION PRODUCTS: Hydrogen on heating to over 850°F. The decomposition temperature may be lowered to 75°F by contact with certain metals such as nickel.

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID: Not Applicable
	May Occur		
	Will Not Occur	X	

OTE: Anhydrous Ammonia is subject to the reporting requirements of SARA (1986, section 313 of Title III) and 40 CFR Part 372.

LAROCHE INDUSTRIES INC

VI. SPILL OR LEAK PROCEDURES

TRANSPORTATION EMERGENCIES
Call CHEMTREC 800-424-9300

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED: Stop leak if feasible. Avoid breathing ammonia. Evacuate personnel not equipped with protective clothing and equipment. Use copious amounts of water spray or fog to absorb ammonia vapor. DO NOT put water on liquid ammonia. Contain run-off to prevent ammonia from entering a stream, lake, sewer or ditch.

Release of 100 lbs. or more of ammonia within 24 hours must be reported to the National Response Center at 800-424-8802, as well as appropriate local and state agencies. Immediate (within minutes) reporting is required.

WASTE DISPOSAL METHOD:
Recover ammonia if feasible. Otherwise, let ammonia evaporate if appropriate. Only personnel experienced in ammonia spills should add water to liquid ammonia. Dispose of diluted ammonia as a fertilizer or in an industrial process.

EPA Waste Identification No. Not Applicable

For hazardous waste regulations, call the RCRA Hotline at 800-424-9346.

VII. HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE:

IDLH Level=500 ppm

MAJOR EXPOSURE HAZARD

[X] INHALATION [X] SKIN CONTACT [X] EYE CONTACT [ ] INGESTION

Ammonia is a strong alkali and readily damages all body tissues. Ammonia is not a cumulative metabolic poison, nor is it a listed carcinogen by IARC, NPT or OSHA. **Inhalation:** Depending on exposure concentration and duration, effects can vary from none or only mild irritation, to obstruction of breathing from laryngeal and bronchial spasm, to edema and severe damage of the mucous membranes of the respiratory tract with possible fatal results. Latent edema and residual reduction in pulmonary function may occur. **Skin Contact:** Prolonged contact with high concentrations can cause painful tissue damage, frostbite and serious chemical burns. **Eye Contact:** Exposure to liquid or high concentrations of vapor can cause painful, instant and possibly irreversible damage to tissues such as the conjunctiva, cornea and lens. Glaucoma and opacities may occur. **Ingestion:** Tissue damage, chemical burns, nausea and vomiting can occur. Ammonia is a gas under normal atmospheric conditions and ingestion is unlikely.

EMERGENCY AND FIRST AID PROCEDURES:
Eye Contact: Flush with large amount of water for at least 15 minutes then immediately seek medical aid. **Inhalation:** Remove from exposure. If breathing has stopped or is difficult, administer artificial respiration or oxygen as needed. Seek immediate medical aid. **Skin Contact:** Immediately flush with large quantities of water for at least 15 minutes while removing clothing. Clothing frozen to the skin should be thawed with water before removal. Seek immediate medical aid. **Ingestion:** Do not induce vomiting. Have the victim drink large quantities of water if conscious. Immediately seek medical aid. Never give anything by mouth to an unconscious person.

VIII. SPECIAL PROTECTIONS

RESPIRATORY:
Respiratory protection approved by NIOSH/MSHA for ammonia must be used when exposure limits are exceeded. Whether a chemical cartridge respirator or a self-contained breathing apparatus is sufficient for effective respiratory protection depends on the type and magnitude of exposure.

SKIN:
Rubber gloves and rubber or other types of approved protective clothing should be used to prevent skin contact. A face shield should be used for increased protection from contact with liquid.

EYE:
Chemcial splash goggles, approved for use with ammonia, must be worn to prevent eye contact with liquid or vapor. A face shield should be used for increased protection from contact with liquid.

VENTILATION AND ABSORPTION:
Local positive pressure and/or exhaust ventilation should be used to reduce vapor concentrations in confined spaces. Ammonia vapor, being lighter than air, can be expected to dissipate to the upper atmosphere. Ammonia concentrations may also be reduced by the use of an appropriate absorbent or reactant material.

OTHER PROTECTIVE EQUIPMENT AND MEASURES:
Emergency eyewash stations and deluge showers must be available in the work area. Post a list of emergency response contacts and telephone numbers.

IX. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:
Refer to the ANSI K61.1 standard for storage and handling information. Protect containers from physical damage and temperatures exceeding 120° F. Use only approved storage systems. Zinc, copper, silver, cadmium and their alloys must not be used in ammonia systems since they can be rapidly corroded by it. Avoid hydrostatic pressure, which can cause equipment rupture, by adhering to proper filling procedures and the use of hydrostatic pressure relief valves where appropriate.

OTHER COMMENTS:
Contact lenses must not be worn when working with ammonia.

This information is taken from sources or based upon data believed to be reliable; however, LaRoche Industries Inc. makes no warranty as to the absolute correctness or sufficiency of any of the foregoing or that additional or other measures may not be required under particular conditions.

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1 - PRODUCT IDENTIFICATION

PRODUCT NAME: BARIUM CHLORIDE, ANHYDROUS
FORMULA: BACL2
FORMULA WT: 208.25
CAS NO.: 10361-37-2
NIOSH/RTECS NO.: CQ8750000
COMMON SYNONYMS: BARIUM DICHLORIDE
PRODUCT CODES: 0980
EFFECTIVE: 10/21/85
REVISION #02

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH	-	3	SEVERE (POISON)
FLAMMABILITY	-	0	NONE
REACTIVITY	-	0	NONE
CONTACT	-	1	SLIGHT

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

PRECAUTIONARY LABEL STATEMENTS

POISON DANGER
MAY BE FATAL IF SWALLOWED
CAUSES IRRITATION

DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
KEEP IN TIGHTLY CLOSED CONTAINER. WASH THOROUGHLY AFTER HANDLING.

SAF-T-DATA(TM) STORAGE COLOR CODE: BLUE (HEALTH)

2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
BARIUM CHLORIDE, ANHYDROUS	90-100	10361-37-2

3 - PHYSICAL DATA

BOILING POINT: 1560 C (2840 F)
MELTING POINT: 963 C (1765 F)
SPECIFIC GRAVITY: 3.10 (H2O=1)
VAPOR PRESSURE(MM HG): N/A
VAPOR DENSITY(AIR=1): N/A
EVAPORATION RATE: N/A (BUTYL ACETATE=1)

000142

SOLUBILITY(H2O): APPRECIABLE (MORE THAN 10 %) % VOLATILES BY VOLUME: 0

APPEARANCE & ODOR: FINE, WHITE, CRYSTALLINE OR GRANULAR POWDER, WITH NO ODOR.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP: N/A

FLAMMABLE LIMITS: UPPER - N/A % LOWER - N/A %

FIRE EXTINGUISHING MEDIA
USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE.

TOXIC GASES PRODUCED
HYDROGEN CHLORIDE

5 - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): 0.5 MG/M3 (PPM)

TOXICITY:	LD50 (ORAL-RAT) (MG/KG)	-	118
	LD50 (SCU-RAT) (MG/KG)	-	178
	LD50 (IPR-MOUSE) (MG/KG)	-	54

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE
CONTACT WITH SKIN OR EYES MAY CAUSE IRRITATION.
INGESTION MAY BE FATAL.
CHRONIC EFFECTS OF BARIUM COMPOUNDS MAY INCLUDE BRONCHIAL IRRITATION, DEGENERATION OF CENTRAL NERVOUS SYSTEM, AND DAMAGE TO SPLEEN, LIVER, AND BONE MARROW.

TARGET ORGANS
NONE IDENTIFIED

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
NONE IDENTIFIED

ROUTES OF ENTRY
NONE INDICATED

EMERGENCY AND FIRST AID PROCEDURES
CALL A PHYSICIAN.
IF SWALLOWED, IF CONSCIOUS, IMMEDIATELY INDUCE VOMITING.
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

6 - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

DECOMPOSITION PRODUCTS: HYDROGEN CHLORIDE

7 - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER.

DISPOSAL PROCEDURE
DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: D005 (EP TOXIC WASTE)

8 - PROTECTIVE EQUIPMENT

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 3 PPM, A HIGH-EFFICIENCY PARTICULATE RESPIRATOR IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES, UNIFORM, APRON, RUBBER GLOVES ARE RECOMMENDED.

9 - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA(TM) STORAGE COLOR CODE: BLUE (HEALTH)

SPECIAL PRECAUTIONS
KEEP CONTAINER TIGHTLY CLOSED. STORE IN SECURE POISON AREA.

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME CHEMICALS, N.O.S. (NON-REGULATED)

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	BARIUM COMPOUNDS, N.O.S. (BARIUM CHLORIDE, ANHYDROUS)
HAZARD CLASS	6.1
UN/NA	UN1564
LABELS	POISON

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1 - PRODUCT IDENTIFICATION

PRODUCT NAME: CALCIUM FLUORIDE
FORMULA: CAF2
FORMULA WT: 78.08
CAS NO.: 7789-75-5
NIOSH/RTECS NO.: EW1760000
COMMON SYNONYMS: FLUORITE; FLUORSPAR
PRODUCT CODES: 1354
EFFECTIVE: 09/02/86
REVISION #02

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH	-	1	SLIGHT
FLAMMABILITY	-	0	NONE
REACTIVITY	-	0	NONE
CONTACT	-	1	SLIGHT

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

SAFETY GLASSES; LAB COAT

PRECAUTIONARY LABEL STATEMENTS

WARNING
CAUSES IRRITATION
AVOID CONTACT WITH EYES, SKIN, CLOTHING.
KEEP IN TIGHTLY CLOSED CONTAINER. WASH THOROUGHLY AFTER HANDLING.

SAF-T-DATA(TM) STORAGE COLOR CODE: ORANGE (GENERAL STORAGE)

2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
CALCIUM FLUORIDE	90-100	7789-75-5

3 - PHYSICAL DATA

BOILING POINT: 2500 C (4532 F)
MELTING POINT: 1403 C (2557 F)
SPECIFIC GRAVITY: 3.18 (H2O=1)
VAPOR PRESSURE(MM HG): N/A
VAPOR DENSITY(AIR=1): N/A
EVAPORATION RATE: N/A (BUTYL ACETATE=1)

SOLUBILITY(H2O): NEGLIGIBLE (LESS THAN 0.1 %) % VOLATILES BY VOLUME: 0

APPEARANCE & ODOR: ODORLESS, WHITE POWDER OR CUBIC CRYSTALS.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP: N/A

FLAMMABLE LIMITS: UPPER - N/A % LOWER - N/A %

FIRE EXTINGUISHING MEDIA
USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE.

TOXIC GASES PRODUCED
HYDROGEN FLUORIDE

5 - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): 2.5 MG/M3 (PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): 2.5 MG/M3 (PPM)

TOXICITY: LD50 (ORAL-RAT)(MG/KG) - 4250
LD50 (IPR-MOUSE)(MG/KG) - 2775

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE
DUST MAY IRRITATE SKIN OR EYES.
INGESTION MAY CAUSE GASTROINTESTINAL PAIN.
INGESTION IS HARMFUL AND MAY BE FATAL.

TARGET ORGANS
EYES, SKIN, RESPIRATORY SYSTEM, CENTRAL NERVOUS SYSTEM, KIDNEYS

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
NONE IDENTIFIED

ROUTES OF ENTRY
INHALATION, INGESTION, EYE CONTACT, SKIN CONTACT

EMERGENCY AND FIRST AID PROCEDURES
INGESTION: IF SWALLOWED AND THE PERSON IS CONSCIOUS, IMMEDIATELY GIVE LARGE AMOUNTS OF WATER. GET MEDICAL ATTENTION.
INHALATION: IF A PERSON BREATHES IN LARGE AMOUNTS, MOVE THE EXPOSED PERSON TO FRESH AIR. GET MEDICAL ATTENTION.
EYE CONTACT: IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15

MINUTES. GET MEDICAL ATTENTION.
SKIN CONTACT: IMMEDIATELY WASH WITH PLENTY OF SOAP AND WATER FOR AT LEAST 15 MINUTES.

6 - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: NONE DOCUMENTED

INCOMPATIBLES: STRONG ACIDS

DECOMPOSITION PRODUCTS: HYDROGEN FLUORIDE

7 - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER.

DISPOSAL PROCEDURE
DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

8 - PROTECTIVE EQUIPMENT

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: NONE REQUIRED WHERE ADEQUATE VENTILATION CONDITIONS EXIST. IF AIRBORNE CONCENTRATION EXCEEDS TLV, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GLASSES WITH SIDESHIELDS, PROPER GLOVES ARE RECOMMENDED.

9 - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA(TM) STORAGE COLOR CODE: ORANGE (GENERAL STORAGE)

SPECIAL PRECAUTIONS
KEEP CONTAINER TIGHTLY CLOSED. SUITABLE FOR ANY GENERAL CHEMICAL STORAGE AREA.

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME CHEMICALS, N.O.S. (NON-REGULATED)

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME CHEMICALS, N.O.S. (NON-REGULATED)

Martin Marietta Energy Systems, Inc.[0m
Material Safety Data Sheet[0m

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1. IDENTIFICATION

:[0m 00320 Version No:[0m 1
b:[0m 000630-08-0 Version Date:[0m 10/0
0
ial Name:[0m CARBON MONOXIDE

yms:[0m
1) CARBON MONOXIDE, CRYOGENIC LIQUID
2) CARBON OXIDE
3) CARBONIC OXIDE
4) EXHAUST GAS
5) FLUE GAS

s Information:[0m

MSDS Type	MSDS Status	MSDS Available	Request Outstanding
D	A	Yes	No

ication History:[0m

Date of Entry	Date of Change	Last Modifi
08/25/1991	05/20/1992	THI

al Condition:[0m
oup Code:[0m C

No:[0m GSC0024-2400

s No:[0m 039275550

Chemical:[0m Yes
cal Formula:[0m C-O

h Hazard Ratings:[0m 2, <MODERATE HEALTH HAZARD>
ASPHYXIANT

Hazard Ratings:[0m 4, <EXTREMELY FLAMMABLE>

ivity Hazard Ratings:[0m 0, <NONREACTIVE>

cal Form:[0m LIQUID,GAS

0m UNISOLATED COMPONENT OF GASEOUS FUELS, E.G. WATE

GAS REDUCING AGENT IN METALLURGICAL OPERATIONS IN MANUFACTURING METAL CARBONYLS AND ZINC WHITE PIGMENTS CHEMICAL INTERMEDIATE FOR PHOSGENE, METHANOL, ACETIC ACID, ACRYLIC ACID REDUCING AGENT IN IRON ORE PROCESSING

; No:[0m FG3500000

facturers:[0m (Name, Address, Phone, FAX No, Contact)[0m
1) AIR PRODUCTS AND CHEMICALS, INC.
INDUSTRIAL GAS DIVISION
ALLENTOWN, PA 18195
Phone: 215-481-4911

000150

2) LIQUID AIR CORP.

ONE CALIFORNIA PLAZA, [illegible]
CALIFORNIA BLVD.,
WALNUT CREEK, CA 94596
Phone: (800)231-1366

7730

3) MATHESON CO.
P.O. BOX 85, EAST RUTHERFORD, NJ 07073
Phone: (201)933-2400

: Listing:[Om

:-No[Om	Manufacturer Name[Om	MFR MSDS Prep Date[Om	MSDS Rcvd Date[Om	Used To Modify
:h Data[Om				
:2	AIR PRODUCTS AND CHEMICALS, INC.	08/01/1991	01/22/1993	No
)	LIQUID AIR CORP.	10/01/1985	03/19/1992	Yes
:H	MATHESON CO.	10/01/1985	03/19/1992	Yes

-------- 2. PHYSICAL DATA --------[Om

:rial Description:[Om COLORLESS, ODORLESS GAS; VERY FLAMMABLE, BURNS I AIR WITH BRIGHT BLUE FLAME

:cular Weight:[Om 28.01

:ity/Specific Gravity:[Om 1.250 G/L AT 32 DEG F, 0 DEG C FOR GAS; 0.793 G/ FOR LIQUID

'r Density:[Om 1.0 (AIR=1)
: Pressure:[Om >1 ATMOSPHERE AT 68 DEG F, 20 DEG C

:ing Point:[Om -312.7 DEG F, -191.5 DEG C
:ing Point:[Om -337 DEG F, -205 DEG C
:zing Point:[Om

:ent Volatiles:[Om NISS

ıbility in Water:[Om 3.3 ML/100 ML AT 32 DEG F, 0 DEG C
ɔoration Rate:[Om NISS

-------- 3. INGREDIENTS --------[Om

ıents[Om	CAS No.[Om	RTECS No[Om	Percent[Om	Percent
-----[Om	----------[Om	--------[Om	-------[Om	--------
ID:[Om				
:edient Name:[Om	PURE CHEMICAL			
ırd Evaluation:[Om				

-------- 4. FIRE AND EXPLOSION HAZARD DATA --------[Om

:h Point:[Om NISS

ɔignition:[Om 1128 DEG F, 609 DEG C

'r Flammability Limit:[Om 12.5%
: Flammability Limit:[Om 74%

inguishing Media:[Om USE WATER SPRAY/FOG, DRY CHEMICAL, CARBON DIOXID OR FOAM. FOR SMALL FIRES, LET BURN UNLESS LEAK

CAN BE STOPPED IMMEDIATELY. FOR LARGE FIRES, USE WATER SPRAY, FOG, OR FOAM.

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fighting Procedures:[0m COOL CONTAINERS EXPOSED TO HEAT OR FLAMES WITH WATER FROM THE SIDES UNTIL WELL AFTER THE FIRE HAS BEEN EXTINGUISHED.
REMOVE CONTAINERS FROM FIRE AREA IF POSSIBLE.
WITHDRAW IMMEDIATELY IN CASE YOU HEAR A RISING SOUND FROM VENTING SAFETY DEVICE OR SEE ANY DISCOLORATION OF TANK DUE TO FIRE.
WEAR PRESSURE-DEMAND, SELF-CONTAINED BREATHING APPARATUS AND FULL FIREFIGHTING PROTECTIVE CLOTHING.
STOP FLOW OF GAS.

: and Explosion Hazards:[0m CLOSED CONTAINERS MAY EXPLODE WHEN EXPOSED TO EXTREME HEAT.
RUNOFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.
HAZARDOUS DECOMPOSITION PRODUCTS: CARBON DIOXIDE AND OTHER OXIDES OF CARBON.

-------- 5. REACTIVITY DATA --------[0m

ility:[0m STABLE
f Life In Days:[0m
f Life Comments:[0m NISS

litions to Avoid:[0m AVOID HEATING. AVOID IGNITION SOURCES.

mpatible Materials:[0m

MINE TRIFLUORIDE
IUM MONOXIDE
ORINE TRIFLUORIDE
INE HEPTAFLUORIDE
HIUM AND WATER
ROGEN TRIFLUORIDE
GEN (LIQUID)
GEN DIFLUORIDE
ASSIUM AND OXYGEN
VER OXIDE
IUM AND AMMONIA
DIZERS
KEL

mpatible Materials Comments:[0m

rdous Polymerization:[0m WILL NOT OCCUR

ustion and Decomposition Products:[0m

BON DIOXIDE AND OTHER OXIDES OF CARBON

ustion and Decomposition Products Comments:[0m

-------- 6. HEALTH HAZARD DATA --------[0m

Standards:[0m TWA 35 PPM OR 40 MG/CU M, CEILING 200 PPM OR 229 MG/CU M

H TLV:[0m TWA 50 PPM OR 57 MG/CU M, STEL 400 PPM OR 458

Recommendation:[Om	8-HR TWA 35 PPM, CEILING 200 PPM
iatly Dangerous to[Om Life & Health:[Om	1500 PPM
Exposure Limits:[Om	NISS
Inhalation:[Om	CAUSES HYPOXIA WHICH CAUSES: HEADACHE, DIZZINESS DROWSINESS, NAUSEA, UNCONSCIOUSNESS, CONVULSIONS, COMA. MYOCARDIAL AND CENTRAL NERVOUS SYSTEM DAMAGE, PERSONALITY CHANGES. DEATH BY ASPHYXIATION.
Swallowing:[Om	NISS
Skin Absorption:[Om	NISS
Skin Contact:[Om	NONIRRITATING, LIQUID CAUSES FREEZING OF SKIN
Eye Contact:[Om	NONIRRITATING
iic Effects:[Om	AFTER INHALATION: APPETITE DISORDERS, HEADACHE, DIZZINESS, INCOORDINATION, DROWSINESS, CYANOSIS, AND PALLOR.
et Organs/Systems:[Om	ALL ORGANS BECAUSE OF OXYGEN DEPRIVATION, PRIMARILY CENTRAL NERVOUS SYSTEM, CARDIOVASCULAR SYSTEM, RESPIRATORY SYSTEM, BLOOD.
.ation Emergency:[Om	REMOVE TO FRESH AIR IMMEDIATELY. ADMINISTER 100 OXYGEN. GET MEDICAL AID.
lowing Emergency:[Om	
Contact Emergency:[Om	
Contact Emergency:[Om	
icians Notes:[Om	GIVE HYPERBARIC OXYGEN, DIAZEPAM FOR CONVULSIONS MONITOR FOR CEREBRAL EDEMA
ivated Conditions:[Om	CARDIOVASCULAR DISEASES
inogenicity:[Om	NOT LISTED AS CARCINOGEN OR POTENTIAL CARCINOGEN BY NATIONAL TOXICOLOGY PROGRAM (NTP), IARC, OSHA. (LIQUID AIR CORP, 1985)
toxicity:[Om	NISS
oductive/Developmental[Om Toxocity:[Om	NISS

-------- 7. SPILL LEAK AND DISPOSAL INFORMATION --------[Om

l or Leak Emergency:[Om

ION HELP IMMEDIATELY.
2: SHIFT SUPERINTENDENT, 4-7172 OR 911
0: SHIFT SUPERVISOR, 4-6606 OR 911
5: SHIFT SUPERVISOR, 4-3282 OR 911
JCAH: SHIFT SUPERVISOR, BELL-6211, PAX-511
IMIZE THE SPILL OR RELEASE IF YOU CAN DO SO SAFELY.

osal Procedure:[0m

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12: TRANSFER STORAGE OR DISPOSAL OF WASTE PROCEDURE 70-903, DISPOSAL OF ARDOUS MATERIALS. FOR MORE INFORMATION, CONTACT THE WASTE DISPOSAL PARTMENT, 6-7768.
10: WASTE, TRANSPORTATION, STORAGE, AND DISPOSAL MANUAL, EPM-8.0, FORM N-13696. FOR MORE INFORMATION, CONTACT THE DEPARTMENT OF ENVIRONMENTAL NAGEMENT, 4-7467.
25: SPP-4600, FORM UCN-12463. FOR MORE INFORMATION, CONTACT THE WASTE NAGEMENT DIVISION, 4-8214.
DUCAH: ESH-28, FORM UCN-12463A. FOR MORE INFORMATION, CONTACT THE WASTE NAGEMENT DEPARTMENT, PAX-401 OR BELL-6319.

-------- 8. SPECIAL PROTECTION INFORMATION --------[0m

pirators:[0m
RESPIRATORS MAY BE REQUIRED WHEN USING THIS MATERIAL. CONTACT THE INDUSTRIAL HYGIENE DEPARTMENT FOR MORE INFORMATION.

tilation:[0m
CONDITIONS, QUANTITIES, AND OTHER FACTORS DETERMINE VENTILATION REQUIREMENTS. IF THERE ARE UNCERTAINTIES, CONTACT THE INDUSTRIAL HYGIENE DEPARTMENT.

ves:[0m
WEAR PLASTIC OR RUBBER GLOVES, INSULATING GLOVES IF LIQUID IS HANDLED.

Protection:[0m
WEAR SAFETY GOGGLES OR GLASSES.

er Protective Equipment:[0m SPECIAL EQUIPMENT FOR SKIN PROTECTION IS REQUIRE
WHEN HANDLING LIQUID. USE ONLY IN WELL-VENTILATED AREAS. A SAFETY SHOWER SHOULD BE READILY AVAILABLE.

urities, By-Product,[0m
Contaminants:[0m NISS

-------- 9. SPECIAL HANDLING, STORING, PACKAGING --------[0m

TECT CYLINDERS FROM PHYSICAL DAMAGE. STORE IN COOL, DRY, WELL-VENTILATED A OF NON-COMBUSTIBLE CONSTRUCTION AWAY FROM HEAVILY TRAFFICKED AREAS AND RGENCY EXITS. DO NOT ALLOW THE TEMPERATURE WHERE CYLINDERS ARE STORED TO EED 130 DEG F 54 DEG C. CYLINDERS SHOULD BE STORED UPRIGHT AND FIRMLY URED TO PREVENT FALLING OR BEING KNOCKED OVER. FULL AND EMPTY CYLINDERS ULD BE SEGREGATED. POST "NO SMOKING OR OPEN FLAMES" SIGNS IN THE STORAGE OR E AREA. THERE SHOULD BE NO SOURCES OF IGNITION IN THE STORAGE OR USE,AREA. VE PROTECTION CAPS MUST REMAIN IN PLACE UNLESS CONTAINER IS SECURED WITH VE OUTLET PIPED TO USE POINT. DO NOT DRAG, SLIDE OR ROLL CYLINDERS. USE A TABLE HAND TRUCK FOR CYLINDER MOVEMENT. USE A PRESSURE RECUDING REGULATOR N CONNECTING CYLINDER TO LOWER PRESSURE (<2,000 PSIG) PIPING OR SYSTEMS. DO T HEAT CYLINDER BY ANY MEANS TO INCREASE THE DISCHARGE RATE OF PRODUCT FROM E CYLINDER. USE A CHECK VALVE OR TRAP IN THE DISCHARGE LINE TO PREVENT ARDOUS BACK FLOW INTO THE CYLINDER. CARBON MONOXIDE CAN BE HANDLED IN ALL MONLY USED METALS UP TO APPROXIMATELY 500 PSIG (3450 KPA). ABOVE THAT SSURE IT FORMS TOXIC AND CORROSIVE CARBONYL COMPOUNDS WITH SOME METALS. TH-GROUND AND BOND ALL LINES AND EQUIPMENT ASSOCIATED WITH THE CARBON OXIDE SYSTEM. ELECTRICL EQUIPMENT SHOULD BE NONSPARKING OR EXPLOSION-PROOF. MPRESSED GAS CYLINDERS SHOULD NOT BE REFILLED EXCEPT BY QUALIFIED DUCERS OF COMPRESSED GASSES.

10. TRANSPORTATION DATA

Information: (Name, Class, Label, Number)

1) CARBON MONOXIDE, CRYOGENIC LIQUID
FLAMMABLE GAS
FLAMMABLE GAS; FLAMMABLE GAS
NA9202

2) CARBON MONOXIDE
FLAMMABLE GAS
FLAMMABLE GAS; FLAMMABLE GAS
UN1016

ortable Quantity: NISS

ID Number: NISS

erences:

- CHEMLINE, CHEMICAL DICTIONARY ONLINE (DATA BASE) NATIONAL LIBRARY OF MEDICINE, BETHESDA MD, 1991.
- RTECS, REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (DATABASE). NATIONAL LIBRARY OF MEDICINE, BETHESDA MD, 1991.
- AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS. TLV'S THRESHOLD LIMIT VALUES AND BIOLOGICAL EXPOSURE INDICES FROM 1991-1992. CINCINNATI OH: AMERICAN CONFERENCE OF GOVERNMENTAL HYGIENISTS, 1991.
- MATERIAL SAFETY DATA SHEETS (MSDS) PROVIDED BY MANUFACTURERS.
- HSDB, HAZARDOUS SUBSTANCES DATA BANK (DATA BASE), NATIONAL LIBRARY OF MEDICINE, BETHESDA MD, 1990.
- SCIENTIFIC REVIEW COMMITTEE FOR MSDS

NING: THE INFORMATION CONTAINED HEREON IS INTENDED SOLELY FOR THE USE OF EMPLOYEES OF MARTIN MARIETTA ENERGY SYSTEMS, INC. THE INFORMATION IS NOT INTENDED TO BE A DEFINITIVE STATEMENT OF ALL HAZARDS ASSOCIATED WITH SAID MATERIAL OR ALL METHODS OF COUNTERACTING HUMAN EXPOSURE TO SAME. USERS ARE CAUTIONED TO PROCEED WITH DUE CARE IN THE HANDLING, STORING AND DISPOSAL OF THIS MATERIAL AND TO SEEK FURTHER INFORMATION REGARDING PARTICULAR APPLICATIONS AS REQUIRED.

MARTIN MARIETTA ENERGY SYSTEMS, INC.
P.O. BOX 2008
BLDG. 3550, MS 6291
OAK RIDGE, TENNESSEE 37831
PHONE: 615-574-0784
FAX: 615-576-6087

Select this to send FAX (or view image if using Windows).

Martin Marietta Energy Systems, Inc.
Material Safety Reference Sheet

artin Marietta Energy Systems Material Safety Reference Sheet (MSRS) is to be used in njunction with the Manufacturer's MSDS. The information is not intended to be a definitive atement of all hazards associated with the material. It will not meet OSHA requirements ed alone.

entification:

CID: 00320 Version: 2 Version Date: 22-DEC-1993
terial Name: CARBON MONOXIDE
S No: 000630-08-0

nonyms:

CARBON OXIDE
EXHAUST GAS
CARBONIC OXIDE
FLUE GAS
CARBON MONOXIDE, CRYOGENIC LIQUID

atus Information:	MSDS Type	MSDS Status	MSDS Available
	MMES	APPROVED	Yes

ecial Condition: N
HM Group Code: C
MMES Carcinogen: No

eproductive/ Developmental Effector:	Per RTECS	Per MMES
	Yes	Yes

vid Numbers:

000156

GSC0024-2400

ıres Numbers:

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039275550

ɜe Chemical: Yes

.lth Hazard Rating: 2, [MODERATE HEALTH HAZARD]
ASPHYXIANT
ɜe Hazard Rating: 4, [EXTREMELY FLAMMABLE]
ıctivity Hazard Rating: 0, [NONREACTIVE]

ıRTIN MARIETTA ENERGY SYSTEMS HEALTH HAZARD RATINGS ARE BASED ON THE
)TENTIAL TOXICITY OF A MATERIAL. FIRE AND REACTIVITY HAZARD RATINGS ARE
;SIGNED ACCORDING TO NFPA CRITERIA. HAZARD RATINGS ARE NOT TO BE USED
/ THEMSELVES BUT ARE TO BE USED IN CONJUNCTION WITH A HEALTH AND SAFETY
/ALUATION OF THE PROCESS IN WHICH THE MATERIAL IS USED IN ORDER TO
:TERMINE THE POTENTIAL EXPOSURE HAZARDS. A HAZARD CLASSIFICATION GUIDE IS
ROVIDED IN ESS-IH-140.

ı ID Number: NISS
:CS Number: FG3500000

ırget Organ/Systems: Per MFG.
rget Organ Comments:
ENTRAL NERVOUS SYSTEM, CARDIOVASCULAR SYSTEM, RESPIRATORY SYSTEM

ınufacturers: (Name, Address, Phone, FAX No, Contact)

AIR PRODUCTS AND CHEMICALS, INC.
P.O. BOX 538, ALLENTOWN, PA 18195
Phone: (215)481-4911, EMERGENCY: (800)523-9374
AIRCO
DIVISION OF THE BOC GROUP, INC., 575 MOUNTAIN AVENUE,
MURRAY HILL, NJ 07974
Phone: (908)464-8100, TELEX: (710)984-7970
LIQUID AIR CORP.
ONE CALIFORNIA PLAZA, SUITE 350, 2121 N. CALIFORNIA BLVD.,
WALNUT CREEK, CA 94596
Phone: (800)231-1366
MATHESON GAS PRODUCTS
30 SEAVIEW DRIVE
SECAUCUS, NJ 07096
Phone: (201)867-4100

ıgredients:

U R E C H E M I C A L

arcinogenicity:

000157

'he MMES Carcinogen Control Program includes human, human suspect, and

termined) in Section 1.] Chemicals and compounds in concentration of 1% or greater are subject to the guidelines set forth in the MMES rcinogen Control program. Substitution with a non-carcinogen should made if feasible.

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productive/Developmental Toxicity:

HE RTECS REPRODUCTIVE/DEVELOPMENT EFFECTORS ARE MATERIALS LISTED IN THE EGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES THAT HAVE POSITIVE EPRODUCTIVE EFFECTS DATA FOR AT LEAST ONE MAMMALIAN SPECIES THROUGH ANY OUTE OF ADMINISTRATION. THE MMES REPRODUCTIVE/DEVELOPMENTAL EFFECTORS ARE SUBSET OF THE RTECS MATERIALS THAT HAVE POSITIVE EFFECTS IN TWO OR MORE AMMALIAN SPECIES OR ONE POSITIVE STUDY IN HUMANS THROUGH COMMON OCCUPATION OUTES (DERMAL, INGESTION, AND INHALATION) OF EXPOSURE. IN EITHER GROUP UCH EFFECTS MAY INCLUDE PATERNAL, MATERNAL, FERTILITY, EMBRYO/FETUS, EONATAL, DEVELOPMENT ABNORMALITIES OR TUMORIGENESIS. AN ENTRY IN EITHER ROUP DOES NOT AUTOMATICALLY IMPLY THAT THE SUBSTANCE IS HAZARDOUS FOR OMMON USE. A HAZARD DETERMINATION IS GENERALLY REQUIRED.

JOHNSON MATTHEY CATALOG -- COBALT III FLUORIDE, 11490
MATERIAL SAFETY DATA SHEET
FSC: 6810
Manufacturer's CAGE: 0JVJ1
Part No. Indicator: A
Part Number/Trade Name: COBALT III FLUORIDE, 11490

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General Information

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Company's Name: JOHNSON MATTHEY CATALOG CO
Company's Street: 30 BOND ST
Company's City: WARD HILL
Company's State: MA
Company's Country: US
Company's Zip Code: 01835-0747
Company's Emerg Ph #: 508-521-6300;800-424-9300(CHEMTREC)
Company's Info Ph #: 508-521-6300
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 20JUN90
Safety Data Review Date: 24NOV93
MSDS Serial Number: BSJPQ
Hazard Characteristic Code: NK

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: COBALT (III) FLOURIDE
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: 1010479CF
CAS Number: 10026-18-3
OSHA PEL: 2.5 MG/M3 (F)
ACGIH TLV: 2.5 MG/M3 (F)
Other Recommended Limit: 0.05 MG/M3 (CO)

Proprietary: NO
Ingredient: SUPP DATA: SKIN: REPEATED EXPOSURE TO COBALT MAY CAUSE ALLERGIC DERMATITIS. INHAL: COBALT (ING 3)
Ingredient Sequence Number: 02
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 2: FUMES AND DUST MAY CAUSE BENIGN PNEUMOCONIOSIS, PULM SENSITIZATION. OTHER: INTAKE (ING 4)
Ingredient Sequence Number: 03
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 3: OF MORE THAN 6 MG OF FLUORIDE PER DAY MAY RESULT IN FLUOROSIS. HYPOCALCEMIA AND HYPOMAGNESEMA CAN OCCUR (ING 5)
Ingredient Sequence Number: 04
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 4: FROM ABSORPTION OF FLUORIDE IONS INTO BLOOD STREAM. COBALT HAS PRODUCED TUMORS IN EXPERIMENTAL ANIMALS (ING 6)
Ingredient Sequence Number: 05
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 5: AND COBALT HAS BEEN ASSOCIATED WITH KIDNEY DAMAGE.
Ingredient Sequence Number: 06
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: CARCIN COMMENTS: ANIMAL: PULM FIBROSIS (BLOOD EFTS).
Ingredient Sequence Number: 07
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: FIRST AID PROC: GIVE OXYGEN. GET MEDICAL HELP IMMEDIATELY.
Ingredient Sequence Number: 08
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: OTHER PROT EQUIP: SHOWER AND HYGIENIC FACILITIES FOR WASHING.
Ingredient Sequence Number: 09
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
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Physical/Chemical Characteristics

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Appearance And Odor: LIGHT BROWN POWDER; NO ODOR EXCEPT THE ODOR OF HF IN MOIST AIR. (SUPP DATA)
Vapor Pressure (MM Hg/70 F): N/A
Vapor Density (Air=1): N/A
Specific Gravity: 3.88 (H*2O=1)
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: REACTS WITH WATER
Percent Volatiles By Volume: N/A
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Fire and Explosion Hazard Data

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Flash Point: NOT APPLICABLE
Flash Point Method: N/P
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: IF INVOLVED IN FIRE DO NOT USE WATER. USE CARBON DIOXIDE, DRY CHEMICAL EXTINGUISHING AGENTS, DRY SAND, OR (SUPP DATA)
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N). IF WITHOUT RISK REMOVE MATERIAL FROM FIRE AREA.
Unusual Fire And Expl Hazrds: NOT COMBUST, BUT SUBSTANCE IS AN OXIDIZER & ITS HEAT OF RXN W/REDUCING AGENTS/COMBUSTIBLES MAY CAUSE IGNITION.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): INCOMPATIBLES, THERMAL DECOMPOSITION.
Materials To Avoid: AIR, MOISTURE, REDUCING AGENTS, ORGANIC MATERIALS, SILICON COMBUSTIBLS. REACTS W/WATER TO FORM DECOM PRODS.(SUPP DATA)
Hazardous Decomp Products: HYDROGEN FLUORIDE, COBALT HYDROXIDE, OXYGEN.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: ACUTE:INGEST:CORR. MAY CAUSE SORE THROAT, ABDOM PAIN, DIARR, VOMIT & SEV BURNS OF DIGEST TRACT. SKIN:MAY CAUSE SERIOUS SKIN BURNS WHICH MIGHT NOT BE IMMED APPARENT/PAINFUL. SYMP MAY BE DELAYED 8 HRS OR MORE. THE FLUORIDE ION READILY PENETRATES SKIN CAUSING DESTRUCTION OF DEEP TISS LAYERS & EVEN BONE.(EFTS OF OVEREXP)
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: COBALT: IARC MONOGRAPHS ON THE EVALUATION OF CARCIN RISK OF CHEMS TO MAN, VOL 52, PG 363, 1991: GROUP 2B. (ING 7)
Signs/Symptoms Of Overexp: HLTH HAZ:EYE:MAY CAUSE REDNESS, PAIN & BLURRED VISION. PERM EYE DMG MAY OCCUR. INHAL:MAY BE CORR TO RESP TRACT. MAY CAUSE INGEST:CHRONIC INGEST OF COBALT CMPNDS MAY RSLT IN HYPOTENSION, PERICARDIAL EFFUSION, POLYCARDIAL EFFUSION, (SUPP DATA)
Med Cond Aggravated By Exp: PRE-EXISTING SKIN DISORDERS, EYE PROBLEMS, IMPAIRED KIDNEY OR RESPIRATORY FUNCTION.
Emergency/First Aid Proc: INGEST:DO NOT INDUCE VOMIT. IF PATIENT IS CONSCIOUS, GIVE LRG QTYS OF WATER/MILK. SEND TO HOSPITAL IMMED. SKIN:REMOVE IRRIGATE FOR @ LST 15 MIN W/COPIOUS AMTS OF WATER KEEPING EYELIDS APART & AWAY FROM EYEBALLS. GET MED ATTN IMMED. INHAL:MOVE TO FRESH AIR. IF PATIENT IS UNCONSCIOUS GIVE ARTF RESP. IF BRTHG IS DFCLT (ING 8)

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: WEARING FULL PROTECTIVE EQUIPMENT, COVER SPILL WITH DRY SAND OR VERMICULITE. MIX WELL AND CAREFULLY TRANSFER TO A CONTAINER.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: CONSULT STATE, LOCAL OR FEDERAL EPA REGULATIONS FOR PROPER DISPOSAL. DISPOSAL MUST BE IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS (FP N).
Precautions-Handling/Storing: STORE ONLY IN APPROVED CONTAINERS UNDER A DRY NITROGEN ATMOSPHERE. KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED AREA.
Other Precautions: NONE SPECIFIED BY MANUFACTURER.

Control Measures

Respiratory Protection: NIOSH/MSHA APPROVED DUST MASK FOR ORDINARY USE, NIOSH/MSHA APPROVED SCBA FOR EMERGENCY USE.
Ventilation: GLOVE BAG OR BOX WITH DRY INERT ATMOSPHERE.
Protective Gloves: NEOPRENE OR PVC.
Eye Protection: SAFETY GOGGLES W/FULL FACE SHIELD.
Other Protective Equipment: LAB COAT AND APRON, FLAME & CHEMICAL RESISTANT

COVERALLS, EYEWASH CAPABLE OF SUSTAINED FLUSHING, SAFETY DRENCH (ING 9)
Work Hygienic Practices: WASH THOROUGHLY AFTER USE.
Suppl. Safety & Health Data: APPEAR & ODOR: DISCOLORS RAPIDLY ON EXPOSURE TO MOIST AIR. EXTING MEDIA: DRY GROUND DOLOMITE. MATLS TO AVOID: MATERIAL IS OXIDIZER. EFTS OF OVEREXP: POLYCYTHEMIA, CARDIAC FAILURE, VOMITING, CONVULSIONS & THYROID ENLARGEMENT. (ING 2)

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Transportation Data

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Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 24NOV93
Label Date: 22NOV93
Label Status: M
Common Name: COBALT III FLUORIDE, 11490
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Severe: X
Contact Hazard-Severe: X
Fire Hazard-None: X
Reactivity Hazard-Slight: X
Special Hazard Precautions: REACTS WITH WATER/MOISTURE. KEEP UNDER DRY, INERT ATMOSPHERE. ACUTE: CORROSIVE. SERIOUS SKIN/EYE BURNS, REDNESS, BLURRED VISION, DELAYED PAIN, PERMANENT DAMAGE. INHAL: SORE THROAT, COUGH, CONGESTION, INFLAMMATION, DIFFICULT BRTHG. INGEST: BURNS TO DIGESTIVE TRACT, SORE THROAT, ABDOMINAL PAIN, DIARRHEA, VOMIT. CHRONIC: CANCER HAZARD. CONTAINS COBALT WHICH IS LISTED AS A PULMONARY CARCINOGEN TO ANIMALS (FP N). MAY CAUSE HYPOTENSION, HEART FAILURE, CONVULSIONS, THYROID ENLARGEMENT, ALLERGIC SKIN RXN, FLUROSIS, KIDNEY DAMAGE. FUME/DUST MAY CAUSE LUNG EFFECTS.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: JOHNSON MATTHEY CATALOG CO
Label Street: 30 BOND ST
Label City: WARD HILL
Label State: MA
Label Zip Code: 01835-0747
Label Country: US
Label Emergency Number: 508-521-6300;800-424-9300(CHEMTREC)

MATERIAL SAFETY DATA SHEET REV DATE: 022492

330275 DRAW TEMP 275

SECTION I-PRODUCT IDENTIFICATION

PRODUCT NAME: DRAW TEMP 275
PROPER SHIPPING NAME: OXIDIZING SUBSTANCES, SOLID, NOS (CONTAINS SODIUM NITRITE, POTASSIUM NITRATE, AND SODIUM NITRATE), RQ (SODIUM NITRITE)
HAZARD CLASS: OXIDIZER
HAZARD ID NO: UN 1479
CHEMICAL FAMILY: MIXTURE

COMPLETED BY: ROBERT E. WILLIAMS
PHONE NUMBER: (215) 666-4105
24-HR EMERGENCY: (800) 424-9300

SECTION II-HAZARDOUS COMPONENTS

MATERIAL	CAS NO	% BY WT.	HAZARD
SODIUM NITRITE	7632-00-0	40	LD50: 85 MG./KG. (ORAL- RATS)
SODIUM NITRATE	7631-99-4	1-10	OXIDIZER
POTASSIUM NITRATE	7757-79-1	30-60	OXIDIZER

SECTION III-PHYSICAL DATA

BOIL. PT.(DEG F): N/A
VAPOR PRESSURE (MM HG) N/A
VAPOR DENSITY (AIR = 1) N/A
PERCENT VOLATILE: N/A
PH NEAT: N/A PH AT 1.0%:7.5
APPEARANCE AND ODOR:
PINK SALT MIXTURE - NO ODOR

SPECIFIC GRAVITY: 2.14
EVAP RATE: N/A
SOL IN WATER: COMPLETE

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT, DEG. F (METHOD USED): N/A LEL: N/A UEL: N/A
HMIS AND NFPA HEALTH: 0 FIRE: 0 REACTIVITY: 2
EXTINGUISHING MEDIA:
PRODUCT MAY SUPPORT COMBUSTION OF EXISTING FIRE IF IN CLOSE CONTACT. SAND MAY BE USED IF SPREAD EVENLY OVER AREA. DO NOT USE WATER.
SPECIAL FIRE FIGHTING INSTRUCTIONS:
AVOID WATER CONTACT WITH MOLTEN MATERIAL. MATERIAL MAY FUSE IF INVOLVED IN LARGE FIRES; WATER MAY SCATTER MOLTEN MATERIAL.
UNUSUAL FIRE AND EXPLOSION HAZARDS:
AVOID CONTACT WITH CYANIDES. CONTACT WITH ORGANIC MATERIAL MAY CAUSE A FIRE. CONTACT WITH ACIDS MAY FORM TOXIC FUMES.

CONTINUED ON PAGE 2

SECTION V - HEALTH HAZARD INFORMATION

THRESHOLD LIMIT VALUE: NOT APPLICABLE
PERMISSIBLE EXPOSURE LIMIT: NOT APPLICABLE

ROUTES OF EXPOSURE
CHRONIC (RECURRENT) EFFECTS : UNKNOWN FOR THIS PRODUCT.

ACUTE EFFECTS :

INHALATION:
AVOID BREATHING PRODUCT DUST. DUST MAY BE MILD IRRITANT TO NOSE AND THROAT.

SKIN:
NO SIGNIFICANT EFFECTS.

EYE:
POSSIBLE MILD IRRITANT FROM PRODUCT DUST

INGESTION:
NO SIGNIFICANT EFFECTS KNOWN

********** FIRST AID **********

INHALATION:
REMOVE TO SOURCE OF FRESH AIR IF DUST CAUSES IRRITATION. RINSE MOUTH AND NASAL PASSAGES WITH WATER

SKIN:
FLUSH WITH WATER

EYE:
FLUSH WITH WATER 15 MINUTES, CONSULT PHYSICIAN

INGESTION:
INDUCE VOMITING, CONSULT PHYSICIAN. PRODUCT CONTAINS NITRATE AND NITRITE SALTS.

*** MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE ***

NONE KNOWN

SECTION VI - REACTIVITY DATA

STABILITY: STABLE: [X] UNSTABLE: [ ]
CONTACT WITH ACIDS MAY RELEASE TOXIC FUMES

INCOMPATABILITY (MATERIALS TO AVOID):
CYANIDES AND ORGANIC MATERIALS; MOISTURE IN THE MOLTEN STATE.

HAZARDOUS DECOMPOSITION PRODUCTS:
OXIDES OF NITROGEN.

HAZARDOUS POLYMERIZATION: MAY OCCUR: [ ] WILL NOT OCCUR: [X]

CONTINUED ON PAGE 3

SECTION VII - SPILL OR LEAK PROCEDURES

POTENTIAL AS A POLLUTANT:
NOT CONSIDERED A POLLUTANT IF EFFECTIVE WASTE DISPOSAL METHODS ARE UTILIZED. SEE DISPOSAL BELOW.

PILL, LEAK OR RELEASE:
BRUSH UP WITH DRY EQUIPMENT AND PLACE IN CLEAN CONTAINER. REUSE OR DISPOSE OF DEPENDING ON CONDITION.

ASTE DISPOSAL:
DILUTIONS WITH WATER MAY BE TREATED WITH SULFAMIC ACID TO PRODUCE A NITRITE-FREE EFFLUENT, WHICH CAN BE DISCHARGED TO A WASTE CONTROL SYSTEM PROVIDING AIR OR BIOLOGICAL OXIDATION.
THIS PRODUCT WOULD BE CONSIDERED A HAZARDOUS WASTE UNDER 40 CFR 261.21 IF DISCARDED AS A SOLID (OXIDIZER).

SECTION VIII - SPECIAL PROTECTION INFORMATION

SPIRATORY PROTECTION:
DUST MASK FOR DRY POWDER
NTILATION:
FORCED VENTILATION FOR MOLTEN SALT BATH
OTECTIVE GLOVES:
HEAT RESISTANT WHEN PRODUCT IS IN MOLTEN STATE.
PROTECTION:
FACE SHIELD WHEN PRODUCT IN MOLTEN STATE
ER PROTECTIVE EQUIPMENT:
PROTECTIVE APRON

SECTION IX - SPECIAL PRECAUTIONS

AGE AND HANDLING CONDITIONS:
STORE IN COOL DRY AREA. KEEP CONTAINER TIGHTLY CLOSED TO PREVENT MOISTURE ABSORPTION AND CONTAMINATION. AVOID CONTACT WITH EASILY OXIDIZED MATERIALS (CYANIDE). DO NOT EXCEED WORKING TEMPERATURE RANGE. MELT DOWN SLOWLY. DO NOT ADD WET WORK. SEE PRODUCT LABELS.

CONTINUED ON PAGE 4

SECTION X

:CHIGAN CRITICAL MATERIALS REGISTER - ACT 293
ZARDOUS WASTE MANAGEMENT ACT - ACT 64

WE HEREBY STATE THAT DRAW TEMP 275
ES NOT CONTAIN ANY OF THE COMPONENTS LISTED IN THE ABOVE.

ADDITIONAL PRODUCT INFORMATION

RCINOGENS AS DEFINED BY - NTP: NONE IARC: NONE OSHA: NONE.

RCLA REPORTABLE QUANTITY (LBS) :
250 LBS. (BASED ON SODIUM NITRITE)

RA HAZARDOUS WASTE NUMBER :
D001; (IGNITABILITY)

RA TITLE III, SECTION 313
THIS PRODUCT CONTAINS NO TOXIC CHEMICAL SUBJECT TO THE REPORTING REQUIREMENTS OF SECTION 313 OF TITLE III OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 AND 40 CFR PART 372.

AW TEMP is a registered trademark of E. F. Houghton & Co.

EPORT NUMBER: 971 VAN WATERS & ROGERS INC. PAGE: 001
SDS NO: MZFESUL MATERIAL SAFETY DATA SHEET
FFECTIVE DATE: 07/22/93 VERSION: 002

RODUCT: FERROUS SULFATE

ORDER NO:
PROD NO :

AN WATERS & ROGERS INC. , SUBSIDIARY OF UNIVAR (206)889-3400
100 CARILLON POINT , KIRKLAND , WA 98033

---------- EMERGENCY ASSISTANCE ----------

FOR EMERGENCY ASSISTANCE INVOLVING CHEMICALS CALL - CHEMTREC
(800)424-9300

RODUCT NAME:
ERROUS SULFATE

SDS #: MZFESUL

RODUCT IDENTIFICATION:
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ynonyms: Iron (II) sulfate (1:1), heptahydrate; sulfuric acid, iron (2+) salt (1:1), heptahydrate

ormula CAS No.: 7782-63-0 (Hydrated) Molecular Weight: 278.01
SCA CAS No.: 7720-78-7 (Anhydrous)
azardous Ingredients: Chemical Formula: FeSO4 7H2O
errous sulfate (ca. 100%)

PRECAUTIONARY MEASURES

ARNING! MAY BE HARMFUL IF SWALLOWED. MAY CAUSE EYE IRRITATION.
void contact with eyes.
ash thoroughly after handling.

EMERGENCY FIRST AID
---

f swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. Call a physician. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes.
EE SECTION 5.

)ODUCT: FERROUS SULFATE

ORDER NO:
PROD NO :

)T Hazard Class: Not Regulated

ıysical Data SECTION 1

›pearance: Blue-green fine crystals.
dor: Odorless.
›lubility: 48.6 g/100 g water @ 50 C (122 F)
›iling Point: Decomposes ›300 C (572 F)
elting Point: Loses water @ 65 C (149 F)
apor Density (Air=1): No information found.
apor Pressure (mm Hg): No information found.
pecific Gravity: 1.90
vaporation Rate: No information found.

ire and Explosion SECTION 2

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nformation

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ire: Not considered to be a fire hazard.
xplosion: Not considered to be an explosion hazard.
ire Extinguishing Media: Use any means suitable for extinguishing surrounding fire.
pecial Information: Use protective clothing and breathing equipment appropriate for the surrounding fire.

eactivity Data SECTION 3

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tability: Stable under ordinary conditions of use and storage.
azardous Decomposition roducts: When heated to decomposition it emits toxic fumes of sulfur oxides.
azardous Polymerization: Will not occur.
ncompatibilities: Alkalies, soluble carbonates, and oxidizing materials. Reacts in moist air to form ferric sulfate.

eak/Spill Disposal Information SECTION 4

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entilate area of leak or spill. Clean-up personnel may require respiratory rotection from dust. Spills: Sweep up and containerize for reclamation or isposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. isposal: Whatever cannot be saved for reclamation may be delivered to an pproved waste disposal facility.
eportable Quantity (RQ)(CWA/CERCLA) : 1,000 lbs.
nsure compliance with local, state and federal regulations.

ealth Hazard Information SECTION 5

. Exposure/Health Effects

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nhalation: Excessive inhalation of dust may be irritating to the respiratory tract.

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ngestion:	Low toxicity in small quantities but larger dosages may cause nausea, vomiting, diarrhea, and black stool. Pink urine discoloration is a strong indicator of iron poisoning. Liver damage, coma, and death from iron poisoning has been recorded. Smaller doses are much more toxic to children.
kin Contact:	May cause mild irritation.
ye Contact:	Contact may cause irritation, redness, and pain.
hronic Exposure:	Severe or chronic ferrous sulfate poisonings may damage bood vessels. Large chronic doss cause ricketts in infants.
ggravation of re-existing Conditions:	Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance.

3. FIRST AID

Inhalation:	Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:	If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. Call physician immediately.
Skin Exposure:	Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Exposure:	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

C. TOXICITY

(RTECS, 1992)

Oral mouse LD50: 1520 mg/kg, investigated as a mutagen.

Occupational Control Measures SECTION 6

Airborne Exposure Limits:	-OSHA Permissible Exposure Limit (PEL): 1 mg/m3 (TWA) soluble iron salts as Fe -ACGIH Threshold Limit Value (TLV): 1 mg/m3 (TWA) soluble iron salt as Fe
Ventilation System:	A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.
Personal Respirators	If the TLV is exceeded, a dust/mist respirator

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RODUCT: FERROUS SULFATE

ORDER NO:
PROD NO :

NIOSH Approved) may be worn up to ten times the TLV. Consult respirator supplier for details.

kin Protection: Wear protective gloves and clean body-covering clothing.

ye Protection: Use chemical safety goggles. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

torage and Special Information SECTION 7

eep in a tightly closed container, stored in a cool, dry, ventilated area. rotect against physical damage. Isolate from incompatible substances.

Addendum to Material Safety Data Sheet

REGULATORY STATUS

Hazard Categories for SARA Section 311/312 Reporting

Acute	Chronic	Fire	Pressure	Reactive
X				

Product or Components of Product:	SARA EHS Sec. 302 RQ	SARA EHS Sec. 302 TPQ	SARA Sec. 313 Chemicals Name List	SARA Sec. 313 Chemicals Chemical Category	CERCLA Sec.103 RQ lbs	RCRA Sec. 261.33
FERROUS SULFATE (7720-78-7)	No	No	No	No	No	No

SARA Section 302 EHS RQ:
Reportable Quantity of Extremely Hazardous Substance, listed at 40 CFR 355.

SARA Section 302 EHS TPQ:
Threshold Planning Quantity of Extremely Hazardous substance. An asterisk (*) following a Threshold Planning Quantity signifies that if the material is a solid and has a particle size equal to or larger than 100 micrometers, the Threshold Planning Quantity = 10,000 LBS.

SARA Section 313 Chemicals:
Toxic Substances subject to annual release reporting requirements listed at 40 CFR 372.65.

CERCLA Sec. 103:
Comprehensive Enviromental Response, Compensation and Liability Act (Superfund) Releases to air, land or water of these hazardous substances which exceed the Reportable Quantity (RQ) must be reported to the National Response Center, (800-424-8802); Listed at 40 CFR 302.4

RCRA:
Resource Conservation and Reclamation Act. Commercial chemical product wastes designated as acute hazards and toxic under 40 CFR 261.33

Addendum to MSDS - California Proposition 65

The State of California requires that we provide to customers and employees in California warnings about reproductive and carcinogenic

000170

hazards associated with substances sold in California that are listed under Proposition 65. Information on this Proposition 65 MSDS addendum addresses that requirement and should be used in conjunction with this Material Safety Data Sheet.

Product(s): FERROUS SULFATE
CAS NO. 7782-63-0 TSCA NO. 7720-78-7
WARNING: This product may contain a chemical known to the state of California to cause birth defects or other reproductive harm.

---------- FOR ADDITIONAL INFORMATION ----------

CONTACT: MSDS COORDINATOR VAN WATERS & ROGERS INC.
DURING BUSINESS HOURS, PACIFIC TIME (206)889-3400

07/19/95 09:30 PRODUCT: CUST NO: ORDER NO:

---------- NOTICE ----------

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*** END OF MSDS ***

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NATIONAL GYPSUM -- GYPSUM
MATERIAL SAFETY DATA SHEET
FSC: 6810
Manufacturer's CAGE: 9N701
Part No. Indicator: A
Part Number/Trade Name: GYPSUM

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General Information

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Company's Name: NATIONAL GYPSUM
Company's Street: 2001 REXFORD RD
Company's City: CHARLOTTE
Company's State: NC
Company's Country: US
Company's Zip Code: 28211
Company's Emerg Ph #: 704-365-0950
Company's Info Ph #: 704-365-0950
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 07NOV85
Safety Data Review Date: 08MAR94
MSDS Serial Number: BVCNF
Hazard Characteristic Code: NK

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: CALCIUM SULFATE DIHYDRATE
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: EW4150000
CAS Number: 10101-41-4
OSHA PEL: N/K (FP N)
ACGIH TLV: 5 MG/M3 (MFR)

Proprietary: NO
1480-60-7)
Ingredient Sequence Number: 02
NIOSH (RTECS) Number: VV7330000
CAS Number: 14808-60-7
OSHA PEL: 10 MG/M3 (MFR)
ACGIH TLV: 0.1 MG/M3 RDUST

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Physical/Chemical Characteristics

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Appearance And Odor: WHITE TO GREY POWDER/ROCK; NO ODOR.
Boiling Point: N/A
Vapor Pressure (MM Hg/70 F): N/A
Vapor Density (Air=1): N/A
Specific Gravity: 2.3 (H*2O=1)
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: SLIGHT

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Fire and Explosion Hazard Data

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Flash Point: NOT COMBUSTIBLE
Flash Point Method: N/P
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: MEDIA SUITABLE FOR SURROUNDING FIRE (FP N).

Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: NOT APPLICABLE

Reactivity Data

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: NONE KNOWN.
Hazardous Decomp Products: WHEN HEATED TO DECOMPOSITION RELEASES SO*X.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: PRIMARY EXPOSURE ROUTE - INHALATION, CONTINUOUS EXPOSURE TO HIGH CONCENTRATIONS MAY IMPAIR LUNG FUNCTION.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: SILICA, CRYSTALLINE-QUARTZ:IARC MONOGRAPHS, SUPP, VOL 7, PG 341, 1987:GRP 2A. NTP 6TH ANNUAL RPT ON CARCINS, (SUPP DATA)
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: INGEST:CALL MD IMMEDIATELY (FP N). INHAL: REMOVE TO FRESH AIR. SUPPORT BREATHING (GIVE O*2/ARTF RESP) (FP N). SKIN: FLUSH W/COPIOUS AMOUNTS OF WATER. CALL MD (FP N). EYES:WASH W/WATER FOR AT LEAST 15 MINUTES. SEEK MEDICAL AID IF REQUIRED.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: SCOOP UP SHOVEL UP. AVOID CREATING DUST.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISPOSAL MUST BE I/A/W FEDERAL, STATE & LOCAL REGULATIONS (FP N). LANDFILL I/A/W REGULATIONS.
Precautions-Handling/Storing: KEEP DRY TO PRESERVE USEFULNESS.
Other Precautions: NONE SPECIFIED BY MANUFACTURER.

Control Measures

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATORY PROTECTION FOR DUST IF NEEDED.
Ventilation: LOCAL EXHAUST: TO MAINTAIN DUST CONCENTRATION BELOW TLV.
Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: SAFETY GLASSES. GOGGLES IF DUSTY.
Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: EXPLAN OF CARCIN:1991:ANTICIPATED TO BE CARCINOGEN.

Transportation Data

Disposal Data

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Label Data

Label Required: YES
Technical Review Date: 07MAR94
Label Date: 04MAR94
Label Status: M
Common Name: GYPSUM
Chronic Hazard: YES
Signal Word: CAUTION!
Acute Health Hazard-Slight: X
Contact Hazard-Slight: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: ACUTE:MAY IRRITATE LUNGS. CHRONIC:CANCER HAZARD. CONTAINS CRYSTALLINE SILICA, WHICH IS LISTED AS A LUNG CARCINOGEN (FP N). INHALATION:CONTINUOUS EXPOSURE TO HIGH CONCENTRATIONS MAY IMPAIR LUNG FUNCTION.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: NATIONAL GYPSUM
Label Street: 2001 REXFORD RD
Label City: CHARLOTTE
Label State: NC
Label Zip Code: 28211
Label Country: US
Label Emergency Number: 704-365-0950

Select this to send FAX (or view image if using Windows).

Martin Marietta Energy Systems, Inc.
Material Safety Reference Sheet

artin Marietta Energy Systems Material Safety Reference Sheet (MSRS) is to be used in njunction with the Manufacturer's MSDS. The information is not intended to be a definitive tement of all hazards associated with the material. It will not meet OSHA requirements ed alone.

entification:

CID: 00324 Version: 2 Version Date: 30-SEP-1993
terial Name: HYDROGEN SULFIDE
S No: 007783-06-4

nonyms:

HYDROGEN SULFURIC ACID
STINK DAMP
SULFURETED HYDROGEN
HYDROSULFURIC ACID
SULFUR HYDRIDE
DIHYDROGEN SULFIDE

atus Information:	MSDS Type	MSDS Status	MSDS Available
	MMES	APPROVED	Yes

ecial Condition: N
HM Group Code: C
MMES Carcinogen: No

productive/ Developmental Effector:	Per RTECS	Per MMES
	Yes	No

vid Numbers:

GSC0044-4400

ɔres Numbers:

re Chemical: Yes

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alth Hazard Rating: 3, [HIGH HEALTH HAZARD]
IRRITANT, ASPHYXIANT, LACRIMATOR
re Hazard Rating: 4, [EXTREMELY FLAMMABLE]
activity Hazard Rating: 0, [NONREACTIVE]

ARTIN MARIETTA ENERGY SYSTEMS HEALTH HAZARD RATINGS ARE BASED ON THE
OTENTIAL TOXICITY OF A MATERIAL. FIRE AND REACTIVITY HAZARD RATINGS ARE
SSIGNED ACCORDING TO NFPA CRITERIA. HAZARD RATINGS ARE NOT TO BE USED
Y THEMSELVES BUT ARE TO BE USED IN CONJUNCTION WITH A HEALTH AND SAFETY
VALUATION OF THE PROCESS IN WHICH THE MATERIAL IS USED IN ORDER TO
ETERMINE THE POTENTIAL EXPOSURE HAZARDS. A HAZARD CLASSIFICATION GUIDE IS
ROVIDED IN ESS-IH-140.

A ID Number: U135
ECS Number: MX1225000

arget Organ/Systems: Per MFG.
rget Organ Comments:
ENTRAL NERVOUS SYSTEM, CARDIOVASCULAR SYSTEM

anufacturers: (Name, Address, Phone, FAX No, Contact)

LIQUID AIR CORP.
ONE CALIFORNIA PLAZA, SUITE 350, 2121 N. CALIFORNIA BLVD.,
WALNUT CREEK, CA 94596
Phone: (800)231-1366
MATHESON GAS PRODUCTS
30 SEAVIEW DRIVE
SECAUCUS, NJ 07096
Phone: (201)867-4100

gredients:

U R E C H E M I C A L

arcinogenicity:

he MMES Carcinogen Control Program includes human, human suspect, and
onfirmed animal carcinogens. [See MMES Carcinogen: (Yes/No or Not Yet
etermined) in Section 1.] Chemicals and compounds in concentration of
.1% or greater are subject to the guidelines set forth in the MMES
arcinogen Control program. Substitution with a non-carcinogen should
e made if feasible.

eproductive/Developmental Toxicity:

HE RTECS REPRODUCTIVE/DEVELOPMENT EFFECTORS ARE MATERIALS LISTED IN THE
EGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES THAT HAVE POSITIVE
EPRODUCTIVE EFFECTS DATA FOR AT LEAST ONE MAMMALIAN SPECIES THROUGH ANY
OUTE OF ADMINISTRATION. THE MMES REPRODUCTIVE/DEVELOPMENTAL EFFECTORS ARE
SUBSET OF THE RTECS MATERIALS THAT HAVE POSITIVE EFFECTS IN TWO OR MORE
AMMALIAN SPECIES OR ONE POSITIVE STUDY IN HUMANS THROUGH COMMON OCCUPATION
OUTES (DERMAL, INGESTION, AND INHALATION) OF EXPOSURE. IN EITHER GROUP
UCH EFFECTS MAY INCLUDE PATERNAL, MATERNAL, FERTILITY, EMBRYO/FETUS,

ROUP DOES NOT AUTOMATICALLY IMPLY THAT THE SUBSTANCE IS HAZARDOUS FOR
OMMON USE. A HAZARD DETERMINATION IS GENERALLY REQUIRED.

7730

BP OIL

7730

MATERIAL SAFETY DATA SHEET

10055

24-HOUR EMERGENCY ASSISTANCE	GENERAL ASSISTANCE	NFPA FIRE HAZARD SYMBOL
BP America (In Ohio): 800-362-8059 (Outside Ohio): 800-321-8642 CHEMTREC Assist: 800-424-9300	216-441-8124	Flammability, Health, Reactivity, Special Hazards; 4-Extreme, 3-High, 2-Moderate, 1-Slight, 0-Insignificant, *-See Text; 2 0 0
MSDS Number > 1294		

MANUFACTURER/SUPPLIER: BP Oil Company
ADDRESS: 200 Public Square, Cleveland, OH 44114-2375

PRODUCT IDENTIFICATION

TRADE NAME:
BP KEROSINE

CAS NUMBER:	8008-20-6
SYNONYM(S):	KEROSINE; MIDDLE DISTILLATE; PROCESS STREAM
CHEMICAL FAMILY:	PETROLEUM HYDROCARBONS
MOLECULAR FORMULA:	MIXTURE
MOLECULAR WEIGHT:	NA
PRODUCT CODE:	P 1410 HIERARCHY: 040.020

PRODUCT HAZARD SUMMARY

HEALTH

DANGER!
HARMFUL OR FATAL IF SWALLOWED
ASPIRATION HAZARD IF SWALLOWED--CAN ENTER LUNGS AND CAUSE DAMAGE
VAPORS MAY BE HARMFUL
MAY BE IRRITATING TO THE SKIN, EYES AND RESPIRATORY TRACT
HEATED MATERIAL MAY CAUSE THERMAL BURNS
SKIN CANCER HAZARD BASED ON TESTS WITH LABORATORY ANIMALS

FLAMMABILITY

CAUTION!
COMBUSTIBLE LIQUID & VAPOR

REACTIVITY

STABLE

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This reprinted material is not the complete and official position of the NFPA on the referenced subject, which is represented only by the standard in its entirety.

PRODUCT HEALTH HAZARD INFORMATION

INGESTION:

MODERATELY TOXIC. Human oral LDLo = -10 mls. Aspiration into lungs may cause pneumonitis. May cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea. May cause harmful central nervous system effects. Effects may include excitation, euphoria, headache, dizziness, drowsiness, blurred vision, fatigue, tremors, convulsions, loss of consciousness, coma, respiratory arrest and death.

SKIN:

PRACTICALLY NON-TOXIC. Rabbit dermal LD50 = >5 ml/kg. MODERATELY IRRITATING. Rabbit dermal PSI = 2.6. Repeated or prolonged contact may result in defatting, redness, itching, inflammation, cracking and possible secondary infection. May cause allergic reactions in some individuals. Absorption from prolonged or massive skin contact may cause poisoning. High pressure skin injections are SERIOUS MEDICAL EMERGENCIES. Injury may not appear serious at first; within a few hours, tissue will become swollen, discolored and extremely painful (see Notes to Physician section). Contact with heated material may cause thermal burns.

EYE:

Exposure to vapors, fumes or mists may cause irritation. Contact with heated material may cause thermal burns.

INHALATION:

May cause respiratory tract irritation. Exposure may cause central nervous system symptoms similar to those listed under "Ingestion" (see Ingestion section). Degenerative changes in the liver, kidneys and bone marrow may occur with prolonged, high concentrations. Repeated or prolonged exposures may cause behavioral changes.

SPECIAL TOXIC EFFECTS:

Products of similar composition have produced skin cancer in laboratory animals and have been positive in mutagenic test systems. IARC has determined that there is limited evidence for the carcinogenicity of straight-run kerosine in experimental animals.

WARNING: The use of any hydrocarbon fuel in an area without adequate ventilation may result in hazardous levels of combustion products and inadequate oxygen levels.

NOTE: This product has not been tested as a whole for all potential health effects. It may have other health hazards related to its components. See "Ingredient/Health Hazards" for additional information.

FIRST AID

INGESTION:

DO NOT INDUCE VOMITING BECAUSE OF DANGER OF ASPIRATING LIQUID INTO LUNGS. Get immediate medical attention. If spontaneous vomiting occurs, monitor for breathing difficulty.

SKIN CONTACT.

Remove contaminated clothing immediately. Wash area of contact thoroughly with soap and water. Get medical attention if irritation persists. High pressure skin injections are SERIOUS MEDICAL EMERGENCIES. Get immediate medical attention. Thermal burns require immediate medical attention.

EYE CONTACT

Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be

ND = No Data
NA = Not Applicable

held away from the eyeball to ensure thorough rinsing. Get medical attention if irritation results. Thermal burns require immediate medical attention.

INHALATION:
Remove affected person from source of exposure. If not breathing, ensure open airway and institute cardiopulmonary resuscitation (CPR). If breathing is difficult, administer oxygen if available. Get medical attention.

OTHER INFORMATION

In case of ingestion, gastric lavage with activated charcoal can be used promptly to prevent absorption. Consideration should be given to the use of an intratracheal tube, to prevent aspiration. Individuals intoxicated by middle distillates should be hospitalized immediately, wit acute and continuing attention to neurologic and cardiopulmonary function. Positive pressure ventilation may be necessary. After the initial episode, individuals should be followed for changes in blood variables and the delayed appearance of pulmonary edema and chemical pneumonitis. Such patients should be followed for several days or weeks for delayed effects, including bone marrow toxicity, hepatic and renal involvement. Individuals with chronic pulmonary disease will be more seriously impaired, and recovery from inhalation exposure may be complicated. In case of skin injection, prompt debridement of the wound is necessary to minimize necrosis and tissue loss.

PERSONAL PROTECTION INFORMATION

EYE PROTECTION:
Avoid eye contact with this material. Wear safety glasses or chemical goggles. Provide an eyewash station in the work area. Do not wear contact lenses when working with this substance.

SKIN PROTECTION:
Avoid skin contact. When working with this substance, wear appropriate chemical protective gloves. Depending upon conditions of use, additional protection may be necessary such as face shield, apron, armcovers, etc.

RESPIRATORY PROTECTION:
If exposure limits are exceeded or if irritation is experienced, NIOSH approved respiratory protection should be worn. Ventilation and other forms of engineering controls are often the preferred means for controlling chemical exposures. Respiratory protection may be needed for non-routine or emergency situations.

PHYSICAL PROPERTIES

BOILING POINT:	148.900 C (300 F)
SPECIFIC GRAVITY:	0.825 @ 60 F
MELTING POINT:	NA
% VOLATILE:	100.000
VAPOR PRESSURE:	0.400 MM HG @ 68 F
EVAPORATION RATE (WATER=1):	SLOWER
VAPOR DENSITY (AIR=1):	4.700
VISCOSITY:	1.300- 2.200 CST @ 100 F
% SOLUBILITY IN WATER:	NEGLIGIBLE
OCTANOL/WATER PARTITION COEFFICIENT:	ND
POUR POINT:	-34.400 C (-30 F)

ND = No Data
NA = Not Applicable

pH: ND

APPEARANCE/ODOR: COLORLESS/STRAW/COLORED CLEAR LIQUID WITH A HYDROCARBON ODOR.

FIRE AND EXPLOSION DATA

FLASH POINT: > 37.800 C (100 F) TCC
AUTOIGNITION TEMPERATURE: 210.000 C (410 F)
FLAMMABILITY LIMITS IN AIR (% BY VOL.) LOWER: 0.700
FLAMMABILITY LIMITS IN AIR (% BY VOL.) UPPER: 5.000

BASIC FIREFIGHTING PROCEDURES:

Use water spray, dry chemical, foam or carbon dioxide to extinguish fire. Use water spray to cool fire-exposed containers, structures and to protect personnel. If leak or spill has not ignited, ventilate area and use water spray to disperse gas or vapor and to protect personnel attempting to stop leak. Use water to flush spills away from sources of ignition. Do not flush down public sewers or other drainage systems. Exposed firefighters must wear MSHA/NIOSH approved positive pressure self-contained breathing apparatus with full face mask and full protective clothing.

UNUSUAL FIRE AND EXPLOSION HAZARDS:

Dangerous when exposed to heat or flame. Containers may explode in heat of fire. Runoff to sewer may cause fire or explosion hazard. Irritating or toxic substances may be emitted upon thermal decomposition.

REACTIVITY DATA

STABILITY/INCOMPATIBILTY:

Stable. Avoid contact with strong oxidizers.

HAZARDOUS REACTIONS/DECOMPOSITION PRODUCTS:

Combustion may produce CO, CO2 and reactive hydrocarbons.

ENVIRONMENTAL INFORMATION

SPILL OR RELEASE TO THE ENVIRONMENT:

If your facility or operation has an "Oil or Hazardous Substance Contingency Plan", activate its procedures.

-- Take immediate steps to stop and contain the spill. Caution should be exercised regarding personnel safety and exposure to the spilled material.

-- For technical advise and assistance related to chemicals, contact CHEMTREC (800/424-9300) and your local fire department.

-- Notify the National Response Center, if required. Also notify appropriate state and local regulatory agencies, the LEPC and the SERC. Contact the local Coast Guard if the release is into a waterway.

Emergency Action:

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. (Also see Personal Protection Information section.) Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire.

Spill or Leak Procedure:

Shut off ignition sources; no flares, smoking or flames in hazard area. Stop leak if you

ND = No Data
NA = Not Applicable

can do it without risk. Water spray may reduce vapor; but it may not prevent ignition in closed spaces. Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal. Large Spills: Dike far ahead of liquid spill for later disposal.

Notification:
Any spill or release, or substantial threat of release, of this material to navigable water (virtually any surface water) sufficient to cause a visible sheen upon the water must be reported immediately to the National Response Center (800/424-8802), as required by U.S. Federal Law. Failure to report may result in substantial civil and criminal penalties. Also contact the Coast Guard and appropriate state and local regulatory agencies.

WASTE DISPOSAL:
This substance, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulations; however it could be characteristically hazardous if it is considered toxic, corrosive, ignitable, or reactive according to Federal definitions (40 CFR 261). Additionally, it could be designated as hazardous according to state regulations. This substance could also become a hazardous waste if it is mixed with or comes in contact with a hazardous waste. Check 40 CFR 261 to determine whether it is a hazardous waste. If it is a hazardous waste, regulations at 40 CFR 262, 263, 264, 268 and 270 apply. Chemical additions, processing or otherwise altering this material may make the waste management information presented in this MSDS incomplete, inaccurate or otherwise inappropriate.

The transportation, storage, treatment, and disposal of this waste material must be conducted in compliance with all applicable Federal, state, and local regulations.

SARA TITLE III INFORMATION:
Listed below are the hazard categories for the Superfund Amendments and Reauthorization Act (SARA) Section 311/312 (40 CFR 370):
Immediate Hazard: X Delayed Hazard: X Fire Hazard: X Pressure Hazard: - Reactivity Hazard: -

The product does not contain any toxic chemical(s) subject to the reporting requirements of the Superfund Amendments and Reauthorization Act (SARA) Section 313 (40 CFR 372).

ADDITIONAL ENVIRONMENTAL REGULATORY INFORMATION:
There may be specific regulations at the local, regional or state level that pertain to this material.

SPECIAL PRECAUTIONS/SUPPLEMENTAL INFORMATION

HANDLING/STORAGE:
Store in tightly closed containers in cool, dry, isolated, well-ventilated area away from heat, sources of ignition and incompatibles. Use non-sparking tools. Ground lines and equipment used during transfer to reduce the possibility of static spark-initiated fire or explosion. Do not siphon this product by mouth. Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities. Remove contaminated clothing and clean before reuse. Shower after work using soap and water.

This product does not meet the sulfur limits for K-1 Kerosine and should not be used in non-flue connected appliances, heaters or wick lamps.

EMPTY CONTAINERS:
Empty containers may contain toxic, flammable/combustible or explosive residue or vapors.

ND = No Data
NA = Not Applicable

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Do not cut, grind, drill, weld, reuse or dispose containers unless adequate precautions are taken against these hazards.

TRANSPORTATION REQUIREMENTS

D.O.T. PROPER SHIPPING NAME (49 CFR 172.101):	KEROSENE, 3, UN 1223, PG III
D.O.T. HAZARD CLASS (49 CFR 172.101):	3
UN/NA CODE (49 CFR 172.101):	UN 1223
BILL OF LADING DESCRIPTION (49 CFR 172.202):	KEROSENE, 3, UN 1223, PG III
D.O.T. LABELS REQUIRED (49 CFR 172.101):	COMBUSTIBLE
D.O.T. PLACARDS REQUIRED (49 CFR 172.504):	COMBUSTIBLE LIQUID

INGREDIENTS/HAZARD INFORMATION

COMPONENT	CAS NO.	%	EXPOSURE LIMITS - REF.
Kerosine	8008-20-6	99.90-100	None established
Remaining components not determined hazardous and/or hazardous components present at less than 1.0% (0.1% for carcinogens).	NA	Trace	NA

REVISION DATE: 05-feb-1992 REPLACES SHEET DATED: 30-oct-1991

COMPLETED BY: BP OIL HSEQ DEPARTMENT

NOTICE: The information presented herein is based on data considered to be accurate as of the date of preparation of this Material Safety Data Sheet. However, no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, no responsibility can be assumed by vender for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

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ND = No Data
NA = Not Applicable

MSDS for MAGNESIUM, TURNINGS Page 1

1 - PRODUCT IDENTIFICATION

PRODUCT NAME: MAGNESIUM, TURNINGS
FORMULA: MG
FORMULA WT: 24.30
CAS NO.: 07439-95-4
NIOSH/RTECS NO.: OM2100000
PRODUCT CODES: 2420,2410
EFFECTIVE: 10/24/86
REVISION #03

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH	-	0	NONE
FLAMMABILITY	-	2	MODERATE
REACTIVITY	-	2	MODERATE
CONTACT	-	0	NONE

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

SAFETY GLASSES; LAB COAT; CLASS D EXTINGUISHER

PRECAUTIONARY LABEL STATEMENTS

WARNING
FLAMMABLE SOLID

KEEP AWAY FROM HEAT, SPARKS, FLAME.
DO NOT BREATHE DUST. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE, DO NOT USE WATER. USE DRY SAND, EARTH OR SODA ASH. IN CASE OF SPILL, SWEEP UP AND CAREFULLY REMOVE.

SAF-T-DATA(TM) STORAGE COLOR CODE: RED STRIPE (STORE SEPARATELY)

2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
MAGNESIUM	90-100	7439-95-4

3 - PHYSICAL DATA

BOILING POINT:	1107 C (2025 F)	VAPOR PRESSURE(MM HG):	N/A
MELTING POINT:	650 C (1202 F)	VAPOR DENSITY(AIR=1):	N/A
SPECIFIC GRAVITY:	1.74	EVAPORATION RATE:	N/A

(H2O=1) (BUTYL ACETATE=1)

SOLUBILITY(H2O): DECOMPOSES % VOLATILES BY VOLUME: 0

APPEARANCE & ODOR: SILVERY METALLIC SHAVINGS.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP 634 C (1175 F) NFPA 704M RATING: 0-1-2 W

FLAMMABLE LIMITS: UPPER - N/A % LOWER - N/A %

FIRE EXTINGUISHING MEDIA
SMOTHER WITH DRY SODA ASH. NEVER USE WATER OR CHEMICAL FIRE EXTINGUISHERS.

SPECIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.
BURNS WITH A VERY BRIGHT FLAME, FIRE GLASSES MUST BE WORN.

UNUSUAL FIRE & EXPLOSION HAZARDS
REACTS VIOLENTLY WITH WATER PRODUCING HIGHLY FLAMMABLE VAPORS.
CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE OR EXPLOSION.
DUST MAY FORM EXPLOSIVE MIXTURE WITH AIR.

TOXIC GASES PRODUCED
HYDROGEN GAS

5 - HEALTH HAZARD DATA

TLV IS LISTED FOR MAGNESIUM OXIDE FUME.

THRESHOLD LIMIT VALUE (TLV/TWA): 10 MG/M3 (PPM)

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE
CONTACT MAY CAUSE IRRITATION OF SKIN, EYES, AND MUCOUS MEMBRANES.
DUST INHALATION MAY CAUSE TIGHTNESS AND PAIN IN CHEST, COUGHING, AND DIFFICULTY IN BREATHING.
INHALATION OF FUMES MAY RESULT IN LEUKOCYTOSIS.
NOTE: PRODUCT IS A SOLID MASS; HOWEVER, WARNINGS ARE BASED ON INHALATION DUST, MIST OR FUME EMISSIONS THAT ARE POSSIBLE DURING MANUFACTURING OR CHEMICAL REACTIONS.

TARGET ORGANS
RESPIRATORY SYSTEM, EYES

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
NONE IDENTIFIED

ROUTES OF ENTRY
INHALATION, SKIN CONTACT, EYE CONTACT

EMERGENCY AND FIRST AID PROCEDURES
CALL A PHYSICIAN.
IF SWALLOWED, DO NOT INDUCE VOMITING; IF CONSCIOUS, GIVE LARGE AMOUNTS OF WATER.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. FLUSH SKIN WITH WATER.

6 - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: MOISTURE, HEAT, FLAME, OTHER SOURCES OF IGNITION

INCOMPATIBLES: STRONG OXIDIZING AGENTS, STRONG ACIDS, WATER, HALOGENS, CYANIDES

DECOMPOSITION PRODUCTS: HYDROGEN

7 - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
WEAR SUITABLE PROTECTIVE CLOTHING. SHUT OFF IGNITION SOURCES; NO FLARES, SMOKING, OR FLAMES IN AREA. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER.

DISPOSAL PROCEDURE
DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

8 - PROTECTIVE EQUIPMENT

VENTILATION: USE ADEQUATE GENERAL OR LOCAL EXHAUST VENTILATION TO KEEP FUME OR DUST LEVELS AS LOW AS POSSIBLE.

RESPIRATORY PROTECTION: NONE REQUIRED WHERE ADEQUATE VENTILATION CONDITIONS EXIST. IF AIRBORNE CONCENTRATION IS HIGH, A DUST/MIST RESPIRATOR IS RECOMMENDED. IF CONCENTRATION EXCEEDS CAPACITY OF RESPIRATOR, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GLASSES WITH SIDESHIELDS, PROPER GLOVES ARE

RECOMMENDED.

9 - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA(TM) STORAGE COLOR CODE: RED STRIPE (STORE SEPARATELY)

SPECIAL PRECAUTIONS
KEEP CONTAINER TIGHTLY CLOSED. STORE AWAY FROM WATER OR LOCATIONS WHERE WATER MAY BE USED TO EXTINGUISH FIRE.
STORE IN A COOL, WELL-VENTILATED AREA AWAY FROM SOURCES OF HEAT, FLAME, OR IGNITION.

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	MAGNESIUM METAL (TURNINGS)
HAZARD CLASS	FLAMMABLE SOLID
UN/NA	UN1869
LABELS	FLAMMABLE SOLID, DANGEROUS WHEN WET

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	MAGNESIUM METAL (TURNINGS)
HAZARD CLASS	4.1
UN/NA	UN1869
LABELS	FLAMMABLE SOLID

1 - PRODUCT IDENTIFICATION

PRODUCT NAME: MAGNESIUM
FORMULA: MG
FORMULA WT: 24.30
CAS NO.: 7439-95-4
NIOSH/RTECS NO.: OM2100000
PRODUCT CODES: 2416
EFFECTIVE: 10/24/86
REVISION #03

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH	-	1	SLIGHT
FLAMMABILITY	-	4	EXTREME (FLAMMABLE)
REACTIVITY	-	3	SEVERE (WATER REACTIVE)
CONTACT	-	1	SLIGHT

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

SAFETY GLASSES; LAB COAT; CLASS D EXTINGUISHER

PRECAUTIONARY LABEL STATEMENTS

WARNING
CAUSES IRRITATION
DUST MAY FORM FLAMMABLE AND EXPLOSIVE MIXTURE WITH AIR, ESPECIALLY WHEN DAMP.

KEEP AWAY FROM HEAT, SPARKS, FLAME.
DO NOT BREATHE DUST. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE, DO NOT USE WATER. USE DRY SAND, EARTH OR SODA ASH. IN CASE OF SPILL, SWEEP UP AND CAREFULLY REMOVE.

SAF-T-DATA(TM) STORAGE COLOR CODE: RED STRIPE (STORE SEPARATELY)

2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
MAGNESIUM	90-100	7439-95-4

3 - PHYSICAL DATA

BOILING POINT: 1107 C (2025 F) VAPOR PRESSURE(MM HG): N/A

MELTING POINT: 650 C (1202 F) VAPOR DENSITY(AIR=1): 0.84

SPECIFIC GRAVITY: 1.74 (H2O=1)

EVAPORATION RATE: N/A (BUTYL ACETATE=1)

SOLUBILITY(H2O): DECOMPOSES

% VOLATILES BY VOLUME: 0

APPEARANCE & ODOR: SILVERY, WHITE METALLIC POWDER.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP 634 C (1175 F)

NFPA 704M RATING: 0-1-2 W

FLAMMABLE LIMITS: UPPER - N/A % LOWER - N/A %

FIRE EXTINGUISHING MEDIA
SMOTHER WITH DRY SODA ASH. NEVER USE WATER OR CHEMICAL FIRE EXTINGUISHERS.

SPECIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.
BURNS WITH A VERY BRIGHT FLAME, FIRE GLASSES MUST BE WORN.

UNUSUAL FIRE & EXPLOSION HAZARDS
REACTS VIOLENTLY WITH WATER PRODUCING HIGHLY FLAMMABLE VAPORS.
CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE OR EXPLOSION.
DUST MAY FORM EXPLOSIVE MIXTURE WITH AIR.

TOXIC GASES PRODUCED
HYDROGEN GAS

5 - HEALTH HAZARD DATA

TLV IS LISTED FOR MAGNESIUM OXIDE FUME.

THRESHOLD LIMIT VALUE (TLV/TWA): 10 MG/M3 (PPM)

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE
INHALATION OF DUST MAY CAUSE IRRITATION TO UPPER RESPIRATORY TRACT.
INHALATION OF FUMES MAY RESULT IN LEUKOCYTOSIS.
CONTACT MAY CAUSE IRRITATION OF SKIN, EYES, AND MUCOUS MEMBRANES.

TARGET ORGANS
RESPIRATORY SYSTEM, EYES

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
NONE IDENTIFIED

ROUTES OF ENTRY
INHALATION, SKIN CONTACT, EYE CONTACT

EMERGENCY AND FIRST AID PROCEDURES
CALL A PHYSICIAN.
IF SWALLOWED, DO NOT INDUCE VOMITING; IF CONSCIOUS, GIVE LARGE AMOUNTS OF WATER.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. FLUSH SKIN WITH WATER.

6 - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: MOISTURE, HEAT, FLAME, OTHER SOURCES OF IGNITION

INCOMPATIBLES: STRONG OXIDIZING AGENTS, STRONG ACIDS, WATER, HALOGENS, CYANIDES

DECOMPOSITION PRODUCTS: HYDROGEN

7 - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
WEAR SUITABLE PROTECTIVE CLOTHING. SHUT OFF IGNITION SOURCES; NO FLARES, SMOKING, OR FLAMES IN AREA. DO NOT USE WATER.
WITH CLEAN SHOVEL, PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER.
MOVE CONTAINER(S) FROM SPILL AREA.

DISPOSAL PROCEDURE
DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: D001, D003 (IGNITABLE, REACTIVE WASTE)

8 - PROTECTIVE EQUIPMENT

VENTILATION: USE ADEQUATE GENERAL OR LOCAL EXHAUST VENTILATION TO KEEP FUME OR DUST LEVELS AS LOW AS POSSIBLE.

RESPIRATORY PROTECTION: NONE REQUIRED WHERE ADEQUATE VENTILATION CONDITIONS EXIST. IF AIRBORNE CONCENTRATION IS HIGH, USE AN APPROPRIATE RESPIRATOR OR DUST MASK.

EYE/SKIN PROTECTION: SAFETY GLASSES WITH SIDESHIELDS, PROPER GLOVES ARE RECOMMENDED.

9 - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA(TM) STORAGE COLOR CODE: RED STRIPE (STORE SEPARATELY)

SPECIAL PRECAUTIONS
KEEP CONTAINER TIGHTLY CLOSED. STORE AWAY FROM WATER OR LOCATIONS WHERE WATER MAY BE USED TO EXTINGUISH FIRE.
STORE IN A COOL, WELL-VENTILATED AREA AWAY FROM SOURCES OF HEAT, FLAME, OR IGNITION.

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10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	MAGNESIUM METAL (POWDERED)
HAZARD CLASS	FLAMMABLE SOLID
UN/NA	UN1869
LABELS	FLAMMABLE SOLID, DANGEROUS WHEN WET

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	MAGNESIUM, POWDER, NON-PYROPHORIC
HAZARD CLASS	4.3
UN/NA	UN1418
LABELS	DANGEROUS WHEN WET

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MSDS for NITRIC ACID Page 1

1 - PRODUCT IDENTIFICATION

PRODUCT NAME: NITRIC ACID
FORMULA: HNO3
FORMULA WT: 63.01
CAS NO.: 7697-37-2
NIOSH/RTECS NO.: QU5775000
COMMON SYNONYMS: HYDROGEN NITRATE; AZOTIC ACID
PRODUCT CODES: 4801,9605,9602,9598,9606,9601,5371,9597,9600,5113,9616
EFFECTIVE: 09/10/86
REVISION #02

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 3 SEVERE (POISON)
FLAMMABILITY - 0 NONE
REACTIVITY - 3 SEVERE (OXIDIZER)
CONTACT - 4 EXTREME (CORROSIVE)

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

PRECAUTIONARY LABEL STATEMENTS

POISON DANGER
STRONG OXIDIZER - CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE
LIQUID AND VAPOR CAUSE SEVERE BURNS - MAY BE FATAL IF SWALLOWED
HARMFUL IF INHALED AND MAY CAUSE DELAYED LUNG INJURY
SPILLAGE MAY CAUSE FIRE OR LIBERATE DANGEROUS GAS

KEEP FROM CONTACT WITH CLOTHING AND OTHER COMBUSTIBLE MATERIALS. DO NOT STORE NEAR COMBUSTIBLE MATERIALS. DO NOT GET IN EYES, ON SKIN, ON CLOTHING. DO NOT BREATHE VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE VENTILATION. IN CASE OF FIRE, USE WATER SPRAY, ALCOHOL FOAM, DRY CHEMICAL, OR CARBON DIOXIDE. FLUSH SPILL AREA WITH WATERSPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: YELLOW (REACTIVE)

2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
NITRIC ACID	65-75	7697-37-2

3 - PHYSICAL DATA

BOILING POINT: 121 C (250 F) VAPOR PRESSURE(MM HG):

MELTING POINT: -42 C (-44 F) VAPOR DENSITY(AIR=1):

SPECIFIC GRAVITY: 1.41 (H2O=1) EVAPORATION RATE: N/A (BUTYL ACETATE=1)

SOLUBILITY(H2O): COMPLETE (IN ALL PROPORTIONS) % VOLATILES BY VOLUME: 100

APPEARANCE & ODOR: COLORLESS LIQUID, WITH CHOKING ODOR.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP N/A NFPA 704M RATING: 3-0-0 OXY

FLAMMABLE LIMITS: UPPER - N/A % LOWER - N/A %

FIRE EXTINGUISHING MEDIA
USE WATER SPRAY.

SPECIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE EXPOSED CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL; DO NOT GET WATER INSIDE CONTAINERS.

UNUSUAL FIRE & EXPLOSION HAZARDS
STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE.

TOXIC GASES PRODUCED
NITROGEN OXIDES, HYDROGEN GAS

5 - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): 5 MG/M3 (2 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 10 MG/M3 (4 PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): 5 MG/M3 (2 PPM)

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE
INHALATION OF VAPORS MAY CAUSE NAUSEA, VOMITING, LIGHTHEADEDNESS OR HEADACHE.
INHALATION OF VAPORS MAY CAUSE SEVERE IRRITATION OF THE RESPIRATORY SYSTEM.
INHALATION OF VAPORS MAY CAUSE COUGHING, CHEST PAINS, DIFFICULTY BREATHING, OR UNCONSCIOUSNESS.
CONTACT WITH LIQUID OR VAPOR MAY CAUSE SEVERE IRRITATION OR BURNS OF THE SKIN, EYES, AND MUCOUS MEMBRANES.
INGESTION MAY CAUSE SEVERE BURNS TO MOUTH, THROAT, AND STOMACH. MAY HAVE ADVERSE EFFECT ON KIDNEY FUNCTION AND MAY BE FATAL.

INGESTION IS HARMFUL AND MAY BE FATAL.

TARGET ORGANS
EYES, SKIN, RESPIRATORY SYSTEM, TEETH

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
NONE IDENTIFIED

ROUTES OF ENTRY
INHALATION, INGESTION, EYE CONTACT, SKIN CONTACT

EMERGENCY AND FIRST AID PROCEDURES
CALL A PHYSICIAN.
IF SWALLOWED, DO NOT INDUCE VOMITING; IF CONSCIOUS, GIVE WATER, MILK, OR MILK OF MAGNESIA.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
WASH CLOTHING BEFORE RE-USE.

6 - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, LIGHT, MOISTURE

INCOMPATIBLES: STRONG BASES, COMBUSTIBLE MATERIALS, STRONG REDUCING AGENTS, ALKALIES, MOST COMMON METALS, ORGANIC MATERIALS, ALCOHOLS, CARBIDES

DECOMPOSITION PRODUCTS: OXIDES OF NITROGEN, HYDROGEN

7 - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. STOP LEAK IF YOU CAN DO SO WITHOUT RISK. VENTILATE AREA. NEUTRALIZE SPILL WITH SODA ASH OR LIME. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER. KEEP COMBUSTIBLES (WOOD, PAPER, OIL, ETC.) AWAY FROM SPILLED MATERIAL.

J. T. BAKER NEUTRASORB(R) OR NEUTRASOL(R) "LOW NA+" ACID NEUTRALIZERS ARE RECOMMENDED FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE
DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: D002 (CORROSIVE WASTE)

8 - PROTECTIVE EQUIPMENT

VENTILATION:	USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.
RESPIRATORY PROTECTION:	RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 100 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ACID CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.
EYE/SKIN PROTECTION:	SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, ACID-RESISTANT GLOVES ARE RECOMMENDED.

9 - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA(TM) STORAGE COLOR CODE: YELLOW (REACTIVE)

SPECIAL PRECAUTIONS
KEEP CONTAINER TIGHTLY CLOSED. STORE SEPARATELY AND AWAY FROM FLAMMABLE AND COMBUSTIBLE MATERIALS.

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	NITRIC ACID (OVER 40%) POISON - INHALATION HAZARD
HAZARD CLASS	OXIDIZER
UN/NA	UN2031
LABELS	OXIDIZER, CORROSIVE, POISON
REPORTABLE QUANTITY	1000 LBS.

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	NITRIC ACID
HAZARD CLASS	8
UN/NA	UN2031
LABELS	CORROSIVE

MSDS for NITRIC ACID, FUMING, 90% Page 1

1 - PRODUCT IDENTIFICATION

PRODUCT NAME: NITRIC ACID, FUMING, 90%
FORMULA: HNO3
FORMULA WT: 63.01
CAS NO.: 7697-37-2
NIOSH/RTECS NO.: QU5900000
COMMON SYNONYMS: FUMING HYDROGEN NITRATE
PRODUCT CODES: 9624
EFFECTIVE: 09/10/86
REVISION #02

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH	-	4	EXTREME (POISON)
FLAMMABILITY	-	0	NONE
REACTIVITY	-	3	SEVERE (OXIDIZER)
CONTACT	-	4	EXTREME (CORROSIVE)

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

PRECAUTIONARY LABEL STATEMENTS

POISON DANGER
SPILLAGE MAY CAUSE FIRE OR LIBERATE DANGEROUS GAS
HARMFUL IF INHALED AND MAY CAUSE DELAYED LUNG INJURY
LIQUID AND VAPOR CAUSE SEVERE BURNS - MAY BE FATAL IF SWALLOWED
STRONG OXIDIZER - CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE
KEEP FROM CONTACT WITH CLOTHING AND OTHER COMBUSTIBLE MATERIALS. DO NOT STORE NEAR COMBUSTIBLE MATERIALS. DO NOT GET IN EYES, ON SKIN, ON CLOTHING. DO NOT BREATHE VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE VENTILATION. IN CASE OF FIRE, USE WATER SPRAY, ALCOHOL FOAM, DRY CHEMICAL, OR CARBON DIOXIDE. FLUSH SPILL AREA WITH WATERSPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: YELLOW (REACTIVE)

2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
NITRIC ACID, FUMING	90	7697-37-2

3 - PHYSICAL DATA

BOILING POINT: 85 C (185 F) VAPOR PRESSURE(MM HG): 51

MELTING POINT: -51 C (-60 F) VAPOR DENSITY(AIR=1): 2.2

SPECIFIC GRAVITY: 1.50 (H2O=1) EVAPORATION RATE: >1 (BUTYL ACETATE=1)

SOLUBILITY(H2O): COMPLETE (IN ALL PROPORTIONS) % VOLATILES BY VOLUME: 100

APPEARANCE & ODOR: YELLOW TO BROWN-RED, CLEAR,STRONGLY FUMING LIQUID.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP N/A NFPA 704M RATING: 3-0-0 OXY

FLAMMABLE LIMITS: UPPER - N/A % LOWER - N/A %

FIRE EXTINGUISHING MEDIA
USE WATER SPRAY.

SPECIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS
STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE.

TOXIC GASES PRODUCED
NITROGEN OXIDES

5 - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): 5 MG/M3 (2 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 10 MG/M3 (4 PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): 5 MG/M3 (2 PPM)

TOXICITY: LC50 (INHL-RAT-4H) (PPM) - 65
LC50 (INHL-MOUSE-4H) (PPM) - 67

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE
INHALATION OF VAPORS MAY CAUSE COUGHING, CHEST PAINS, DIFFICULTY BREATHING, OR UNCONSCIOUSNESS.
INHALATION OF VAPORS MAY CAUSE SEVERE IRRITATION OF THE RESPIRATORY SYSTEM.
LIQUID MAY CAUSE SEVERE BURNS TO SKIN AND EYES.
INHALATION AND INGESTION ARE HARMFUL AND MAY BE FATAL.
INGESTION MAY CAUSE SEVERE BURNING OF MOUTH AND STOMACH.

TARGET ORGANS
EYES, SKIN, RESPIRATORY SYSTEM, TEETH

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
LUNG DISEASE

ROUTES OF ENTRY
INHALATION, INGESTION, EYE CONTACT, SKIN CONTACT

EMERGENCY AND FIRST AID PROCEDURES
CALL A PHYSICIAN.
IF SWALLOWED, DO NOT INDUCE VOMITING; IF CONSCIOUS, GIVE WATER, MILK, OR MILK OF MAGNESIA.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
WASH CLOTHING BEFORE RE-USE.

6 - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, LIGHT

INCOMPATIBLES: STRONG BASES, COMBUSTIBLE MATERIALS, STRONG REDUCING AGENTS, MOST COMMON METALS, ORGANIC MATERIALS

DECOMPOSITION PRODUCTS: OXIDES OF NITROGEN

7 - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. STOP LEAK IF YOU CAN DO SO WITHOUT RISK. VENTILATE AREA. NEUTRALIZE SPILL WITH SODA ASH OR LIME. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER. KEEP COMBUSTIBLES (WOOD, PAPER, OIL, ETC.) AWAY FROM SPILLED MATERIAL.

DISPOSAL PROCEDURE
DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: D001, D002 (IGNITABLE, CORROSIVE WASTE)

8 - PROTECTIVE EQUIPMENT

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 100 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ACID CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, ACID-RESISTANT GLOVES ARE RECOMMENDED.

9 - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA(TM) STORAGE COLOR CODE: YELLOW (REACTIVE)

SPECIAL PRECAUTIONS
KEEP CONTAINER TIGHTLY CLOSED. STORE SEPARATELY AND AWAY FROM FLAMMABLE AND COMBUSTIBLE MATERIALS.

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	NITRIC ACID, FUMING, "POISON - INHALATION HAZARD"
HAZARD CLASS	OXIDIZER
UN/NA	UN2032
LABELS	OXIDIZER, POISON
REPORTABLE QUANTITY	1000 LBS.

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	NITRIC ACID, RED FUMING
HAZARD CLASS	8, 5.1
UN/NA	UN2032
LABELS	CORROSIVE, OXIDIZING AGENT, POISON

7730

AIR PRODUCTS & CHEMICALS -- NITROGEN - CYLINDER, NITROGEN
MATERIAL SAFETY DATA SHEET
Part No. Indicator: A
Part Number/Trade Name: NITROGEN

General Information

CYLINDER, NITROGEN Company's Name: AIR PRODUCTS AND CHEMICALS INC.
Company's Street: 7201 HAMILTON BLVD
Company's City: ALLENTOWN
Company's State: PA
Company's Country: US
Company's Zip Code: 18195-1501
Company's Emerg Ph #: 800-523-9374 (800-322-9092 IN PA)
Company's Info Ph #: 215-481-8257
Distributor/Vendor # 1: ORLOTRONICS CORP (215-825-1513)
Distributor/Vendor # 1 Cage: 54267
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 002
Status: SE
Date MSDS Prepared: 27AUG87
Safety Data Review Date: 13MAY93
Supply Item Manager: CX
MSDS Serial Number: BQQDN
Specification Number: MIL-C-81575
Spec Type, Grade, Class: UNKNOWN
Hazard Characteristic Code: G3
Unit Of Issue: EA
Unit Of Issue Container Qty: UNKNOWN
Type Of Container: CYLINDER
Net Unit Weight: UNKNOWN

Ingredients/Identity Information

Proprietary: NO
Ingredient: NITROGEN
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: QW9700000
CAS Number: 7727-37-9
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: ASPHYXIANT; 9293
Other Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: BOTH LIQUID AND GASEOUS NITROGEN ARE COLORLESS AND ODORLESS.
Boiling Point: -321F,-196C
Melting Point: -346F,-210C
Vapor Pressure (MM Hg/70 F): N/A
Vapor Density (Air=1): 0.07273
Specific Gravity: 0.967
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: N/A
Solubility In Water: 1.53% VOLUME
pH: N/A
Corrosion Rate (IPY): UNKNOWN

Fire and Explosion Hazard Data

Flash Point: N/A
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: USE WATER FOG, CARBON DIOXIDE, FOAM, OR DRY CHEMICAL.
Special Fire Fighting Proc: WEAR FIRE FIGHTING PROTECTIVE EQUIPMENT AND A FULL FACED SELF CONTAINED BREATHING APPARATUS. COOL FIRE EXPOSED CONTAINERS WITH WATER SPRAY.
Unusual Fire And Expl Hazrds: COMBUSTION OR HEAT OF FIRE MAY PRODUCE HAZARDOUS DECOMPOSITION PRODUCTS AND VAPORS.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): HIGH HEAT, OPEN FLAMES AND OTHER SOURCES OF IGNITION
Materials To Avoid: STRONG OXIDIZING AGENTS
Hazardous Decomp Products: NONE
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT APPLICABLE

Health Hazard Data

LD50-LC50 Mixture: UNKNOWN
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: NITROGEN IS DEFINED AS A SIMPLE ASPHYXIANT. OXYGEN LEVELS SHOULD BE MAINTAINED AT GREATER THAN 18 MOLAR PERCENT AT NORMAL ATMOSPHERIC PRESSURE WHICH IS EQUIVALENT TO A PARTIAL PRESSURE OF 135 MM HG.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: THIS COMPOUND CONTAINS NO INGREDIENTS AT CONCENTRATIONS OF 0.1% OR GREATER THAT ARE CARCINOGENS OR SUSPECT CARCINOGENS.
Signs/Symptoms Of Overexp: EFFECTS OF EXPOSURE TO HIGH CONCENTRATIONS SO AS TO DISPLACE THE OXYGEN IN AIR NECESSARY FOR LIFE MAY INCLUDE ANY, ALL, OR NONE OF THE FOLLOWING: LOSS OF BALANCE OR DIZZINESS; TIGHTNESS IN THE FRONTAL AREA OF THE FOREHEAD; TINGLING OF THE TONGUE, FINGERTIPS OR TOES; WEAKENED SPEECH; REDUCED CONSCIOUSNESS; AND OTHERS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: INHALATION: CONSCIOUS PERSONS SHOULD BE ASSISTED TO AN UNCONTAMINATED AREA AND INHALE FRESH AIR. QUICK REMOVAL FROM THE CONTAMINATED AREA IS MOST IMPORTANT. UNCONSCIOUS PERSONS SHOULD BE MOVED TO AN UNCONTAMINATED AREA, GIVEN MOUTH-TO-MOUTH RESUSCITATION AND SUPPLEMENTAL OXYGEN. FURTHER TREATMENT SHOULD BE SYMPTOMATIC AND SUPPORTIVE.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE ALL PERSONNEL FROM AFFECTED AREA. USE APPROPRIATE PROTECTIVE EQUIPMENT. IF LEAK IS IN CONTAINER OR CONTAINER VALVE, CONTACT YOUR CLOSEST SUPPLIER LOCATION OR CALL THE EMERGENCY TELEPHONE NUMBER LISTED HEREIN.
Neutralizing Agent: NONE
Waste Disposal Method: DO NOT ATTEMPT TO DISPOSE OF WASTE OR UNUSED QUANTITIES. RETURN IN THE SHIPPING CONTAINER PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE TO YOUR SUPPLIER.
Precautions-Handling/Storing: PROTECT CYLINDERS FROM PHYSICAL DAMAGE.

STORE IN COOL, DRY WELL VENTILATED AREA AWAY FROM HEAVILY TRAFFICKED AREAS AND EMERGENCY EXITS. STORE <130F.
Other Precautions: USE A PRESSURE REDUCING REGULATOR WHEN CONNECTING CYLINDER TO LOWER PRESSURE (<3,000 PSIG) PIPING OR SYSTEMS. DO NOT HEAT CYLINDER BY ANY MEANS TO INCREASE THE DISCHARGE RATE OF PRODUCT FROM CYLINDER.

Control Measures

Respiratory Protection: POSITIVE PRESSURE AIR LINE WITH MASK OR SELF-CONTAINED BREATHING APPARATUS SHOULD BE AVAILABLE FOR EMERGENCY USE.
Ventilation: LOCAL AND MECHANICAL(GENERAL) EXHAUST TO PROVIDE ADEQUATE VENTILATION.
Protective Gloves: ANY MATERIAL
Eye Protection: SAFETY GLASSES - CHEMICAL SPLASH GOGGLES
Other Protective Equipment: SAFETY SHOES.
Work Hygienic Practices: NORMAL PRACTICES.
Suppl. Safety & Health Data: COMPRESSED GAS CYLINDERS SHOULD NOT BE REFILLED EXCEPT BY QUALIFIED PRODUCERS OF COMPRESSED GASSES.

Transportation Data

Trans Data Review Date: 93133
DOT PSN Code: KLZ
DOT Proper Shipping Name: NITROGEN, COMPRESSED
DOT Class: 2.2
DOT ID Number: UN1066
DOT Label: NONFLAMMABLE GAS
IMO PSN Code: KSR
IMO Proper Shipping Name: NITROGEN, COMPRESSED
IMO Regulations Page Number: 2163
IMO UN Number: 1066
IMO UN Class: 2(2.2)
IMO Subsidiary Risk Label: -
IATA PSN Code: SBP
IATA UN ID Number: 1066
IATA Proper Shipping Name: NITROGEN, COMPRESSED
IATA UN Class: 2.2
IATA Label: NON-FLAMMABLE GAS
AFI PSN Code: SBP
AFI Prop. Shipping Name: NITROGEN, COMPRESSED
AFI Class: 2.2
AFI ID Number: UN1066
AFI Label: NON-FLAMMABLE GAS
AFI Basic Pac Ref: 6-6,6-10

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 13MAY93
Label Date: 17OCT92
Label Status: F
Common Name: NITROGEN
Chronic Hazard: NO
Signal Word: WARNING!
Acute Health Hazard-Moderate: X
Contact Hazard-Slight: X
Fire Hazard-None: X

Reactivity Hazard-None: X
Special Hazard Precautions: NITROGEN IS DEFINED AS A SIMPLE ASPHYXIANT. OXYGEN LEVELS SHOULD BE MAINTAINED AT GREATER THAN 18 MOLAR PERCENT AT NORMAL ATMOSPHERIC PRESSURE WHICH IS EQUIVALENT TO A PARTIAL PRESSURE OF 135 MM HG. PROTECT CYLINDERS FROM PHYSICAL DAMAGE. STORE IN COOL, DRY WELL VENTILATED AREA AWAY FROM HEAVILY TRAFFICKED AREAS AND EMERGENCY EXITS. STORE <130F. FIRST AID: INHALATION: CONSCIOUS PERSONS SHOULD BE ASSISTED TO AN UNCONTAMINATED AREA AND INHALE FRESH AIR. QUICK REMOVAL FROM THE CONTAMINATED AREA IS MOST IMPORTANT. UNCONSCIOUS PERSONS SHOULD BE MOVED TO AN UNCONTAMINATED AREA, GIVEN MOUTH-TO-MOUTH RESUSCITATION AND SUPPLEMENTAL OXYGEN.
Protect Respiratory: Y
Label Name: AIR PRODUCTS AND CHEMICALS INC.
Label Street: 7201 HAMILTON BLVD
Label City: ALLENTOWN
Label State: PA
Label Zip Code: 18195-1501
Label Country: US
Label Emergency Number: 800-523-9374 (800-322-9092 IN PA)
Year Procured: 1990
URL for this msds http://hazard.com If you wish to update, add to, or delete information on your products please email data to dan@hazard.com.

Revised 7/18/94

Material Safety Data Sheet

for

Portland Cement

Section I-Identity

Manufacturer's name and address: Rio Grande Portland Cement
P.O. Box 100
#1 Cement Plant Lane
Tijeras, NM 87059

Emergency Telephone Number: (505) 281-3311

Chemical Name and Synonyms: Portland Cement (CAS #65997-15-1)

Trade Name and Synonyms: Hydraulic Cement, Types I, II, & III

Section II-Chemical Data

Chemical family: Calcium Salts

Formula: Portland cement consists of a finely ground portland cement clinker mixed with a small amount of calcium sulfate to control set. Portland cement clinker is a sintered material produced by heating to high temperature (greater than 1200 degrees celsius) a mixture of substances such as limestone and shale from the earth's crust. The substances manufactured are essentially hydraulic calcium silicates contained in a crystalline mass, not separable into the individual components.

Substances similar to the following are known to be present in portland cement:

$3CaO.SiO_2$	(CAS # 12168-85-3)
$2CaO.SiO_2$	(CAS # 10034-77-2)
$3CaO.Al_2O_3$	(CAS # 12042-78-3)
$4CaO.Al_2O_3.Fe_2O_3$	(CAS # 12068-35-8)
$CaSO_4.XH_2O$	(CAS # 13397-24-5)

Small amounts of CaO, MgO, K_2SO_4, Na_2SO_4 may also be present.

Section III-Hazardous Ingredients

Ingredients: Portland cements are listed by OSHA in 29 CFR 1910.1000, Table Z-1-A and require material safety data sheets (FR, January 19, 1989).. MSHA (30 CFR 55.5.-1, Ref. 2. ACGIH TLV's for 1973, Appendix E) and ACGIH (TLV's for 1984-5. appendix D) list portland cements as nuisance dusts. Portland cements are NOT listed by NTP, IARC, OR OSHA as carcinogens. However, since portland cement is manufactured from raw materials mined from the earth (limestone, marl, sand, shale, clay, etc.)

and process heat is provided by burning fossil fuels, trace, but detectable, amounts of naturally occurring, and possible harmful, elements may be found during chemical analysis. Under ASTM standards, portland cement may contain .75 percent insoluble residue. A fraction of these residues may be free crystalline silica.

Section IV-Physical Data

Boiling Point: Not applicable, portland cement is a powdered solid.

Vapor Pressure: Not applicable, portland cement is a powdered solid.

Vapor Density: Not applicable, portland cement is a powdered solid.

Solubility in Water: Slight (0.1-1.0%)

Specific Gravity: (H_2O=1) 3.15

Evaporation Rate: Not applicable, portland cement is a powdered solid.

Appearance and Odor: Gray or white powder; no odor.

Melting Point: Not applicable.

Section V-Fire and Explosion Hazard Data

Flash Point: Portland cements are noncombustible and not explosive.

Flammable or Explosive Limits: Not applicable.

Extinguishing Media: Not applicable.

Special Firefighting Procedures: Not applicable.

Unusual Fire and Explosion Hazards: None.

Lower Explosive Limit: Not applicable.

Upper Explosive Limit: Not applicable.

Section VI-Health Hazard Data

ACGIH Threshold Limit Value (1988-89): Total dust containing no asbestos and less than 1% silica - 10 mg/m^3

OSHA PKL (Transitional): Total dust - .50 million particles/ft^3

OSHA PKL (Final): Total dust - 10 mg/m^3
Respirable Dust - 5 mg/m^3

Effects of Overexposure:

Acute: Wet cement, especially as an ingredient in plastic (unhardened) concrete, mortar or slurries, can dry the skin and cause caustic burns. Direct contact with the eyes can cause irritation. Inhalation can irritate the upper respiratory system.

Chronic: Cement dust can cause inflammation of the lining tissue of the interior of the nose and inflammation of the cornea. Hypersensitive individuals may develop an allergic dermatitis. [Cement may contain trace (less than 0.05%) amounts of chromium salts or compounds including hexavalent chromium, or other metals found to be hazardous or toxic in some chemical forms. These metals are mostly present as trace substitutions within the principal minerals.]

Emergency and First Aid Procedures: Irrigate eyes immediately and repeatedly with water and get prompt medical attention. Wash exposed skin areas with soap and water. Apply sterile dressings. If ingested, consult a physician immediately. Drink water.

Section VII-Reactivity Data

Stability: Product is stable. Keep dry until used.

Incompatibility: Aluminum powder and other alkali and alkaline earth elements will react in wet mortar or concrete, liberating hydrogen gas.

Hazardous Decomposition Products: None.

Hazardous Polymerization: Will not occur.

Section VIII-Spill Procedures

Steps to be taken in case material is spilled: Use dry cleanup methods that do not disperse the dust into the air. Avoid breathing the dust. Emergency procedures are not required.

Disposal Method: Small amounts of material can be disposed of as common waste or returned to the container for later use it if is not contaminated. Large volumes may require special handling.

Section IX-Special Protection Information

Respiratory Protection: In dusty environments, the use of a MSHA/NIOSH-approved respirator is recommended.

Ventilation: Local exhaust can be used to control airborne dust levels.

Eye Protection: Use tight fitting goggles in dusty environments.

Skin Protection: Use barrier creams, impervious, abrasion- and alkali-resistant gloves, boots and protective clothing to protect the skin from prolonged contact with wet cement in plastic concrete, mortar or slurries. Immediately after working with cement or cement-containing materials, workers should shower with soap and water. Precautions must be taken. Cement burns with little warning—little heat is sensed.

Section X-Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	American Society for Testing and Materials
CAS	Chemical Abstract Service
CFR	Code of Federal Regulations
ft^3	Cubic foot
IARC	International Agency for Research on Cancer
m^3	Cubic meter
mg	Milligram
MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure List
TLV's	Threshold Limit Values

Note: This material safety data sheet attempts to describe as accurately as possible the potential exposures associated with normal cement use. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. Users have the responsibility to evaluate and use this product safely and to comply with all applicable laws and regulations.

Section XI-Regulatory Information

FEDERAL EPA

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center of release of quantities of Hazardous Substances equal to or greater than the reportable quantities (RQs) in 40 CFR 302.4.

Components present in this product at a level which could require reporting under this statute are:

None

Superfund Amendments and Re-Authorization Act of 1986
SARA Title III

Requires emergency planning based on Threshold Planning Quantities (TPQs) and release reporting based on Reportable quantities (RQs) in 40 CFR 335 (used for SARA 302,304,311, and 312).

Components present in this product at a level which could require reporting under this statute are:

None

Superfund Amendments and Re-Authorization Act of 1986
SARA Title III

Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR 372 (for SARA 313). This information must be included in all MSDSs that are copied and distributed for this material.

Components present in this product at a level which could require reporting under this statute are:

None

REPORT NUMBER: 971
MSDS NO: PG0066
EFFECTIVE DATE: 03/14/94

VAN WATERS & ROGERS INC.
MATERIAL SAFETY DATA SHEET

VERSION: 004

PRODUCT: SODIUM SULFIDE

ORDER NO:
PROD NO :

VAN WATERS & ROGERS INC. , SUBSIDIARY OF UNIVAR (206)889-3400
6100 CARILLON POINT , KIRKLAND , WA 98033

---------- EMERGENCY ASSISTANCE ----------

FOR EMERGENCY ASSISTANCE INVOLVING CHEMICALS CALL - CHEMTREC
(800)424-9300

PRODUCT NAME:
SODIUM SULFIDE

MSDS #: PG0066

- - - SODIUM SULFIDE

DATE: 03/01/93
EDITION: 006
TRADE NAME: SODIUM SULFIDE
CHEM NAME/SYN: SODIUM MONOSULFIDE

CHEMICAL FAMILY: SULFUR CHEMICALS
FORMULA: NA2S (FLAKE AND SOLID)
CAS NUMBER: 001313-82-2
U.S. DOT SHIPPING NAME: SODIUM SULFIDE, HYDRATED
U.S. DOT HAZARD CLASS: 8 (CORROSIVE MATERIAL)
SUBSIDIARY RISK: N/A
I.D. NUMBER: UN1849
PACKING GROUP: II
REPORTABLE QUANTITY: N/A
IMO DESCRIPTION: SODIUM SULFIDE, HYDRATED, CLASS 8, UN1849, PACKING GROUP II, IMDG CODE PAGE 8227.

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PRODUCT: SODIUM SULFIDE

ORDER NO:
PROD NO :

SECTION 1 - PHYSICAL DATA

BOILING POINT @ 760 MM HG:	346 F
VAPOR DENSITY (AIR=1):	N/A
SPECIFIC GRAVITY (H2O=1):	1.858 (FLAKE)
PH OF SOLUTIONS:	STRONGLY ALKALINE
FREEZING/MELTING POINT:	92 C (197 F)
SOLUBILITY (WEIGHT % IN WATER):	15% @ 68 F
BULK DENSITY:	40 LBS./CU.FT. (FLAKE)
VOLUME % VOLATILE:	VERY LOW
VAPOR PRESSURE:	UNKNOWN
EVAPORATION RATE:	N/A
HEAT OF SOLUTION:	MILDLY EXOTHERMIC

APPEARANCE AND ODOR:
WHITE TO YELLOW FLAKES; SLIGHT ROTTEN EGG ODOR

SECTION 2 - INGREDIENTS

MATERIAL	PERCENT
SODIUM SULFIDE	60-62
(HYDRATED--38% WATER OF CRYSTALLIZATION)	

SECTION 3 - FIRE/EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED):
NONFLAMMABLE

FLAMMABLE LIMITS IN AIR (% BY VOLUME)
LEL: N/A
UEL: N/A

EXTINGUISHING MEDIA:
NOT APPLICABLE

SPECIAL FIRE FIGHTING PROCEDURES:
FIREFIGHTERS MUST WEAR NIOSH/MSHA APPROVED SELF-CONTAINED BREATHING APPARATUS IN THE PRESSURE DEMAND MODE.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
CONTACT WITH ALL ACIDS WILL LIBERATE POISONOUS, FLAMMABLE HYDROGEN SULFIDE GAS. IF HYDROGEN SULFIDE GAS IS LIBERATED, THE FIRE AND EXPLOSION HAZARD SHOULD BE HANDLED IN THE SAME MANNER AS THE HYDROGEN SULFIDE. (REFER TO

PRODUCT: SODIUM SULFIDE

ORDER NO:
PROD NO :

ATTACHED PPG HYDROGEN SULFIDE MSDS).

SECTION 4 - HEALTH HAZARD DATA

TOXICITY DATA:

LC50 INHALATION:	UNKNOWN
LD50 DERMAL:	(RABBITS) 177.8 MG/KG
SKIN/EYE IRRITATION:	SEE SECTION 5
LD50 INGESTION:	(RATS) 200 MG/KG
FISH,LC50 (LETHAL CONCENTRATION):	(BLUEGILL SUNFISH) TLM: 48 HR., 61 PPM

CLASSIFICATION:

INHALATION:	UNKNOWN
SKIN:	HIGHLY TOXIC
SKIN/EYE:	CORROSIVE
INGESTION:	MODERATELY TOXIC
AQUATIC:	TOXIC

SECTION 5 - EFFECTS OF OVEREXPOSURE

IS CHEMICAL LISTED AS A CARCINOGEN OR POTENTIAL CARCINOGEN?
NTP - NO IARC - NO OSHA - NO

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:
NONE KNOWN.

PERMISSIBLE EXPOSURE LIMITS:
NONE ESTABLISHED BY OSHA, ACGIH OR PPG.

ACUTE:

INHALATION: IRRITATION OF MUCOUS MEMBRANES, EYES, AND RESPIRATORY TRACT IS POSSIBLE FOLLOWING EXPOSURE TO THE DECOMPOSITION PRODUCT, HYDROGEN SULFIDE GAS, WHICH IS POTENTIALLY LETHAL. (REFER TO ATTACHED PPG HYDROGEN SULFIDE MSDS).

EYE/SKIN: MAY CAUSE IRRITATING AND SEVERE BURNS TO THE SKIN. MATERIAL IS CONSIDERED CORROSIVE AND HAS THE CAPABILITY OF BEING ABSORBED THROUGH THE SKIN PRODUCING THE TOXICITY TYPICAL OF HYDROGEN SULFIDE POISONING.

SIMILAR EFFECTS AS ALKALIES FOLLOWING DIRECT EXPOSURE TO THE EYE AND CAN CAUSE IRREVERSIBLE DAMAGE, INCLUDING BLINDNESS.

NOTE: THE TEST DATA FROM RABBIT STUDIES DEMONSTRATE THAT THIS MATERIAL

HAS A DERMAL LD50 BELOW 200 MG/KG. HOWEVER, THE EXTREME IRRITATION EXPERIENCED BY SKIN CONTACT PRECLUDES THE LIKELIHOOD THAT EXPOSURE TO AMOUNTS SUFFICIENT TO CAUSE HUMAN ILLNESS WOULD BE ENCOUNTERED. PPG, THEREFORE, CONSIDERS THAT THE IRRITATING PROPERTIES OF THIS MATERIAL AND THE LONG HISTORY OF SAFE USE OBVIATES THE NEED TO LABEL IT A POISON B.

INGESTION: GASTRIC ACIDITY WOULD CONVERT MATERIAL TO HYDROGEN SULFIDE GAS WHICH IS POTENTIALLY LETHAL. MATERIAL IS QUITE CORROSIVE AND WOULD PRODUCE BURNS OF THE STOMACH LINING CAPABLE OF CAUSING SEVERE INJURY AND DEATH. (REFER TO ATTACHED PPG HYDROGEN SULFIDE MSDS).

CHRONIC:
THE EFFECTS OF LONG-TERM, LOW-LEVEL EXPOSURES TO THIS PRODUCT HAVE NOT BEEN DETERMINED. SAFE HANDLING OF THIS MATERIAL ON A LONG-TERM BASIS SHOULD EMPHASIZE THE AVOIDANCE OF ALL EFFECTS FROM REPETITIVE ACUTE EXPOSURES.

EMERGENCY AND FIRST AID PROCEDURES

INHALATION:
(HYDROGEN SULFIDE) REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO-MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN. CALL A PHYSICIAN. HYDROGEN SULFIDE HAS A CHARACTERISTIC 'ROTTEN EGG' ODOR.

EYE OR SKIN CONTACT:
IMMEDIATELY FLUSH EYES AND SKIN WITH PLENTY OF WATER (SOAP AND WATER FOR SKIN) FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. CALL A PHYSICIAN. THOROUGHLY CLEAN CLOTHING AND SHOES BEFORE REUSE OR DISCARD.

INGESTION:
IF CONSCIOUS, DRINK LARGE QUANTITIES OF WATER. THEN INDUCE VOMITING BY PLACING A FINGER FAR BACK IN THE THROAT. ADMINISTER ADDITIONAL WATER. TAKE IMMEDIATELY TO A HOSPITAL OR PHYSICIAN. IF UNCONSCIOUS, OR IN CONVULSIONS, TAKE IMMEDIATELY TO A HOSPITAL. DO NOT ATTEMPT TO INDUCE VOMITING OR GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

NOTES TO PHYSICIAN (INCLUDING ANTIDOTES):
TREAT SYMPTOMATICALLY. IN CASES WHERE THERE IS EXPOSURE TO HYDROGEN SULFIDE, REFER TO ATTACHED PPG HYDROGEN SULFIDE MSDS.

SECTION 6 - REACTIVITY DATA

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PRODUCT: SODIUM SULFIDE

ORDER NO:
PROD NO :

STABILITY:
STABLE
CONDITIONS TO AVOID:
AVOID CONCENTRATING SOLUTIONS--COULD CAUSE SPONTANEOUS IGNITION.

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR
CONDITIONS TO AVOID: NONE

INCOMPATIBILITY (MATERIALS TO AVOID):
AVOID CONTACT WITH STRONG OXIDIZING AGENTS AND ACIDS. SODIUM SULFIDE SOLUTIONS ATTACK ZINC, COPPER, ALUMINUM, AND ALLOYS OF THESE METALS.

HAZARDOUS DECOMPOSITION PRODUCTS:
CONTACT WITH ACIDS WILL LIBERATE FLAMMABLE AND POISONOUS HYDROGEN SULFIDE GAS.

SECTION 7 - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS SPILLED OR RELEASED:
IMMEDIATELY EVACUATE AREA, REMOVE IGNITION SOURCES, AND PROVIDE MAXIMUM VENTILATION. ONLY PERSONNEL EQUIPPED WITH NIOSH/MSHA-APPROVED, SELF-CONTAINED BREATHING APPARATUS OF FULL FACEPIECE AIRLINE RESPIRATORS WITH AUXILIARY SCBA'S OPERATED IN THE PRESSURE/DEMAND MODE AND EYE/SKIN PROTECTION SHOULD BE PERMITTED IN AREA. SWEEP SPILLED MATERIAL INTO CONTAINERS FOR DISPOSAL. SPILLED SODIUM SULFIDE SHOULD BE RECLAIMED IF POSSIBLE. AFTER ALL VISIBLE TRACES HAVE BEEN REMOVED, THOROUGHLY WET VACUUM THE AREA. PRODUCT MUST NOT COME IN CONTACT WITH ACIDS. DO NOT FLUSH SPILLS TO SEWERS!

WASTE DISPOSAL METHOD:
MUST BE DISPOSED OF IN AN APPROVED HAZARDOUS WASTE MANAGEMENT FACILITY. CARE MUST BE TAKEN WHEN USING OR DISPOSING OF CHEMICAL MATERIALS AND/OR THEIR CONTAINERS TO PREVENT ENVIRONMENTAL CONTAMINATION. IT IS YOUR DUTY TO DISPOSE OF THE CHEMICAL MATERIALS AND/OR THEIR CONTAINERS IN ACCORDANCE WITH THE CLEAN AIR ACT, THE CLEAN WATER ACT, THE RESOURCE CONSERVATION AND RECOVERY ACT, AS WELL AS ANY OTHER RELEVANT FEDERAL, STATE, OR LOCAL LAWS/REGULATIONS REGARDING DISPOSAL.

SECTION 8 - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:
USE NIOSH/MSHA-APPROVED COMBINATION ACID GAS AND DUST/MIST CARTRIDGE OR CANISTER RESPIRATOR WITH FULL FACEPIECE WHENEVER VAPOR OR MIST GENERATION IS LIKELY. AIRLINE AND/OR SELF-CONTAINED BREATHING APPARATUS OPERATED IN A

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PRODUCT: SODIUM SULFIDE

ORDER NO:
PROD NO :

POSITIVE PRESSURE DEMAND MODE SHOULD BE READILY AVAILABLE IN CASE OF HYDROGEN SULFIDE GENERATION. SEE SECTION 7 FOR RESPIRATORY PROTECTION IN THE EVENT OF A SPILL OR LEAK. RESPIRATOR USE LIMITATIONS MADE BY NIOSH/MSHA OR THE MANUFACTURER MUST BE OBSERVED. RESPIRATORY PROTECTION PROGRAMS MUST BE IN ACCORDANCE WITH 29 CFR 1910.134.

VENTILATION(TYPE):
LOCAL EXHAUST VENTILATION SUFFICIENT TO MINIMIZE EMPLOYEE EXPOSURES.

EYE PROTECTION:
CHEMICAL GOGGLES (MONOGOGGLES)

GLOVES:
IMPERVIOUS

OTHER PROTECTIVE EQUIPMENT:
BOOTS, APRONS, OR CHEMICAL SUITS MUST BE USED WHEN NECESSARY TO PREVENT SKIN CONTACT. PERSONAL PROTECTIVE CLOTHING AND USE OF EQUIPMENT MUST BE IN ACCORDANCE WITH 29 CFR 1910.132 AND 29 CFR 1910.133.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN DURING HANDLING AND STORING:
- STORE AWAY FROM STRONG OXIDIZING AGENTS.
- DO NOT ALLOW CONTACT WITH ACIDS. WILL LIBERATE FLAMMABLE HYDROGEN SULFIDE GAS.
- STORE IN COOL, VENTILATED AREA.
- WEAR NIOSH/MSHA-APPROVED RESPIRATORY PROTECTION WHENEVER EXPOSURE IS LIKELY
- STORE ONLY IN CLOSED, PROPERLY LABELED CONTAINERS.
- DO NOT STORE IN ZINC, ALUMINUM, OR COPPER CONTAINERS.
- KEEP SHIPPING CONTAINERS CLOSED WHEN NOT IN USE.
- WEAR GOGGLES, RUBBER GLOVES, APRON, AND BOOTS WHEN HANDLING.

OTHER PRECAUTIONS:
- DO NOT BREATHE DUST OR MISTS FROM SOLUTIONS. INDIVIDUALS WITH RESPIRATORY AND/OR CENTRAL NERVOUS SYSTEM DISEASES SHOULD NOT BE EXPOSED.
- DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING. MAY CAUSE SEVERE BURNS AND PERMANENT DAMAGE. WASH THOROUGHLY AFTER HANDLING.
- USE WITH ADEQUATE VENTILATION. VENTILATION MUST BE SUFFICIENT TO MINIMIZE EMPLOYEE EXPOSURE.
- DO NOT SWALLOW.
- DO NOT EAT, DRINK, OR SMOKE IN WORK AREA.

COMMENTS:
NOTE: SINCE A POTENTIALLY CRITICAL HAZARD IN WORKING WITH THIS PRODUCT MAY RESULT BECAUSE OF THE GENERATING OF HYDROGEN SULFIDE GAS UNDER CERTAIN

CONDITIONS, PPG RECOMMENDS YOU CONSIDER THE INSTALLATION OF A CONTINUOUS MONITORING HYDROGEN SULFIDE GAS DETECTION AND ALARM SYSTEM IN ANY AREA WHERE GENERATION OF SULFIDE GAS MAY OCCUR. DETAILS PERTAINING TO THE OPERATION AND MAINTENANCE OF THE HYDROGEN SULFIDE GAS MONITORING SYSTEM, AS WELL AS EMPLOYEE TRAINING ARE OUTLINED BY NIOSH.

TSCA - SODIUM SULFIDE IS ON THE TSCA INVENTORY UNDER CAS NO. 1313-82-2.

SARA TITLE III - 311/312 CATEGORIES - ACUTE AND REACTIVITY, B) NOT LISTED IN SECTION 313, C) NOT LISTED AS AN "EXTREMELY HAZARDOUS SUBSTANCE" IN SECTION 302.

CANADA WHMIS - A) SENSITIZATION TO PRODUCT: NONE KNOWN, B) REPRODUCTIVE TOXICITY: NONE KNOWN, C) OBOR THRESHOLD: NOT KNOWN, D) PRODUCT USE: CHEMICAL PROCESSING, E) REQUIRES CORROSIVE SYMBOL (CLASS E).

AS ADDITIONAL INFORMATION TO BE CONSIDERED WHEN HANDLING THIS PRODUCT, PPG'S HYDROGEN SULFIDE MSDS IS ATTACHED.

REVISIONS MADE TO 8/30/89, 5TH EDITION - DATE, EDITION, DOT SHIPPING INFORMATION UPDATED, IMO DESCRIPTION ADDED, PERCENT UNDER INGREDIENTS SECTION UPDATED.

PRODUCT: SODIUM SULFIDE

ORDER NO:
PROD NO :

---------- FOR ADDITIONAL INFORMATION ----------

CONTACT: MSDS COORDINATOR VAN WATERS & ROGERS INC.
DURING BUSINESS HOURS, PACIFIC TIME (206)889-3400

07/19/95 09:30 PRODUCT: CUST NO: ORDER NO:

---------- NOTICE ----------

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WITH RESPECT TO THE PRODUCT OR INFORMATION PROVIDED HEREIN, AND SHALL UNDER

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*** E N D O F M S D S ***

7730

12408

MATERIAL SAFETY DATA SHEET

Johnson Matthey
Alfa Aesar
30 Bond Street
Ward Hill, MA 01835-0747
Emergency Phone-(508) 521-6300
CHEMTREC-(800) 424-9300

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 18

To Ben Cambria	From Dan Fleming
Co.	Co. FCA/PLC
Dept.	Phone # (513) 648-4237
Fax # (423) 482-4970	Fax # (513) 648-5747

SECTION 1-IDENTIFICATION

Product Code: 36407 Revision Date: 8/8/95
Product Name: Thorium (IV) nitrate
Synonyms: Nitric acid, thorium (4+) salt
Chemical Family: Metal nitrate
CAS#: 13470-07-0
Molecular Formula: $Th(NO_3)_4.4H_2O$

SECTION 2-INGREDIENTS

Chemical: Thorium (IV) nitrate

CAS#	%	PEL	TLV
13470-07-0	100	Not established	Not established

SECTION 3- PHYSICAL DATA

Boiling Point: Not applicable
% Volatiles: Not applicable
Solubility in Water : Soluble
Specific Gravity (H_2O=1): No data
Freezing/Melting Point: 500°C (932°F) Decomposes
Evaporation Rate (butyl acetate=1): Not applicable
Vapor Density (air=1): Not applicable
Vapor Pressure : Not applicable
Appearance and Odor: White powder, odorless
Other: Half-life: 1.41 x 1010 years

SECTION 4-FIRE AND EXPLOSION HAZARD DATA

Flash Point:(°F) Not applicable
Flammable Limits in Air, % by volume: Lower Not applicable
Upper Not applicable
Autoignition Temperature: No data
Extinguishing Media: Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Use water, carbon dioxide, dry chemical extinguishing agents, dry sand, or dry ground dolomite.
Special Fire Fighting Procedures: No special firefighting procedures needed. Use normal procedures which include wearing NIOSH/MSHA approved self-contained breathing apparatus, flame and

chemical resistant clothing; hats, boots and gloves. If without risk, remove material from fire area. Cool container with water from maximum distance.

****

SECTION 5-HEALTH DATA

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OSHA (PEL): Not established
ACGIH (TLV): Not established

A. ANIMAL TOXICITY

LD_{50}: Oral-mouse: 1760 mg/kg (anhydrous salt)
LC_{50}: No data
Other: No data

B. EFFECTS OF EXPOSURE

ACUTE EFFECTS

Ingestion: Large amounts of nitrates taken by mouth may have serious or even fatal results. The symptoms are dizziness, abdominal cramps, vomiting, bloody diarrhea, weakness, convulsions and collapse. Absorption of thorium salts via the gastrointestinal system is slight.
Skin Contact: May cause irritation.
Eye Contact: May cause irritation.
Inhalation: May cause irritation.
Medical Conditions, if any, Aggravated by the Chemical: None known
Other Health Hazards: None known
Most Likely Routes of Entry: Ingestion

CHRONIC EFFECTS

Ingestion: Thorium compounds are known to cause severe radiation damage and cancer of the bone, blood vessels, liver and other organs.
Skin Contact: May cause dermatitis.
Eye Contact: None known
Inhalation: May cause effects similar to those of ingestion.
Other: Anhydrous thorium nitrate has caused reproductive effects in laboratory rats.
Exposure to sufficient quantities of ionizing radiation can potentially cause harmful biological effects which include cancer, leukemia, and genetic and teratogenic effects.

C. EMERGENCY AND FIRST AID PROCEDURES

Ingestion: If swallowed induce vomiting. Give large quantities of water or milk if available. Call a physician immediately. Never give anything by mouth to an unconscious person.
Skin Contact: Remove contaminated clothing, flood skin with large amounts of water. If irritation persists seek medical attention.
Eye Contact: Immediately flush eyes, including under eyelids, with large amounts of water for at least 15 minutes. Call a physician.
Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Call a physician immediately.

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JMC

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SECTION 6-REACTIVITY

Incompatibility: Reducing agents, combustible materials, oxidizable substances
Hazardous Decomposition Products: NO_x. Thorium oxide at high temperatures.
Conditions to Avoid: Incompatibles
Stability: Stable except for radioactive disintegration.
Hazardous Polymerization: Will not occur
Other: No data

SECTION 7-ENVIRONMENTAL INFORMATION

RCRA Code: Not a solid waste by RCRA exclusion, see 40CFR 261.4(a)(4)
TSCA Registered: Yes
Spill and Leak Procedures: Wearing full protective equipment, cover spill with dry sand or vermiculite. Mix well and carefully transfer to a container. Check personnel and clothing for contamination and radioactivity. Contaminated clothing should be removed.
Waste Disposal: Disposal must comply with 10CFR Part 40

SECTION 8-PROTECTION INFORMATION

Ventilation Requirements: Laboratory fume hood
Respiratory Protection: High efficiency particle respirator
Protective Gloves: Rubber
Eye/Face Protection: ANSI approved safety goggles

SECTION 9-SPECIAL PRECAUTIONS

Handling and Storage: Keep container tightly closed. Store in a cool, dry, well-ventilated area. Wash thoroughly after use.
Other Precautions: Lab coat and apron, flame and chemical resistant coveralls, eyewash capable of sustained flushing, safety drench shower and hygienic facilities for washing. See 10CFR for specific requirements pertaining to licensing, storage of source materials and personnel monitoring.

SECTION 10-COMMENTS

Danger: Oxidizer, may cause GI pain. Caution! Radioactive material.

The radioactive content of thorium and thorium containing materials is defined as its specific activity. The specific activity for natural occuring thorium is 0.00000022 curie/gram (8,140 Bq/gram) of contained thorium.

Warning: This product contains a chemical known to the State of California to cause cancer

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

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NUCLEAR RESEARCH -- THORIUM 232
MATERIAL SAFETY DATA SHEET
FSC: 6850
NIIN: 00N004250
Manufacturer's CAGE: 96696
Part No. Indicator: A
Part Number/Trade Name: THORIUM 232

General Information

Company's Name: NUCLEAR RESEARCH CORPORATION
Company's Street: 125 TITUS AVE
Company's P. O. Box: H
Company's City: WARRINGTON
Company's State: PA
Company's Country: US
Company's Zip Code: 18976-2424
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Date MSDS Prepared: 01JAN85
Safety Data Review Date: 25SEP84
MSDS Serial Number: BCLQS
Report for NIIN: 00N004250
NRC/State License Number: N/A
Net Propellant Weight-Ammo: N/A

Ingredients/Identity Information

Proprietary: NO
Ingredient: THORIUM
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: XO6400000
CAS Number: 7440-29-1

Physical/Chemical Characteristics

Appearance And Odor: DARK GRAY METAL STRIP
Boiling Point: N/A
Specific Gravity: 11.3
Magnetism (Milligauss): N/P

Fire and Explosion Hazard Data

Flash Point: N/A
Flash Point Method: N/P
Extinguishing Media: N/A
Special Fire Fighting Proc: N/A
Unusual Fire And Expl Hazrds: N/A

Reactivity Data

Stability: YES
Report for NIIN: 00N004250
Materials To Avoid: NONE
Hazardous Decomp Products: NONE
Hazardous Poly Occur: NO

Health Hazard Data

Route Of Entry - Inhalation: N/P
Route Of Entry - Skin: N/P
Route Of Entry - Ingestion: N/P
Carcinogenicity - NTP: N/P
Carcinogenicity - IARC: N/P
Carcinogenicity - OSHA: N/P
Signs/Symptoms Of Overexp: VIRTUALLY NO OVEREXPOS EFFECTS FROM THE AMOUNT OF RADIATION, UNLESS INGESTED.
Emergency/First Aid Proc: CALL PHYSICIAN IF RADIOACTIVE MATERIAL IS INGESTED. WASH HANDS AFTER CONTACT WITH RADIOACTIVE SOURCE TO REMOVE ANY POSSIBLE CONTAMINATION.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: CORDON THE SPILL AREA, MARK RADIATION AREA & CONTACT REGIONAL NUCLEAR REGULATORY COMMISSION FOR DECONTAMINATION.
Waste Disposal Method: MANUFACTURER RECOMMENDS SENDING TO RADIOACTIVE WASTE DISPOSAL SERVICE. DISPOSAL METHODS MUST BE IAW FEDERAL, STATE & LOCAL REGULATIONS.
Precautions-Handling/Storing: AVOID TOUCHING THE RADIOACTIVE MATERIAL AT THE BOTTOM OF THE UNIT WHEN METER IS OUT OF CASE.

Control Measures

Respiratory Protection: MANUFACTURER STATES NONE REQUIRED
Ventilation: N/A
Protective Gloves: RECOMMENDED
Eye Protection: N/A
Other Protective Equipment: N/A
Suppl. Safety & Health Data: DIMENSIONS: 2.25 X 2.75 X 0.010 INCHES, EACH PIECE AT 0.5 UCI EACH.

Transportation Data

Trans Data Review Date: 85318
Report for NIIN: 00N004250
DOT Proper Shipping Name: UNDER REVIEW
IMO Proper Shipping Name: RADIOACTIVE SUBSTANCES
IMO UN Number: 2910
IMO UN Class: 7
IATA UN ID Number: 2910
IATA Proper Shipping Name: RADIOACTIVE MATERIAL,LIMITED QUANTITY,N.O.S.
IATA Label: NONE
AFI Prop. Shipping Name: UNDER REVIEW
Additional Trans Data: 0.5 UCI EACH PIECE

Disposal Data

Report for NIIN: 00N004250

Label Data

Label Required: YES
Label Status: F
Chronic Hazard: N/P
Special Hazard Precautions: FIRE MAY PRODUCE IRRITATING OR POISONOUS GASES. LOW LEVEL RADIOACTIVE MATERIAL; LITTLE PERSONAL RADIATION HAZARD.
Label Name: NUCLEAR RESEARCH CORP
Label Street: 125 TITUS AVE
Label P.O. Box: H
Label City: WARRINGTON

7730

Label State: PA
Label Zip Code: 18976-2424
Label Country: US

Tri-n-Butyl Phosphate

10019

N-BUTYL PHOSPHATE
N-BUTYL PHOSPHATE
N-BUTYL PHOSPHATE

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796-7100

EMERGENCY CONTACTS
GASTON L. PILLORI
(201) 796-7100

DATE: 05/04/86
PO NBR: N/A
ACCT: 878202-02
INDEX: 12-8612-10106
CAT NO: B4044

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 126-73-8

SUBSTANCE: **N-BUTYL PHOSPHATE**

TRADE NAMES/SYNONYMS: TRI-N-BUTYL PHOSPHATE; TBP; TRIBUTYL PHOSPHATE; PHOSPHORIC ACID, TRIBUTYL ESTER; PHOSPHORIC ACID TRIBUTYL ESTER; B-104

CHEMICAL FAMILY:
ESTER, NON-CARBOXYLIC

MOLECULAR FORMULA: C12-H27-04-P MOL WT: 266.32

CERCLA RATINGS (SCALE 0-3): HEALTH=2 FIRE=1 REACTIVITY=0 PERSISTENCE=0

COMPONENTS AND CONTAMINANTS

PERCENT: 100.0 COMPONENT: N-BUTYL PHOSPHATE

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
5 MG/M3 OSHA TWA;
0.2 PPM (2.5 MG/M3) ACGIH TWA; 0.4 PPM (5 MG/M3) ACGIH STEL (NOTICE OF INTENDED CHANGE 1984-1985)

PHYSICAL DATA

DESCRIPTION: ODORLESS, COLORLESS TO PALE YELLOW LIQUID.

BOILING POINT: 560 F (293 C) MELTING POINT: -112 F (-80 C)

SPECIFIC GRAVITY: 0.98 VAPOR PRESSURE: 13.7 MM @ 20 C MMHG

EVAPORATION RATE: NOT AVAILABLE SOLUBILITY IN WATER: INSOLUBLE

SOLVENT SOLUBILITY: MISCIBLE IN ALCOHOL OR ETHER VAPOR DENSITY: 9.1

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
A SLIGHT FIRE HAZARD OR EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME OR BY REACTION WITH INCOMPATIBLE SUBSTANCES.

FLASH POINT: 295 F (146 C) (OC) UPPER EXPLOSION LIMIT: NOT AVAILABLE

LOWER EXPLOSION LIMIT: NOT AVAILABLE AUTOIGNITION TEMP.: 900 F (543 C)

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR FOAM (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL FOAM (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FIREFIGHTING:
MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE. COOL CONTAINERS EXPOSED TO FLAMES WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

EXTINGUISH USING AGENTS INDICATED; DO NOT USE WATER DIRECTLY ON MATERIAL. IF LARGE AMOUNTS OF COMBUSTIBLE MATERIALS ARE INVOLVED, USE WATER SPRAY OR FOG IN FLOODING AMOUNTS. USE WATER SPRAY TO ABSORB CORROSIVE VAPORS. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING CORROSIVE VAPORS; KEEP UPWIND (BUREAU OF EXPLOSIVES, EMERGENCY HANDLING OF HAZARDOUS MATERIALS IN SURFACE TRANSPORTATION, 1981).

TOXICITY

3000 MG/KG ORAL RAT LD50; 100 MG/KG INTRAVENOUS RAT LDLO; CARCINOGEN STATUS: NONE.
N-BUTYL PHOSPHATE IS A SEVERE PULMONARY, SKIN, AND MUCOUS MEMBRANE IRRITANT. SEVERE EXPOSURE MAY AFFECT THE CENTRAL NERVOUS SYSTEM. PERSONS WITH A HISTORY OF CHRONIC RESPIRATORY OR SKIN DISEASE MAY BE AT AN INCREASED RISK FROM EXPOSURE.

HEALTH EFFECTS AND FIRST AID

INHALATION:
+CORROSIVE. 1300 MG/M3 IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.
ACUTE EXPOSURE- EXPOSURE TO THE LIQUID MAY IRRITATE EYES, SKIN, THROAT, NOSE, MUCOUS MEMBRANES, OR MAY CAUSE HEADACHE, NAUSEA, WEAKNESS, FEVER, OR COUGHING. SEVERE EXPOSURE MAY CAUSE PROLONGED PULMONARY EDEMA, NARCOSIS, OR COMA.

CHRONIC EXPOSURE- HAS NOT BEEN REPORTED.

FIRST AID- REMOVE FROM EXPOSURE TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON

WARM AND AT REST. GET MEDICAL ATTENTION.

SKIN CONTACT:
IRRITANT.
ACUTE EXPOSURE- MAY CAUSE IRRITATION. PROLONGED CONTACT MAY CAUSE BURNS.

CHRONIC EXPOSURE- MAY CAUSE DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION.

EYE CONTACT:
IRRITANT.
ACUTE EXPOSURE- MAY CAUSE IRRITATION. PROLONGED CONTACT MAY CAUSE BURNS, TEMPORARY EPITHELIAL INJURY, OR VISUAL DISTURBANCES.

CHRONIC EXPOSURE- MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). IN PRESENCE OF BURNS, APPLY STERILE BANDAGES LOOSELY WITHOUT MEDICATION. GET MEDICAL ATTENTION.

INGESTION:
CORROSIVE.
ACUTE EXPOSURE- MAY CAUSE ABDOMINAL PAIN, VOMITING, OR DIARRHEA. TOXIC AMOUNTS WILL CAUSE NARCOSIS.

FIRST AID- IF VICTIM IS CONSCIOUS, IMMEDIATELY GIVE 2 TO 4 GLASSES OF WATER, AND INDUCE VOMITING BY TOUCHING FINGER TO BACK OF THROAT. GET MEDICAL ATTENTION IMMEDIATELY.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL CONDITIONS. REACTS VIOLENTLY WITH STRONG OXIDANTS.

INCOMPATIBILITIES:
REACTS VIOLENTLY WITH STRONG OXIDANTS.

DECOMPOSITION:
ON COMBUSTION EMITS TOXIC OXIDES OF NITROGEN AND TOXIC OXIDES OF PHOSPHORUS.

POLYMERIZATION:
NOT KNOWN TO OCCUR.

****

CONDITIONS TO AVOID

MAY BE IGNITED BY HEAT OR FLAMES. CONTAINER MAY EXPLODE IN HEAT OF FIRE. VAPOR EXPLOSION HAZARD INDOORS. AVOID CONTACT OR STORAGE WITH STRONG OXIDANTS.

****

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA. KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION OR GENERAL DILUTION VENTILATION TO MEET PERMISSIBLE EXPOSURE LIMITS.

RESPIRATOR:
EXPOSURE LIMITS TO 50 MG/M3-
50 MG/M3- SUPPLIED-AIR RESPIRATOR.
SELF-CONTAINED BREATHING APPARATUS.

250 MG/M3- GAS MASK WITH AN ORGANIC VAPOR CANISTER (CHIN-STYLE OR FRONT- OR BACK-MOUNTED CANISTER) WITH A DUST AND MIST FILTER.
SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE, HELMET, OR HOOD.
SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

1300 MG/M3- TYPE 'C' SUPPLIED -AIR RESPIRATOR OPERATED IN PRESSURE-DEMAND, OTHER POSITIVE-PRESSURE, OR CONTINUOUS-FLOW MODE.

ESCAPE- GAS MASK WITH AN ORGANIC VAPOR CANISTER WITH A HIGH -EFFICIENCY PARTICULATE FILTER.
SELF-CONTAINED BREATHING APPARATUS.

FIREFIGHTING- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACE-PIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
WEAR FACESHIELD (8 INCH MINIMUM) AND VENTED SAFETY GOGGLES. DO NOT WEAR CONTACT LENSES WHEN WORKING WITH CHEMICALS.

AUTHORIZED - ALLIED FISHER SCIENTIFIC
CREATION DATE: 01/11/85 REVISION DATE: 10/22/85

-ADDITIONAL INFORMATION-

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CHEM REPORT
05/23/1986

CHEM ID	CHEM NAME
010102-06-4	URANYL NITRATE

ENTRY INFORMATION
05/23/1986

PREPARER	REVIEWER	ENTRY DATE	REVISED
D. AVERILL	J. BROWER	02/12/1985	05/14/1986

DOE CHEMICAL HAZARDS EMERGENCY MANAGEMENT SYSTEM
05/23/1986

HEALTH AND SAFETY INFORMATION AUTHORITY

CHEMICAL NAME OR SYNONYM

* URANYL NITRATE
* URANIUM NITRATE
* URANIUM, BIS(NITRATO-O,O') DIOXO
* URANYL DINITRATE
* DINITROTODIOXOURANIUM
* URANYL NITRATE, SOLID DOT
* URANYL NITRATE HEXAHYDRATE
* YELLOW SALT
* 10102-06-4

DISPOSAL

WASTE SHOULD BE SENT TO RECOVERY FACILITY. UNRECOVERABLE URANIUM WASTE SHOULD BE HANDLE AND PACKAGED AS RADIOACTIVE WASTE AND SHIPPED TO APPROVED DISPOSAL SITE BY DISPOSAL FIRM APPROVED FOR HANDLING RADIOACTIVE MATERIALS.

DECOMPOSITION PRODUCTS

THERMAL DECOMPOSITION-OXIDES OF NITROGEN AND URANIUM DIOXIDE.

ENVIRONMENTAL EFFECTS

NO CRITERIA SET, BUT EPA HAS SUGGESTED A PERMISSIBLE CONCENTRATION IN WATER OF 3 UG/L BASED ON HEALTH EFFECTS.

EMERGENCY PROCEDURES

IF A SPILL OCCURS, RESTRICT AREA TO TRAINED PERSONS EQUIPPED WITH APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING. VENTILATE AREA. AVOID CREATING DUSTS WHEN COLLECTING MATERIAL. USE APPROVED CLEANING EQUIPMENT. DISPOSE IN SEALED CONTAINERS FOR RECLAMATION OF URANIUM. DECONTAMINATE OR DISPOSE OF CLEANING EQUIPMENT AND CONTAMINATED CLOTHING. CHELATING AGENTS SUCH AS EDTA CAN BE USED TO CLEAN UP AND DECONTAMINATE SPILL SITES AND PERSONNEL. LIQUIDS SHOULD BE ABSORBED IN VERMICULATE, DRY SAND, EARTH OR SIMILAR MATERIAL AND DISPOSE IN SEALED CONTAINERS.

FIRST AID

WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER. GET MEDICAL ATTENTION. CONTACT LENSES SHOULD NOT BE WORN WHEN WORKING WITH THIS CHEMICAL. SKIN EXPOSURE - PROMPTLY WASH CONTAMINATED SKIN USING SOAP OR MILD DETERGENT AND WATER. IF IRRITATION IS PRESENT AFTER WASHING, GET MEDICAL ATTENTION. INHALATION - IF A PERSON BREATHES IN LARGE AMOUNTS OF URANIUM MOVE THE EXPOSED PERSON TO FRESH AIR AT ONCE. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP THE AFFECTED PERSON WARM AND AT REST. GET MEDICAL ATTENTION IMMEDIATELY. SWALLOWING - GIVE THE PERSON LARGE QUANTITIES OF WATER IMMEDIATELY. AFTER THE WATER HAS BEEN SWALLOWED, TRY TO GET THE PERSON TO VOMIT BY TOUCHING THE BACK OF THE THROAT WITH A FINGER. DO NOT MAKE AN UNCONSCIOUS PERSON VOMIT. GET MEDICAL ATTENTION IMMEDIATELY.

FIRE HAZARD

OXIDIZER. SEVERE FIRE AND EXPLOSION HAZARD WHEN SHOCKED OR HEATED OR IN CONTACT WITH ORGANIC MATERIALS. WEAR SCBA AND FULL PROTECTIVE CLOTHING. FLOOD FIRE WITH WATER. USE CAUTION SINCE WATER MAY SCATTER MOLTEN MATERIAL.

HEALTH HAZARD

HIGHLY TOXIC AND RADIOACTIVE.
SOLUBLE URANIUM COMPOUNDS ARE TOXIC IF THEY ARE INHALED, SWALLOWED, OR IF THEY COME IN CONTACT WITH THE EYES OR SKIN. THESE URANIUM COMPOUNDS ARE MORE TOXIC THAN THE INSOLUBLE COMPOUNDS. IT IS IT IS WEAKLY RADIOACTIVE AND IS PRINCIPALLY AN ALPHA PARTICLE EMITER. IT IS NOT A SIGNIFICANT EXTERNAL RADIATION HAZARD. IT POSES AN INTERNAL RADIATION AND CHEMICAL HAZARD.
IT MAY CAUSE AN INCREASE IN CANCER OF THE LYMPHATIC AND BLOOD-FORMING TISSUES IN MAN. PROLONGED CONTACT WITH THE SKIN MIGHT CAUSE RADIATION DAMAGE TO THE SKIN AND/OR SKIN RASH (DERMATITIS). PROLONGED INHALATION HAS CAUSED DAMAGE TO THE LUNGS OF ANIMALS. URANIUM IS HIGHLY TOXIC TO THE KIDNEYS AND LIVER.

MEDICAL RECCOMMENDATIONS

AFTER ORAL OR INHALATION EXPOSURE CHELATION THERAPY FOR URANIUM USING USING CALCIUM EDTA IS RECOMMENDED ACCORDING TO DOSE SCHEDULE FOR LEAD POISONING. PREEMPLOYMENT MEDICAL EXAMS SHOULD STRESS THE BLOOD, LUNGS AND KIDNEYS. PERIODIC MEDICAL EXAMS SHOULD INCLUDE CHEST X-RAY, URINALYSIS, COMPLETE BLOOD COUNT AND CHEMISTRY.

PHYSICAL DESCRIPTION

YELLOW CRYSTALS

PROTECTION MEASURES

GOOD ENGINEERING CONTROLS SHOULD BE USED TO REDUCE ENVIRONMENTAL CONCENTRATIONS TO THE PERMISSIBLE EXPOSURE LEVEL (PEL). ABOVE THE PEL RESPIRATORY PROTECTION MUST BE WORN. AT A U CONCENTRATION OF 2.5 MG/M3 OR LESS WEAR ANY FUME RESPIRATOR OR HIGH EFFICENCY PARTICULATE RESPIRATOR APPROVED FOR RADIONUCLIDES, A SUPPLIED-AIR RESPIRATOR, OR A SCBA. EMPLOYEES SHOULD WEAR IMPERVIOUS CLOTHING, GLOVES, AND GOGGLES TO PREVENT SKIN CONTACT WITH URANIUM. EATING AND SMOKING SHOULD NOT BE PERMITTED IN AREAS WHERE SOLIDS OR LIQUIDS CONTAINING URANIUM OR INSOLUBLE COMPOUNDS ARE HANDLED, PROCESSED, OR STORED. EMPLOYEES WHO HANDLE URANIUM SHOULD WASH THEIR HANDS THOROUGHLY WITH SOAP OR MILD DETERGENT AND WATER BEFORE EATING, SMOKING OR USING TOILET FACILITIES.

REACTIVITY

MAY EXPLODE WHEN SHOCKED OR IMPACTED. PHOTOREACTIVE IN ETHER. CELLULOSE, ETHER AND ORGANIC SOLVENTS MAY FORM EXPLOSIVE MIXTURES.

SHIPPING INFORMATION

SHIP AS RADIOACTIVE MATERIAL WITH RADIOACTIVE AND OXIDIZER LABEL. REGULATED BY DOT.

STORAGE RECOMMENDATIONS

STORE IN COOL DRY AREA. PROTECT FROM DAMAGE. SEPARATE FROM COMBUSTIBLE AND OXIDIZABLE MATERIALS. STORE AS RADIOACTIVE MATERIAL.

USE

USED AS A SOURCE MATERIAL FOR URANIUM DIOXIDE AND EXTRACTION OF URANIUM.

CHEMICAL CATEGORIES
05/23/1986

CATEGORY	CLASS NAME	CLASS CODE
***		
* CHEMICAL	URANIUM COMPOUND	UO2(NO3)2
* NFPA HAZARD	HEALTH	1
* NFPA HAZARD	FIRE	0
* NFPA HAZARD	REACTIVITY	0
* NFPA HAZARD	SPECIAL	OXY
* PHYSICAL HAZARD	OXIDIZER	
* PHYSICAL HAZARD	RADIOACTIVE	

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* TRANSPORTATION RADIOACTIVE AND OXIDIZER NA9177
CHEM NAME* URANYL NITRATE

CHEMICAL ATTRIBUTES
05/23/1986

ATTRIBUTE	VALUE	UNITS	QUALITY	COMMENTS
***				
* ORAL TOXICITY	12.000	MG/KG	LD50	DOG
* SPECIFIC GRAVITY	2.807		WATER=1.0	
* SOLUBILITY	1.500	PARTS	SOLUBLE	IN WATER
* CHEM FORMULA			UO2(NO3)2	
* MOL WEIGHT	394.040	G/MOL		
* ODOR			ODORLESS	
* MELTING POINT	60.200	C		
* BOILING POINT	118.000	C		
* EXPOSURE LIMIT	0.200	MG/CU.M	TLV	AS U
* EXPOSURE LIMIT	0.050	MG/CU.M	PEL	AS SOLUBLE U
* MUTAGENICITY	100.000	UG/I	CYT.	HUMAN LEUKOC

SELECTED MATERIALS THAT ARE RELATED TO OR CONTAIN THE SUBSTANCE
05/23/1986

CHEM NAME* URANYL NITRATE

***
* URANIUM

$UO_2(NO_3)_2 \cdot 2H_2O$

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FISHER SCIENTIFIC CHEMICAL DIV -- URANYL NITRATE,HEXAHYDRATE, U725
MATERIAL SAFETY DATA SHEET
FSC: 6810
NIIN: 00N008681
Manufacturer's CAGE: IB464
Part No. Indicator: A
Part Number/Trade Name: URANYL NITRATE,HEXAHYDRATE, U725

General Information

Company's Name: FISHER SCIENTIFIC, CHEMICAL DIV.
Company's Street: 1 REAGENT LANE
Company's City: FAIRLAWN
Company's State: NJ
Company's Zip Code: 07410-2802
Company's Emerg Ph #: 201-796-7100 (GASTON L. PILLORI
Company's Info Ph #: 201-796-7100
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Date MSDS Prepared: 27APR86
Safety Data Review Date: 30MAR88
MSDS Serial Number: BCQTT
Unit Of Issue: NK
Report for NIIN: 00N008681

Ingredients/Identity Information

Proprietary: NO
Ingredient: URANYL NITRATE,HEXAHYDRATE
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: YR3850000
CAS Number: 113520-83-7
OSHA PEL: 0.05 MG(U)/CUM TWA
ACGIH TLV: 0.2 MG(U)/CUM TWA
Other Recommended Limit: N/K (FP N/ORNL)

Physical/Chemical Characteristics

Appearance And Odor: ODORLELL,YELLOW,DELIQUESCENT,RHOMBIC CRYSTALS.
Boiling Point: 244F,118C
Melting Point: 140 60C
Vapor Pressure (MM Hg/70 F): N/K (FP N)
Vapor Density (Air=1): N/K (FP N)
Specific Gravity: 2.8
Decomposition Temperature: N/K (FP N)
Evaporation Rate And Ref: N/K (FP N/ORNL)
Solubility In Water: SOLUBLE
pH: ACIDIC
Magnetism (Milligauss): N/P

Fire and Explosion Hazard Data

Flash Point: NONCOMBUSTIBLE
Flash Point Method: N/P
Lower Explosive Limit: N/K (FP N)
Upper Explosive Limit: N/K (FP N)
Extinguishing Media: DRY CHEMICAL,CO*2,H*20 SPRAY OR FOAM.W/LG FIRE,USE FLOODING AMT OF H*2O FROM A DISTANCE
Special Fire Fighting Proc: PRESS-DEMAND/OTHR POSITIVE PRESS SCBA W/FULL

FACEPIECE.CALL LOCAL/STATE/DOE RADIOL RESPONSE TEAM.AVOID BRTNING DUST/ VAPORS.EVACUATE 2500FT RADIUS (SUPP DATA)
Unusual Fire And Expl Hazrds: SMALL FIRE & SEV EXPLOSION HAZARD WHEN SFOCHED/FRICTION/HEAT OR CONT W/ OXIDIZABLE MATL.H*2O MAY CAUSE SCATTERING OF MOLTEN MATL.RELEASES (SEE OTHER PRECAUT)
Report for NIIN: 00N008681

Reactivity Data

Stability: YES
Cond To Avoid (Stability): IN ETHER SOLN,MAY EXPLODE UNDER SUNLIGHT. H*2O SOLN IS ACIDIC,CORRODES METALS.MAY TRIBOLUMINESCE/EXPLODE FROM FRICTION.
Materials To Avoid: ORGANIC SOLVENTS & OTHER OXIDIZABLE MATL,COMBUSTIBLES. ABSORBED ON CELLULOSE TO FORM EXPLOSIVE CELLULOSE NITRATE
Hazardous Decomp Products: THERMAL DECOMPOSITION MAY RELEASE TOXIC OXIDES OF NITROGEN.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): N/K (FP N/ORNL)LD50-DOG-SC A MG/KG,RABBIT-SC 1470 UG/KG

Health Hazard Data

Route Of Entry - Inhalation: N/P
Route Of Entry - Skin: N/P
Route Of Entry - Ingestion: N/P
Health Haz Acute And Chronic: EYE & MUCOUS MEMBRANE IRRITANT.POISONING MAY DMG EYES,LUNGS,KIDNEYS,SKIN,LIVER,LYMPHATICS,BLOOD & BONE MARROW.URANIUM MAY CAUSE RADIATION DMG,CARCINOGENESIS.LONG TERM EXPOSURE TO SOLUBLE URANIUM SALTS HAS BEEN REPORTED TO CAUSE AN INCREASE IN CANCER OF LYMPHATIC & BLOOD-FORMING TISSUE OF MAN.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: LONG TERM EXPOS TO SOLUBLE URANIUM SALTS REPORTED TO CAUSE INCREASE CANCER OF LYMPHATIC & BLOOD FORMING TISSUE OF MAN.
Signs/Symptoms Of Overexp: INH:ACUTE EXPOS-IRRIT LUNGS,KIDNEYS INFLAMN W/ URINATION DISORDERS.SUBSEQUENT LIQUER DMG.POSS NITRATE POISONING CAUSES CYANOSIS,METHEMOGLOBINEMIA,HYPOTENSION,TACHY,NERVOUS SYMP & POSS CONVUL & COMA.CHRONIC EXPOS-PULMONRY & RENAL DMG.SKIN:ACUTE-IRRIT.CHRONIC-DERMATITIS.EYE:ACUTE-MOD TO SEV INJURY (SUPP DATA)
Med Cond Aggravated By Exp: N/K (FP N/ORNL)
Emergency/First Aid Proc: INH:REMOVE TO FRESH AIR.W/ STOPPED BRTHING, GIVE O*2.KEEP WARM & REST.SKIN:REMOVE CONTAMED CLOTHING & SHOES.WASH AFFECTED AREA W/ SOAP/MILD DETERGENT & H*2O FOR APPROX 15-20 MINUTES.EYE: WASH W/ H*2O FOR AT LEAST 15 MINUTES.INGEST:IF CONSCIOUS,GIVE 2-4 GLASSES OF H*2O & INDUCE VOMIT.IN ALL ABOVE CASES,GET IMMED MED ATTN & ADVISE MED PERSON THAT VICTIM MAY BE CONTAMED W/ RADIOACTIVE MATL/CHEM BURN.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: SOIL:DIG HOLDING AREA.DIKE FLOW OF SPILL W/ SOIL/FOAM/CONCRETE.ABSORB SPILL W/ CEMENT POWDER/FLY ASH.NEUTRALIZE SPILL W/AGENTS.H*2O:NEUTRALIZE TO PH7.EXTRACT PRECIPT.OCCU:USE ABSORBENT MATL FOR SM SPILL.FOR LG SPILL,DIKE AHEAD OF SPILL (SUPP DATA)
Neutralizing Agent: AGRICULTURAL/SLAKED LIME,CRUSHED LIMETONE,SODIUM BICARBONATE
Waste Disposal Method: DISPOSAL MUST BE IN ACCORDANCE W/ FEDERAL,STATE &
Report for NIIN: 00N008681
LOCAL REGULATIONS (FP N).
Precautions-Handling/Storing: PROTECT CONTR FROM PHYSICAL DMG & AVOID

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CONTACT W/ INCOMPATIBLES (FP N/ORNL).
Other Precautions: UNUSUAL FIRE HAZ:TOXIC GASEOUS NITROGEN OXIDED IF INVOLVED IN FIRE.INCREASES FLAMMABILITY OF ANY COMBUSTIBLE MATL.IF SHAKEN, RUBBED/CRUSHED,CRYSTALS SHOW TRIBOLUMINESCENCE WITH OCCASIONAL DETONATION.

Control Measures

Respiratory Protection: 2.5 MG(U)/CUM:HIGH EFFECIENT PARTICULATE RSPTR W/ FULL FACEPIECE,SUPPLY AIR RSPTR,SCBA.20 MG(U)/CUM:TYPE C SUPPLY AIR RSPTR W/FULL FACEPIECE IN PRESS DEMAND/OTHR POSITIVE PRESS MODE OR W/FULL FACEPIECE,HELMET/HOOD W/CONSTANT FLOW.ESCAPE:SCBA
Ventilation: PROCESS ENCLOSURE RECOMMENCED (MFR).
Protective Gloves: WEAR APPROPRIATE PROTECTIVE GLOVES
Eye Protection: CHEMICAL WORKERS GOGGLES & FACESHLD
Other Protective Equipment: WEAR APPROPRIATE PROTECTIVE CLTHG & EQUIPMENT TO PREVENT SKIN CONTACT WITH SUBSTANCE.
Work Hygienic Practices: PROVIDE EYE-WASH STATION WITHIN IMMEDIATE WORK AREA FOR EMERGENCY USE
Suppl. Safety & Health Data: SIGNS & SYMP:EYE:CHRONIC-CONJUNCTIVITIS. INGEST:ACUTE-MOUTH & STOMACH IRRIT,TOXIC AMT MAY CAUSE EARLY SYMP OF NITRATE POISONING & DELAYED SYMP OF URANIUM TOXICITY.FIRE FGTING:KEEP AREA CLEAR UNTIL DECLARED SAFE.SPILL PROC:DELAY CLEANUP OF LG OCC SPILL TILL ARRIVAL OF QUALIFIED AUTHORITY

Transportation Data

Trans Data Review Date: 88144
DOT PSN Code: PMZ
DOT Proper Shipping Name: URANYL NITRATE, SOLID
DOT Class: 7
DOT ID Number: UN2981
DOT Label: RADIOACTIVE, OXIDIZER
IMO PSN Code: PET
IMO Proper Shipping Name: URANYL NITRATE HEXAHYDRATE SOLUTION
IMO Regulations Page Number: 7105
IMO UN Number: 2980
IMO UN Class: 7
IMO Subsidiary Risk Label: CORROSIVE
AFI PSN Code: ZCH
Report for NIIN: 00N008681
AFI Prop. Shipping Name: URANYL NITRATE, SOLID
AFI Class: 7
AFI ID Number: UN2981
AFI Label: RADIOACTIVE, OXIDIZER
AFI Basic Pac Ref: 11-9

Disposal Data

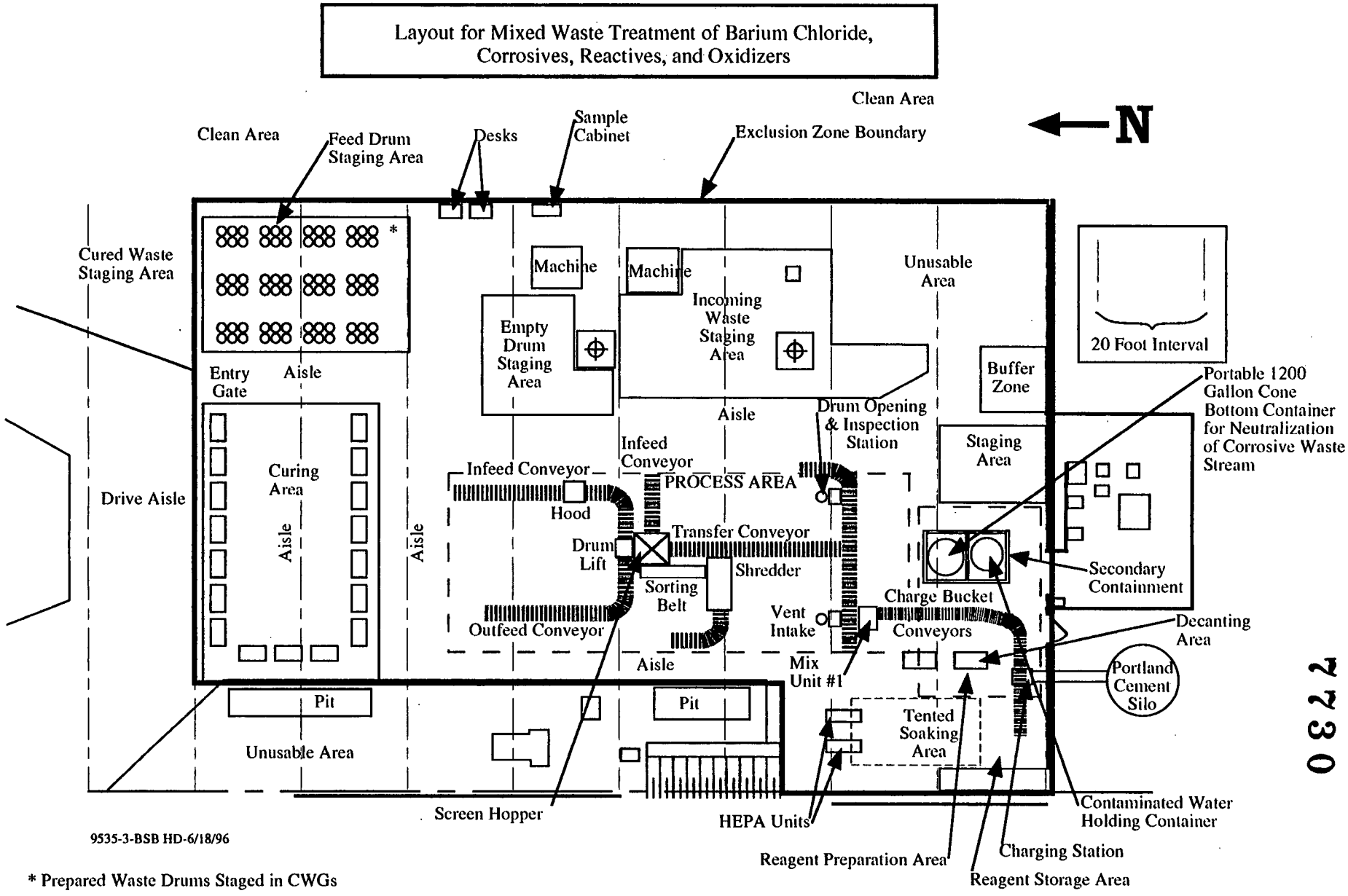
Label Data

Label Required: YES
Label Status: G
Common Name: URANYL NITRATE,HEXAHYDRATE, U725
Chronic Hazard: N/P
Report for NIIN: 00N008681
Special Hazard Precautions: EYE & MUCOUS MEMBRANE IRRITANT.POISONING MAY DMG EYES,LUNGS,KIDNEYS,SKIN,LIVER,LYMPHATICS,BLOOD & BONE MARROW.URANIUM MAY CAUSE RADIATION DMG,CARCINOGENESIS.LONG TERM EXPOSURE TO SOLUBLE URANIUM SALTS HAS BEEN REPORTED TO CAUSE AN INCREASE IN CANCER OF LYMPHATIC & BLOOD-FORMING TISSUE OF MAN. INH:ACUTE EXPOS- IRRIT LUNGS,KIDNEYS INFLAMN

W/ URINATION DISORDERS.SUBSEQUENT LIQUER DMG. POSS NITRATE POISONING CAUSES CYANOSIS,METHEMOGLOBINEMIA,HYPOTENSION,TACHY, NERVOUS SYMP & POSS CONVUL & ACUTE-IRRIT.CHRONIC-DERMATITIS.EYE:ACUTE-MOD TO SEV INJURY (SUPP DATA)
Label Name: FISHER SCIENTIFIC, CHEMICAL DIV.
Label Street: 1 REAGENT LANE
Label City: FAIRLAWN
Label State: NJ
Label Zip Code: 07410-2802
Label Emergency Number: 201-796-7100 (GASTON L. PILLORI

ATTACHMENT F

WORK AREA MAP



Mixed Waste Stabilization Project Layout Modified to Treat Barium Chloride and Other Waste Residues
Plant 6 Equipment Layout

Appendix F, Figure F-1

Fernald Plant 6 Layout of Mobile Treatment Unit

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ATTACHMENT G

OSHA AND DOE
EMPLOYEE RIGHTS POSTER

Occupational Safety and Health Protection for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities

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Policy:

U. S. Department of Energy (DOE) contractor employees shall be provided with safe and healthful working conditions in accordance with the standards prescribed pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, and the Department of Energy Organization Act of 1977; said standards shall be consistent with those promulgated under the Occupational Safety and Health Act of 1970, Public Law 91-596. Please refer to the Order DOE 5483.1A for details.

DOE Contractors:

DOE has determined that Fernald Environmental Restoration Management Corporation (FERMCO) is subject to DOE Acquisition Regulation (DEAR), Subpart 970.23, and is, therefore, required to comply with applicable DOE-prescribed Occupational Safety and Health Administration (OSHA) standards listed therein. This Order and the standards are available for employee review at Safety & Health Building #53. As delineated by the Order DOE 5483.1A, the DOE contractor is required to:

1. Furnish to employees, employment and a place of employment which are as free from occupational safety and health hazards as possible.

2. Establish and implement programs and procedures to comply with the Order DOE 5483.1A. These shall include programs and procedures to monitor the workplace for known toxic materials and harmful physical agents which are used or produced at the facility, and maintain records of the data. As part of these programs and procedures:

(a) Advise employees or their representatives that they are to be provided with an opportunity to (1) observe monitoring or measuring for toxic materials or harmful physical agents, and (2) have access to the results thereof.

*(b) Provide to each employee, former employee, or designated representative, within 15 days of the receipt of a written request, access to or copies of any monitoring or bioassay records relevant to the employee's potential exposure to toxic materials or harmful physical agents during employment.

(c) Notify employees promptly of any information indicating that an exposure to toxic materials or harmful physical agents may have exceeded the limits specified by the DOE-prescribed OSHA standards.

*(d) Provide to each employee, former employee, or designated representative, within 15 days of the receipt of a written request, access to or copies of the employee's cumulative recorded occupational radiation dose during employment.

(e) Notify employees promptly of any information indicating that a radiation dose may have exceeded the limits specified by the DOE-prescribed OSHA standards.

* For purposes of access to an employee's monitoring, bioassay, or radiation exposure records, if the representative is not the recognized/certified collective bargaining agent, then he or she must have the employee's written authorization for such access.

Employees:

All employees are required to:

1. Observe the DOE-prescribed OSHA standards applicable to their work.

2. Report promptly to the contractor any condition which may lead to a violation of these standards.

3. Respond to warning signals which may be activated in the event of fire, radiation, or other possible emergencies.

4. Report emergencies using established procedures.

Inspections:

All activities under this contract are subject to inspection by DOE. When an inspection under the Order DOE 5483.1A is conducted, a contractor management representative and a representative authorized by the employees will be given an opportunity to accompany the DOE inspector.

Where there is no representative authorized by the employees, the DOE inspector will consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaints:

Employees may file a complaint with the contractor management or with the local DOE office using the form DOE F 5480.4 to request an inspection of the workplace. Complaints also may be filed by letter, telegram, or oral means. DOE F 5480.4 to request an inspection of the workplace. Complaints also may be filed by letter, telegram, or oral means. DOE F 5480.4 is available from the FERMCO Safety Department. When an employee requests anonymity from the contractor, DOE shall honor this request.

Imminent Danger:

For any condition or practice which presents an immediate hazard that could reasonably be expected to cause death or serious physical harm (permanent or prolonged impairment of the body or temporary disablement requiring hospitalization), the contractor and/or DOE shall take immediate and effective remedial actions to remove employees from the hazard and/or eliminate the hazard. As soon as possible, an inspection shall be conducted by the contractor and/or DOE to assure that appropriate actions have been taken to preclude recurrence of the hazard.

Nondiscrimination:

No contractor shall discharge or in any manner discriminate against any employee by virtue of the filing of a complaint, or in any other fashion exercising on behalf of himself or herself or others any action set forth in the Order DOE 5483.1A.

Inquiries:

Inquiries should be addressed to the contractor; however, additional inquiries may be addressed to the following local DOE official:

Acting DOE Director
DOE Field Office, Fernald
P. O. Box 538704
Cincinnati, OH 45253-8704

Posting Requirements:

Copies of this notice must be posted in a sufficient number of places in Government-owned plants and facilities operated by DOE contractors subject to DOE Acquisition Regulation (DEAR), Subpart 970.23, to permit employees working in or frequenting any portion of the plant to observe a copy on the way to or from their workplace.

U.S. Department of Energy

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ATTACHMENT H

ACKNOWLEDGMENT FORM

ACKNOWLEDGEMENT STATEMENT
FOR THE MIXED WASTE CHEMICAL TREATMENT PROJECT
Neutralization/Precipitation/Deactivation/Stabilization

The undersigned persons have been orientated on the Project Specific Health and Safety Plan for the Fernald Mixed Waste Chemical Treatment Project and agree to abide by all provisions

NAME (printed)	SIGNATURE	DATE
Team Leader		
Job Site Safety Officer		

APPENDIX B

QUALITY ASSURANCE PLAN

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Quality Assurance Plan

for the

FERMCO Mixed Waste Chemical Treatment Project

Neutralization/Precipitation/Deactivation/Stabilization

Perma-Fix Environmental Services, Inc.

June 18, 1996

Revision 0

Perma-Fix Environmental Services, Inc. (PESI)

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FERNALD MIXED WASTE CHEMICAL TREATMENT PROJECT

Neutralization/Precipitation/Deactivation/Stabilization

QUALITY ASSURANCE PLAN

Robert D. Flodstrom, QA Coordinator
Performance Development Corporation

Date

Dr. Lou Centofanti, Chief Executive Officer
Perma-Fix Environmental Services, Inc.

Date

Timothy L. Kimball, Project Manager
Perma-Fix Environmental Services, Inc.

Date

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QUALITY ASSURANCE POLICY STATEMENT

It is the policy of PESI to provide products and services to our customers which meet or exceed their expectations. A central part of this policy is working and managing in a way that provides an objective basis for confidence that we will provide quality products and services while meeting any regulatory requirements imposed by the client or the client's regulatory agencies through the contract, operating licenses, permits, or similar means.

Our Quality Assurance Program is designed to provide this confidence, and to serve as an integral part of our approach to managing the job so that it is completed as scheduled. This program is primarily implemented by line managers and workers, with important supplemental activities being carried out by staff organizations. The integrated execution of all the actions contained in the program by line and staff personnel will provide PESI managers, and the customer, with confidence in the project's results.

The Quality Assurance program, being an integral part of our approach to the job, is not subject to being diminished due to cost, schedule, or other considerations. Performing work in accordance with the requirements of the Quality Assurance program, as contained in the project's procedures, is a condition of employment for all PESI managers and employees.

Dr. Lou Centofanti, Chief Executive Officer
Perma-Fix Environmental Services, Inc.

QUALITY ASSURANCE PLAN

FERMCO MIXED WASTE CHEMICAL TREATMENT PROJECT
Neutralization/Precipitation/Deactivation/Stabilization

INTRODUCTION

The purpose of the PESI Quality Assurance Plan for the FERMCO Mixed Waste Chemical Treatment Project is to document the overall approach to be used on this project for Quality Assurance activities. This applies to the activities that comprise the full life-cycle of the project, from mobilization of facilities, equipment, and personnel; through the treatment and packaging of waste; to project de-mobilization activities. Quality Assurance activities include all those actions that provide confidence in the quality of the final product, and the process that produced it. These activities are carried out by a combination of all project participants. This includes those involved in planning, performing, and assessing work and work results.

The PESI Quality Assurance Program meets the requirements of FERMCO specification RM-0012. Therefore, it also meets the requirements of ANSI/ASME NQA-1, EPA QAMS-005/80, DOE Order 5700.6c, and 10 CFR 830.120. For each work item or activity, RM-0012 requirements are selectively applied based on the item or activity's importance to quality, health and safety, potential risk to the environment, or significance in meeting project objectives.

The scope and rigor of the individual assuring actions that collectively comprise the PESI Quality Assurance Program are anchored in the fact that the Perma-Fix process is a known technology with a well-defined operating envelope that is implemented by well-trained and experienced operators and managers. Most assuring actions, therefore, are the responsibility of line managers and workers. The approach to Quality Assurance for this project emphasizes providing confidence that these people will do the right job right the first time by integrating the vast majority of assuring actions into the work process itself. Program-level assuring actions necessary to strengthen this approach are carried out by staff specialists in planning, Quality Assurance, Health and Safety, and similar disciplines.

The PESI Quality Assurance Program is composed of assuring activities related to ten criteria that are grouped under three functional categories: Management, Performance, and Assessment. The assuring activities to be applied in these areas are described below. The program will be implemented for all phases of the project. The elements of the program, and their associated documents, will be modified as needed based on data gained from operating experience.

FUNCTIONAL CATEGORY A: MANAGEMENT

Criterion 1.0: Program

The program is documented in the PESI Quality Assurance Policy Statement, in this Quality Assurance Plan, in the Quality Assurance Program Procedures, and in the Project Procedures that govern the conduct of Perma-Fix work under this contract. All participants will be certified to have read and understood the program documents that apply to their jobs. Changes to the program based on operating experience or other factors will be reflected in the program documentation, will be made in a controlled manner, and will be transmitted to all concerned.

The program is structured around the principle of line accountability. This means that PESI management is responsible for the implementation of all aspects of the program, and that emphasis is placed in the program design on each individual being responsible for the quality of his/her work. "Quality" work includes taking the actions that achieve the desired results and that also provide a basis for confidence in those results.

The organization of the Perma-Fix team is shown in Figure 1. The team is composed of experienced personnel who are responsible for ensuring that all aspects of the Quality Assurance program are implemented. The organizational structure provides for the following:

1. Quality is achieved and maintained by those responsible for performing the work.

2. Quality achievement is verified by persons or organizations not directly responsible for performance of the work.

3. Internal and external organizational interfaces are defined and understood.

The functions and responsibilities of each field position in the project organization are described below. The Perma-Fix Project Manager reports to the Chief Executive Officer of Perma-Fix and is responsible for providing the overall policy for activities related to the project. The Project Manager is responsible for the quality of assigned operations, is the main point of contact with FERMCO, and ensures the effective implementation of this quality assurance program plan in functional and technical line organizations as follows:

1. Interfacing with the Quality Assurance Coordinator on all matters pertaining to quality.

2. Ensuring that procedures for controlling work activities and processes are developed, documented, available, clearly understood, controlled, and effectively utilized.

3. Ensuring compliance with applicable federal, state, and local codes, standards, regulations, as well as compliance with commercial practices and standards.

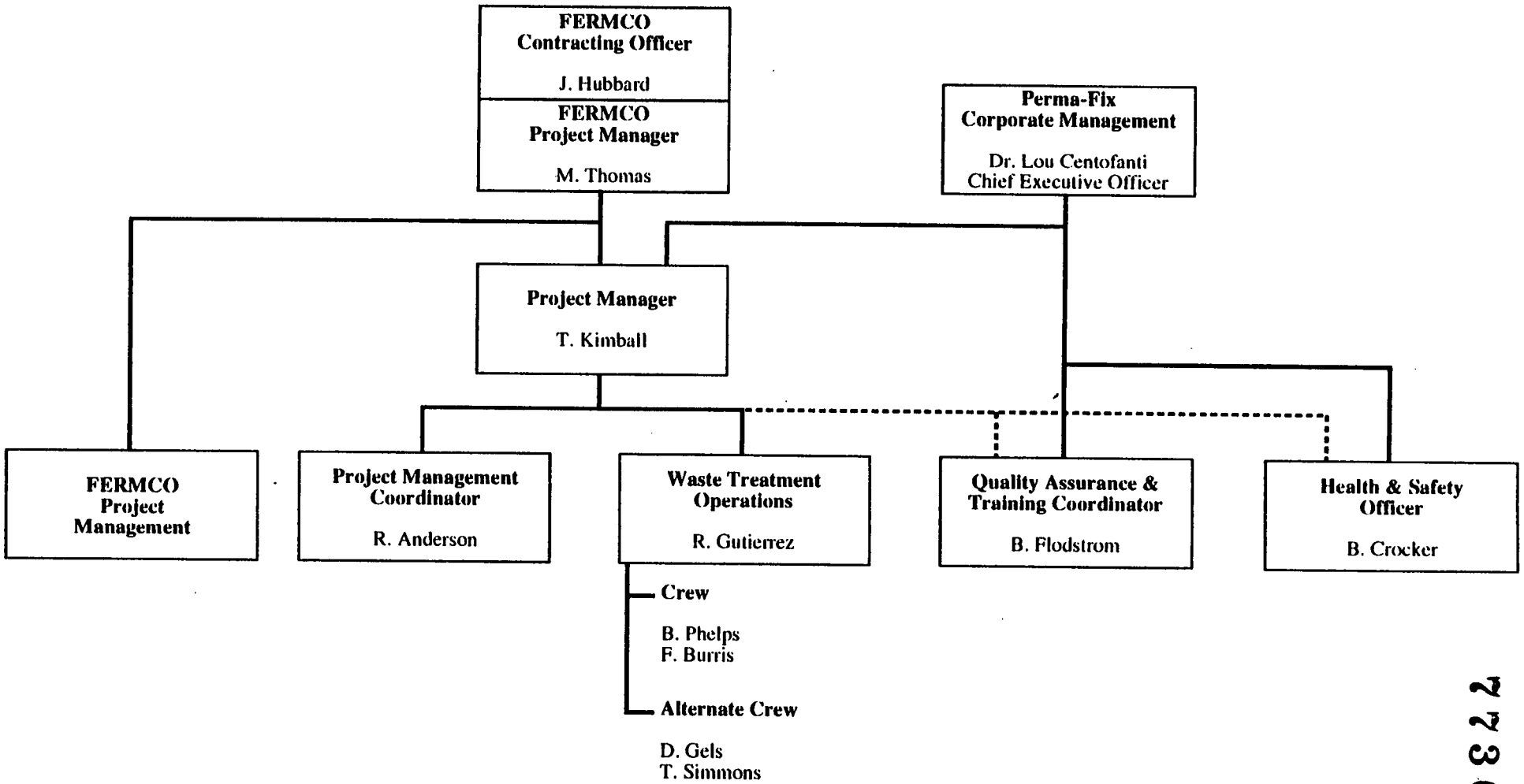

Figure 1
Project Organization
Fernald Mixed Waste Chemical Treatment Project

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4. Interfacing with the FERMCO Project Manager and Contracting Officer on all project matters.

5. Ensuring that project programmatic and operational objectives are accomplished through an effective quality assurance program.

6. Reviewing and approving this plan and ensuring its requirements are satisfied.

7. Supervising the performance of project team members.

8. Ensuring that project deliverables are reviewed for technical accuracy and completeness including data validation before release to FERMCO.

9. Assigning duties to project members and providing orientation to the needs and requirements of this project.

The Perma-Fix Waste Treatment Operations, Supervisors and crew report to the Project Manager. They ensure the quality of operations delegated by the Project Manager as follows:

1. Planning and implementing the appropriate requirements as the designated representative of the Project Manager.

2. Providing the personnel, resources, and equipment necessary to ensure that the services and support provided meet the quality assurance requirements of this plan.

3. Interfacing with the Quality Assurance Coordinator on matters concerning quality.

4. Ensuring that quality related issues and problems are identified and reported and that actions are taken to correct them.

5. Other responsibilities as requested by the Project Manager.

The Health and Safety Officer reports directly to the Chief Executive Officer and is responsible for ensuring the implementation of the procedures controlling radiation and industrial safety activities. This supervisor is also responsible for the appropriate training of personnel, conduct of surveys, and the collection and recording of appropriate radiation data and industrial safety data. The Health and Safety Officer has the authority to delay or stop activities upon observing an unsafe condition or for any anticipated adverse condition.

The Quality Assurance Coordinator reports to the Chief Executive Officer and has been delegated the authority for the effective implementation of quality assurance requirements for appropriate segments of this project. The Quality Assurance Coordinator has sufficient independence from the line functions and cost and schedule considerations. The Quality Assurance Coordinator also assists the Project Manager and the responsible technical supervisors and coordinators as follows:

1. Serving as the formal contact for the project's quality assurance matters.

2. Actively identifying and responding to quality assurance and quality control needs, resolving problems, and providing requests for guidance or assistance.

3. Reviewing, evaluating, and approving quality related changes to the project's operational plans.

4. Actively tracking the progress of the process tasks in this project and consulting periodically with the Project Manager and the Executive Vice President.

5. Verifying that the appropriate corrective actions are taken for Nonconformances.

6. Verifying that the appropriate methods are specified and accomplished for obtaining required data of known quality and integrity.

7. Scheduling and performing the appropriate verification activities to ensure compliance with requirements and procedures and to provide input for the development of quality improvement actions which could provide any needed management control enhancements and improve overall project effectiveness.

8. Assisting coordinators and supervisors in determining requirements for instructions, procedures, and drawings to support process activities.

9. Preparing and submitting quality assurance and quality control reports to the Project Manager.

10. Initiating stop work if appropriate.

11. Maintaining appropriate documentation and quality records.

12. Fulfilling other responsibilities as requested by the Project Manager.

The Quality Assurance Program will be binding on all project personnel, including those having responsibility for planning and scheduling. Perma-Fix management will take necessary actions to ensure that the Quality Assurance Program is understood and implemented by project participants.

Any project participant can stop work if an unsafe condition exists, or is thought to exist. Under normal circumstances, the Quality Assurance Coordinator through the Project Manager, will issue Stop Work orders, This person will also control the resumption of work to ensure that the conditions that brought the stop-work about are corrected before work is resumed. This incudes further processing, deliver, installation, or use of any Nonconforming items. The Quality

Assurance Coordinator will have the authority to ensure that planning and scheduling considerations do not override safety, quality, or environmental protection considerations.

Criterion 2.0: PERSONNEL TRAINING AND QUALIFICATION

The Quality Assurance Coordinator will serve as the training coordinator for the project. This person will ensure that all project personnel receive FERMCO-required site training, that they have read and understood all operating procedures that pertain to their jobs, and that they understand both the letter and spirit of the Quality Assurance program that governs their work.

Only personnel with demonstrated capabilities and experience will be assigned project tasks. Initial training needed will be limited to that required by FERMCO. The Quality Assurance Coordinator will coordinate with FERMCO prior to the start of project activities to identify any legally required training so that it can be provided before work begins.

New training needs that arise will be identified and dealt with by the Quality Assurance Coordinator.

If FERMCO training personnel provide the required training, they will maintain the training records generated and will provide copies to the Quality Assurance Coordinator. Training records generated by PESI will be maintained as project records and will be turned over to FERMCO as part of the final records turnover package.

Criterion 3.0: QUALITY IMPROVEMENT

This project will be guided by the principle of continuous improvement. This will include practices designed to enhance quality by initiating improvements in work methods, processes, equipment, systems, documentation, training, and other aspects of the project and its implementation.

All workers and managers will be empowered to identify quality problems with items or processes; halt, curtail, or modify operations when necessary, and take actions to solve the problem. This will be accomplished through a prescribed and controlled system. Actions to solve the problem will include an identification of the cause(s) of the problem, a set of actions to be taken to eliminate those causes, and a set of actions to be taken to prevent their recurrence. Significant quality problems will be identified to FERMCO upon discovery, and a copy of all written documents related to them will be provided. Corrective actions and actions to prevent recurrence will be approved by FERMCO.

Nonconforming items will be controlled to prevent inadvertent test, installation, or use. Nonconforming items will be dispositioned as follows:

Use-as-is Repair Rework

Decisions to "use-as-is," "repair" will be approved by FERMCO. Reworked or replaced items will be inspected and tested in accordance with the original requirements. Repaired items will be inspected and tested in accordance with specified alternatives to the original requirements.

The Project Manager and the Quality Assurance Coordinator will regularly examine daily operating experience, assessment results, and similar data sources to identify adverse trends and determine how to address them.

Criterion 4.0: DOCUMENTS AND RECORDS

Documented instructions are maintained for the preparation, issuance, and change of documents that specify quality requirements or prescribe activities affecting quality. These documents include records, drawings, specifications, procedures, and similar documents. These documents are controlled to ensure that correct documents are being used, are available at the location in which they are to be used, and are properly stored. At a minimum, the documented instructions provide for the following:

- Identification of documents to be controlled
- Identification of personnel, positions, and organizations responsible for preparing, reviewing, approving, changing, and issuing documents
- Review of documents for adequacy, completeness, and correctness prior to approval and issuance
- Classification and identification of documents for non record or record files
- Storage instructions

Implementing procedures will provide for documenting the completion of designated process steps. The records generated will be reviewed by PESI management.

The instructions include distribution lists for the various types of documents to be issued. Distribution lists are limited to persons who need the information. Lists are periodically updated, and documents are approved for release by authorized personnel.

Documents that establish policies, prescribe work, specify requirements or establish design will be controlled in the above manner and will be designated Quality Assurance Records. Quality

Assurance Records will not be erased or obliterated when revised. Instead, a line will be drawn through errors or items deleted. The person making the revision will initial and date the revision.

FUNCTIONAL CATEGORY B: PERFORMANCE

Criterion 5.0: WORK PROCESSES

Work will be performed to established technical standards and administrative controls. Work will be planned, authorized and accomplished under controlled conditions using technical standards, instructions, procedures, or other appropriate means.

Persons performing work are responsible for the quality of their work. Management will review work and related information to ensure that the desired quality is being achieved and to identify areas needing improvement.

Perma-Fix personnel will identify work activities and special processes (as required by specifications) and translate these specification requirements into working Project Procedures to be used to accomplish the scope of the work. These procedures will contain methods for on-site storage of items and materials that have been inspected and released for use. Measuring and test equipment for monitoring and data collection will be of the accuracy and type suitable for the intended use and will be controlled to ensure proper calibration, maintenance, and use. The objective for measurement of data is to provide adequate control and review so that the measurements and data collected by Perma-Fix are scientifically sound, defensible, and of known and documented quality.

Project Procedures define how containers of contaminated materials (for storage or processing) are uniquely identified. Items procured in quantity or off-the-shelf that do not have specific material, test, or inspection requirements are identified by the catalog number, standard identification number on the container, or in the shipping information. Waste receipts and shipment records for burial or storage are maintained in accordance with a Project Procedure, which specifies hold points for any necessary quality control checks.

Project Procedures prescribe controls to prevent damage or loss and to minimize deterioration to limited-life materials.

Criterion 6.0: DESIGN CONTROL

This project includes no design activities *per se*. All equipment is available from catalogs and off-the-shelf sources, so additional engineering is not needed. When Nonconforming items are dispositioned as "use-as is" or "repair", PESI and FERMCO will identify and complete all required reviews to ensure that items are subjected to the same degree of rigor as the original design.

Project mobilization activities have a critical enough impact on overall project success, however,

to merit being treated in a manner that is very similar to the way in which design activities would be treated. Therefore, PESI will apply a number of design control activities to this phase of the project. Project plans and schedules will be reviewed much as a design would. Lists of equipment, facility layouts, and infrastructure descriptions will also be reviewed. Such items will be placed under configuration control, and changes to them will be subject to the same rigor as they received initially.

Criterion 7.0: PROCUREMENT

Control activities for items and services procured for this project are conducted in accordance with the applicable quality assurance requirements. Items and services are normally purchased as standard off-the-shelf or readily available services. Special instructions and controls are not usually required. Subcontractors are not expected to be used.

Items requiring special quality attributes are evaluated to ensure that they meet their intended use. As part of this evaluation, FERMCO will have the right of access to Perma-Fix's work area and offices, and all sub-tier vendors/suppliers for pre-award assessments and in-process audits, surveillances, and/or inspections as deemed appropriate.

Procurement activities are specified, reviewed, and controlled for any unique safety-related items. (Purchase of such items will be documented to show catalog items, supplier and any documentation from the supplier as to the grade or nature of the items or supplies.) Purchase orders are reviewed by engineering and quality assurance personnel who understand the requirements and intent of the procurement process. Procurement documents are controlled in accordance with Section 4.0, "Documents and Records" of this plan.

Purchase of chemicals, critical materials, and equipment will be conducted to meet established specifications, using quality assurance procedures as described in the Project Management, *Control of Project Procurement.*

Criterion 8.0: INSPECTION AND ACCEPTANCE

All goods supplied will conform to the requirements of applicable purchase orders. Objective evidence of conformance to each specific drawing and specification required by the purchase order will be on file and available for examination by FERMCO.

Inspection checklists are prepared and maintained for quality-related inspections of key items or processes. These activities include checking chemical mixing calculations, sample preparation and collection, and results are documented.

Project Procedures for controlling tests are prepared, reviewed and controlled in accordance with Section 4.0, "Documents and Records." Inspections are performed by qualified individuals who

are independent from those directly responsible for the work. At a minimum, the following reviews and tests are performed on project activities:

- Project Procedures approved for implementation
- Sampling
- Measuring and test equipment (M&TE) calibration
- Training and qualification records
- Proper posting of hazardous material
- Packaging and storage of hazardous material

The Quality Assurance Coordinator selects other areas in which to perform surveillance. The Quality Assurance Coordinator records data or verification of prerequisites, operating steps, or compares data to acceptance criteria delineated in an approved procedure. Results of these surveillances are documented.

When acceptance criteria are not met, deficiencies are to be resolved and corrected areas are to be reinspected or retested.

Sample testing is to be done by FERMCO. The testing laboratory will implement their approved Quality Assurance Plan.

A Project Procedure is provided for the process measuring equipment used in weighting, making volumetric determinations, etc., along with an Project Procedure for health physics equipment used to measure radiation. The measuring and test equipment used shall be of the accuracy and type suitable for the intended use. A list of M&TE is maintained as a quality record in accordance with Section 4.0, "Documents and Records." M&TE calibration and routine adjustments are made in accordance with the manufacturer's instructions for accuracy and frequency and will be controlled in accordance with Section 5.0, "Work Processes." Measuring and test equipment found out of calibration will be tagged and not used until it is recalibrated.

Status indicators are used to prevent the use of defective or otherwise Nonconforming items or materials. Each package returned to FERMCO for eventual disposal has a unique identifier.

FUNCTIONAL CATEGORY C: ASSESSMENT

Criterion 9.0: MANAGEMENT ASSESSMENT

The PESI project Manager will periodically, in coordination with the Quality Assurance Coordinator, conduct management assessments of project operations. These management assessments will normally be accomplished through review of daily operating logs, inspection and test results, and similar data; daily overview of the project's work processes and results; and review of the result of independent assessments by the Quality Assurance Coordinator. Formal assessment activities, such as surveillance, will not normally be needed but may be scheduled and conducted by the Project Manager if the need arises.

Criterion 10.0: INDEPENDENT ASSESSMENT

The Quality Assurance Coordinator is responsible for planning and performing assessments of key project activities and processes at scheduled intervals and on a random basis. Prepared checklists will be used during the conduct of the assessments. Assessment results will be transmitted to those affected, including the Chief Executive Officer. The PESI corrective action system will be used to ensure that all assessment results are reviewed, evaluated, and acted upon by the appropriate levels of management.

APPENDIX C

MATERIAL EVALUATION FORMS

SUBPROJECT	MEF #	INV #	LOT C OD	DRM #	NET WT	SIZE	INVENTORY DESCRIPTION	RTR COMMENTS	U	U235	EPA CODES
REACTIVES	700	W506635	R050 511 P 19 0349	00000	165	085	MAGNESIUM METAL CONTAMINATED WITH OILY		0.01	0.5	D001
REACTIVES	1551	W507728	R020 733 P 047 0361	00000	3	055	COBALT TRIFLUORIDE, COBALTIC FLUORIDE, COF	JARS	0.01	0.2	D003
REACTIVES	40137	W506566	R000 320 T 079 0106	00000	2	055	UNFIRED REDUCTION CHARGE PLUS CAF2	STAT=A			D001 D003
REACTIVES	50089	W065214	D690 730 019 0331	00000	231	055	CONTAMINATED MAGNESIUM		10	0.2	D001
REACTIVES	50089	W079543	S070 107 019 XXX	00000	21	055	CONTAMINATED MAGNESIUM		0.01	0.7	D001
REACTIVES	50089	W088409	W050 107 P 019 XXX	00000	355	085	CONTAMINATED MAGNESIUM		0.01	0.5	D001
REACTIVES	50089	W088410	W050 107 P 019 XXX	00000	342	085	CONTAMINATED MAGNESIUM		0.01	0.5	D001
REACTIVES	50089	W150563	H093 510 019 0408	00000	25	005	MAGNESIUM POWDER AND TURNINGS		10	0.2	D001
REACTIVES	50089	W150954	R060 500 P 019 0370	00000	319	085			0.01	0.6	D001
REACTIVES	50089	W150955	R060 500 P 019 0370	00000	304	085			0.01	0.6	D001
REACTIVES	50089	W150956	R060 500 P 019 0370	00000	307	085			0.01	0.6	D001
REACTIVES	50089	W150957	R060 500 P 019 0370	00000	242	085			0.01	0.6	D001
REACTIVES	50089	W150958	R060 500 P 019 0370	00000	312	085			0.01	0.6	D001
REACTIVES	50089	W150959	R060 500 P 019 0370	00000	336	085			0.01	0.6	D001
REACTIVES	50089	W150960	R060 500 P 019 0370	00000	248	085			0.01	0.6	D001
REACTIVES	50089	W150961	R060 500 P 019 0370	00000	317	085			0.01	0.6	D001
REACTIVES	50089	W150962	R060 500 P 019 0370	00000	337	085			0.01	0.6	D001
REACTIVES	50089	W150963	R060 500 P 019 0370	00001	294	085			0.01	0.6	D001
REACTIVES	50089	W150964	R060 500 P 019 0370	00001	323	085			0.01	0.6	D001
REACTIVES	50089	W150965	R060 500 P 019 0370	00001	317	085			0.01	0.6	D001
REACTIVES	50089	W509035	H093 510 019 0273	00000	111	085	MAGNESIUM POWDER & TURNINGS	METAL,STAT=A	10	0.2	D001
REACTIVES	50089	W509627	H093 510 019 0267	00010	166	055	MAGNESIUM POWDER & TURNINGS	METAL,STAT=A	7.71	0.2	D001
REACTIVES	50089	W511534	H093 510 019 0267	00010	160	055	MAGNESIUM POWDER & TURNINGS	METAL,STAT=A	7.71	0.2	D001
REACTIVES	50089	W511535	H093 510 019 0267	00010	139	055	MAGNESIUM POWDER & TURNINGS	METAL,STAT=A	7.71	0.2	D001
REACTIVES	50089	W514402	H093 510 019 0379	00000	276	055	MAGNESIUM POWDER & TURNINGS	METAL,STAT=A	0.01	0.5	D001
CORROSIVES	816	W047682	W050 137 P 012 0352	00000	301	055	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W048145	W050 137 P 012 0352	00000	273	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W048146	W050 137 P 012 0352	00000	612	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W048147	W050 137 P 012 0352	00000	631	055	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W048151	W050 137 P 012 0352	00000	632	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W048152	W050 137 P 012 0352	00000	629	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W048153	W050 137 P 012 0352	00000	603	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W091978	W050 137 P 012 0374	00000	280	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W091979	W050 137 P 012 0374	00000	385	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W091980	W050 137 P 012 0374	00000	412	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W091981	W050 137 P 012 0374	00000	411	055	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W091982	W050 137 P 012 0374	00000	300	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W091983	W050 137 P 012 0374	00000	398	055	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W091984	W050 137 P 012 0374	00000	378	055	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W091985	W050 137 P 012 0374	00001	352	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W091986	W050 137 P 012 0374	00000	599	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	816	W300702	W050 137 P 012 0374	00000	155	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D018 D019 D039 D040
CORROSIVES	1604	W091533	W050 732 P 013 0365	00000	45	055	CONTAMINATED SOLVENT OR ORGANIC CHEMIC		0.01	0.5	D001 D002 D006 D007 D009 D011
CORROSIVES	1707	W514045	R070 CNL P 012 0371	00000	425	085		FULL BLADDER INSIDE (55 & 85 GAL)	0.01	0.7	D002 D007 D008 D018 D019 D028 D029 D040 D043
CORROSIVES	1707	W514046	R070 CNL P 012 0371	00000	440	085		3/4 FULL LIQUID BETWEEN DRUMS (55 & 85 GAL	0.01	0.7	D002 D007 D008 D018 D019 D028 D029 D040 D043
CORROSIVES	1707	W514047	R070 CNL P 012 0371	00000	437	055		FULL OF FREE LIQUID	0.01	0.7	D002 D007 D008 D018 D019 D028 D029 D040 D043
CORROSIVES	1707	W514048	R070 CNL P 012 0371	00001	436	055		FULL OF FREE LIQUID	0.01	0.7	D002 D007 D008 D018 D019 D028 D029 D040 D043
CORROSIVES	1707	W514049	R070 CNL P 012 0371	00001	446	055		FULL OF FREE LIQUID	0.01	0.7	D002 D007 D008 D018 D019 D028 D029 D040 D043
CORROSIVES	1707	W514050	R070 CNL P 012 0371	00001	242	085		1/2 FULL BLADDER INSIDE (55 & 85 GAL)	0.01	0.7	D002 D007 D008 D018 D019 D028 D029 D040 D043
CORROSIVES	1707	W514051	R070 CNL P 012 0371	00300	452	085		FULL BLADDER (55 & 85 GAL)	0.01	0.7	D002 D007 D008 D018 D019 D028 D029 D040 D043
CORROSIVES	1707	W514842	R067 CTC P 012 0385	00000	462	055	LAB GENERATED WASTE, ACID DIGESTATES	FULL OF FREE LIQUID	0.01	0.67	D002 D007 D008 D018 D019 D028 D029 D040 D043
CORROSIVES	1707	W514843	R067 CTC P 012 0385	00000	462	055	LAB GENERATED WASTE, ACID DIGESTATES	FULL OF FREE LIQUID	0.01	0.67	D002 D007 D008 D018 D019 D028 D029 D040 D043
CORROSIVES	1707	W514844	R067 CTC P 012 0385	00000	429	055	LAB GENERATED WASTE, ACID DIGESTATES	3/4 FULL OF FREE LIQUID	0.01	0.67	D002 D007 D008 D018 D019 D028 D029 D040 D043
CORROSIVES	1707	W514846	R067 CTC P 012 0385	00000	479	055	LAB GENERATED WASTE, ACID DIGESTATES	FULL OF FREE LIQUID	0.01	0.67	D002 D007 D008 D018 D019 D028 D029 D040 D043

SUBPROJECT	MEF #	INV #	LOT CODE	DRM #	NET WT	SIZE	INVENTORY DESCRIPTION	RTR COMMENTS	U	U235	EPA CODES
CORROSIVES	1707	W515067	R067 CTC P 013 0391	Q0000	473	055	LAB GENETAGED WASTE, ACID DIGESTATES	FULL BLADDER INSIDE (30 & 55 GAL)	0.01	0.67	D002 D007 D008 D018 D019 D028 D029 D040 D043
CORROSIVES	1709	W150546	R067 TCT P 012 0407	00000	458	055	LAB GENERATED WASTE FLAMMABLE ORGANIC E		0.01	0.67	D001 D002
CORROSIVES	1709	W150550	R067 TCT P 012 0407	00000	454	055	LAB GENERATED WASTE FLAMMABLE ORGANIC E		0.01	0.67	D001 D002
CORROSIVES	1709	W150551	R067 TCT P 012 0407	00000	452	055	LAB GENERATED WASTE FLAMMABLE ORGANIC E		0.01	0.67	D001 D002
CORROSIVES	1709	W514036	R050 CNL P 047 0371	00001	70	055	LAB GENERAGED, FLAMMABLE ORGANIC EXTRAC		0.01	0.5	D001 D002
CORROSIVES	1711	W149778	R050 TCT P 012 0375	00000	240	085	METALS,EXTRACTS AND DIGESTS		0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	1711	W149779	R050 TCT P 012 0375	00001	399	085	METALS,EXTRACTS AND DIGESTS		0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	1711	W306263	R050 TCT P 012 0375	00000	401	085			0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	1711	W514208	R050 TCT P 012 0375	00000	180	055	METALS,EXTRACTS AND DIGESTS	RUBBER TUBE IN LIQUID, 1/4 FULL OF FREE LIQUI	0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	1711	W514210	R050 TCT P 012 0375	00000	410	055	METALS,EXTRACTS AND DIGESTS	FULL OF FREE LIQUID	0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	1711	W514211	R050 TCT P 012 0375	00000	363	055	METALS,EXTRACTS AND DIGESTS	3 QUARTER FULL OF FREE LIQUID (55 GAL. DRU	0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	1711	W514212	R050 TCT P 012 0375	00000	410	055	METALS,EXTRACTS AND DIGESTS	FULL OF FREE LIQUID	0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	1711	W514213	R050 TCT P 012 0375	00000	406	055	METALS,EXTRACTS AND DIGESTS	3/4 FULL OF FREE LIQUID	0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	1711	W514214	R050 TCT P 012 0375	00000	396	055	METALS,EXTRACTS AND DIGESTS	3/4 FULL OF FREE LIQUID	0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	1711	W514216	R050 TCT P 012 0375	00000	406	055	METALS,EXTRACTS AND DIGESTS	3/4 FULL OF FREE LIQUID	0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	1711	W514218	R050 TCT P 012 0375	00001	355	055	METALS,EXTRACTS AND DIGESTS	3/4 FULL OF FREE LIQUID	0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	1711	W514219	R050 TCT P 012 0375	00001	477	055	METALS,EXTRACTS AND DIGESTS	FULL OF FREE LIQUID S/S DRUM	0.01	0.5	D001 D002 D008 D009 D010 D18 D019 D028 D040 D043
CORROSIVES	2362	W514927	R067 ITA P 012 0387	00000	504	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514928	R067 ITA P 012 0387	00000	500	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514929	R067 ITA P 012 0387	00000	501	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514930	R067 ITA P 012 0387	00000	499	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514931	R067 ITA P 012 0387	00000	470	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514932	R067 ITA P 012 0387	00000	487	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514933	R067 ITA P 012 0387	00000	540	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514934	R067 ITA P 012 0387	00000	493	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514935	R067 ITA P 012 0387	00000	509	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514936	R067 ITA P 012 0387	00001	482	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514937	R067 ITA P 012 0387	00001	457	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514938	R067 ITA P 012 0387	00001	487	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514939	R067 ITA P 012 0387	00001	482	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514940	R067 ITA P 012 0387	00001	458	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514941	R067 ITA P 012 0387	00001	496	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514942	R067 ITA P 012 0387	00001	502	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514943	R067 ITA P 012 0387	00001	476	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514944	R067 ITA P 012 0387	00001	428	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514945	R067 ITA P 012 0387	00001	527	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514946	R067 ITA P 012 0387	00002	515	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514947	R067 ITA P 012 0387	00002	512	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514948	R067 ITA P 012 0387	00002	488	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514949	R067 ITA P 012 0387	00002	507	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514950	R067 ITA P 012 0387	00002	501	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514951	R067 ITA P 012 0387	00002	489	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514952	R067 ITA P 012 0387	00002	468	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514953	R067 ITA P 012 0387	00002	497	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514954	R067 ITA P 012 0387	00002	518	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514955	R067 ITA P 012 0387	00002	534	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514956	R067 ITA P 012 0387	00003	500	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514957	R067 ITA P 012 0387	00003	488	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514958	R067 ITA P 012 0387	00003	505	085	CONTAMINATED WATER OR SUMP LIQUOR, NON-		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514959	R067 ITA P 012 0387	00003	483	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514960	R067 ITA P 012 0387	00003	480	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514961	R067 ITA P 012 0387	00003	486	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514962	R067 ITA P 012 0387	00003	493	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514963	R067 ITA P 012 0387	00003	505	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043

SUBPROJECT	MEF #	INV #	LOT C OD	DRM #	NET WT	SIZE	INVENTORY DESCRIPTION	RTR COMMENTS	U	U235	EPA CODES
CORROSIVES	2362	W514964	R067 ITA P 012 0387	00003	503	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514965	R067 ITA P 012 0387	00003	540	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514966	R067 ITA P 012 0387	00004	481	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514967	R067 ITA P 012 0387	00004	512	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514968	R067 ITA P 012 0387	00004	517	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514969	R067 ITA P 012 0387	00004	514	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514970	R067 ITA P 012 0387	00004	497	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514971	R067 ITA P 012 0387	00004	508	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514972	R067 ITA P 012 0387	00004	459	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2362	W514973	R067 ITA P 012 0387	00004	486	085	RADIOACTIVE ACIDIC LAB WASTE		0.01	0.5	D002 D007 D008 D018 D019 D021 D022 D028 D029 D035 D039 D040 D043
CORROSIVES	2425	W514346	R050 CTC P 013 0378	00000	437	055	CTC CORROSIVE WASTE	FULL OF FREE LIQUID	0.01	0.5	D002
CORROSIVES	2690	W148787	R067 QT P 013 0400	00000	444	085			0.01	0.67	D002
CORROSIVES	2690	W148788	R067 QT P 013 0400	00000	429	085			0.01	0.67	D002
CORROSIVES	2690	W150182	R067 QT P 013 0407	00000	59	055	ACIDIC EXTRACT WASTE		0.01	0.67	D002
CORROSIVES	2690	W150183	R067 QT P 013 0407	00000	456	055	ACIDIC EXTRACT WASTE		0.01	0.67	D002
CORROSIVES	2690	W306235	R067 QT P 013 0407	00000	454	085			0.01	0.67	D001 D002 D007 D018
CORROSIVES	61006	W500470	R050 730 P 013 0307	00000	550	085	MAGNUSPRAY/SURPLUS CHEMICALS		0.01	0.5	D002 D007
BARIUM CHLORIDE	10002	W150565	R050 FTA 066 0408	00000	33	005	SCRAP SALTS		1.14	0.5	D005 D008
BARIUM CHLORIDE	10002	W500905	R050 FTA P 066 7414	00000	631	055	SCRAP SALTS	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W500907	R050 FTA P 066 6378	00000	638	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501171	R050 FTA 066 5155	00000	510	055	SCRAP SALTS	VERY DENSE MATERIAL, FLOOR SWEEPINGS	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501197	R050 FTA 066 6333	00000	652	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501200	R050 FTA 066 6321	00000	686	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501206	R050 FTA 066 5066	00000	462	085	SCRAP SALTS	FLOOR SWEEPINGS, TRASH SPRAY CAN IN DRU	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501207	R050 FTA 066 5060	00000	511	085	SCRAP SALTS	VERY DENSE MATERIAL METAL AND FLOOR SWE	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501211	R050 FTA 066 6337	00000	656	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501223	R050 FTA 066 5167	00000	474	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501226	R050 FTA 066 5179	00000	515	085	SCRAP SALTS	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501228	R050 FTA 066 6307	00000	666	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501242	R050 FTA 066 5076	00000	460	055	SCRAP SALTS	VERY DENSE MATERIAL, FLOOR SWEEPINGS	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501244	R050 FTA 066 BRCH	00000	427	055	SCRAP SALTS	TRASH, FLOOR SWEEPINGS	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501271	R050 FTA 066 6294	00000	655	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501282	R050 FTA 066 5061	00000	441	055	SCRAP SALTS	VERY DENSE MATERIAL, FLOOR SWEEPINGS	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501283	R050 FTA 066 5078	00000	458	085	SCRAP SALTS	FLOOR SWEEPINGS, TRASH	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501284	R050 FTA 066 5068	00000	636	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501287	R050 FTA 066 5151	00000	564	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT, DRUM	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501288	R050 FTA 066 5100	00000	611	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT, DRUM	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501314	R050 FTA 066 5181	00000	542	085	SCRAP SALTS	FLOOR SWEEPINGS	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501315	R050 FTA 066 5169	00000	683	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501316	R050 FTA 066 5182	00000	564	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT	0.01	0.5	D005 D008
BARIUM CHLORIDE	10002	W501826	S063 FTA 066 7113	00068	641	055	SCRAP SALTS	VERY DENSE MATERIAL, FURNACE SALT	0.01	0.63	D005 D008
BARIUM CHLORIDE	10002	W501853	S063 FTA 066 7114	00071	610	055	SCRAP SALTS	VERY DENSE MATERIAL	1	0.63	D005 D008
BARIUM CHLORIDE	10025	W500125	R050 FTA P 011 8400	00000	706	055	CONTAMINATED SOIL & ROCKS	CONTAMINATED BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W500126	R050 FTA P 011 8400	00000	624	055	CONTAMINATED SOIL & ROCKS	CONTAMINATED BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W500127	R050 FTA P 011 8400	00000	745	055	CONTAMINATED SOIL & ROCKS	CONTAMINATED BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W500128	R050 FTA P 011 8400	00000	660	055	CONTAMINATED SOIL & ROCKS	CONTAMINATED BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W500171	R050 FTA P 011 0271	00000	609	085	CONTAMINATED SOIL & ROCKS	FURNACE SALT AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W500172	R050 FTA P 011 0271	00000	519	055	CONTAMINATED SOIL & ROCKS	FURNACE SALT AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501052	R050 FTA P 011 8629	00000	570	055	CONTAMINATED SOIL & ROCKS	FURNACE SALT AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501073	R095 FTA 011 8664	00000	330	055	CONTAMINATED SOIL & ROCKS	FURNACE SALT AND BRICKS	0.01	0.95	D005
BARIUM CHLORIDE	10025	W501074	R095 FTA 011 8655	00000	449	055	CONTAMINATED SOIL & ROCKS	FURNACE BRICKS	0.01	0.95	D005
BARIUM CHLORIDE	10025	W501173	R050 FTA 011 BRCH	00000	421	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501175	R050 FTA 011 5239	00000	573	085	CONTAMINATED SOIL & ROCKS	CONTAMINATED FURNACE SALT	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501178	R050 FTA 011 BRCH	00000	692	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005

SUBPROJECT	MEF #	INV #	LOT	C	OD	DRM #	NET WT	SIZE	INVENTORY DESCRIPTION	RTR COMMENTS	U	U235	EPA CODES
BARIUM CHLORIDE	10025	W501190	R050	FTA	01	BRCH	00000	396	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501224	R050	FTA	01	5228	00000	391	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501250	R050	FTA	01	BRCH	00000	528	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501251	R050	FTA	01	BRCH	00000	546	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501252	R050	FTA	01	BRCH	00001	586	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501298	R050	FTA	01	5242	00000	499	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501309	R050	FTA	011	BRCH	00001	486	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501318	R050	FTA	011	BRCH	00001	523	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501319	R050	FTA	01	BRCH	00001	598	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	10025	W501732	R050	FTA	011	BRCH	00001	600	085	CONTAMINATED SOIL & ROCKS	FURNACE SALTS AND BRICKS	0.01	0.5	D005
BARIUM CHLORIDE	60306	W039000	S044	FTA	044	5588	00055	458	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		16.7	0.44	D005
BARIUM CHLORIDE	60306	W039001	S044	FTA	044	5588	00055	94	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		16.7	0.44	D005
BARIUM CHLORIDE	60306	W039002	S044	FTA	044	5588	00055	462	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		16.7	0.44	D005
BARIUM CHLORIDE	60306	W039037	S051	FTA	044	5585	00069	490	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		16.6	0.51	D005
BARIUM CHLORIDE	60306	W039038	S044	FTA	044	5588	00055	462	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		16.7	0.44	D005
BARIUM CHLORIDE	60306	W039039	S044	FTA	044	5588	00055	443	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		16.7	0.44	D005
BARIUM CHLORIDE	60306	W039040	S051	FTA	044	5585	00069	547	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		16.6	0.51	D005
BARIUM CHLORIDE	60306	W039049	S051	FTA	044	5585	00069	490	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		16.6	0.51	D005
BARIUM CHLORIDE	60306	W039050	S051	FTA	044	5585	00069	489	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		16.6	0.51	D005
BARIUM CHLORIDE	60306	W039051	S051	FTA	044	5585	00069	462	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		16.6	0.51	D005
BARIUM CHLORIDE	60306	W039068	S054	FTA	044	0035	00019	481	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.54	D005
BARIUM CHLORIDE	60306	W039073	S044	FTA	044	0035	00019	532	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.44	D005
BARIUM CHLORIDE	60306	W039074	S054	FTA	044	0035	00019	515	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.54	D005
BARIUM CHLORIDE	60306	W039075	S054	FTA	044	0035	00019	473	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.54	D005
BARIUM CHLORIDE	60306	W039076	S053	FTA	044	0035	00017	476	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.53	D005
BARIUM CHLORIDE	60306	W039112	S062	FTA	044	6653	00010	460	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.62	D005
BARIUM CHLORIDE	60306	W039113	S062	FTA	044	6653	00010	458	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.62	D005
BARIUM CHLORIDE	60306	W039114	S062	FTA	044	6653	00010	485	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.62	D005
BARIUM CHLORIDE	60306	W039115	S062	FTA	044	6653	00010	463	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.62	D005
BARIUM CHLORIDE	60306	W039161	S044	FTA	044	0035	00019	474	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.44	D005
BARIUM CHLORIDE	60306	W039162	S044	FTA	044	0035	00019	505	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.44	D005
BARIUM CHLORIDE	60306	W039163	S053	FTA	044	0035	00017	465	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.53	D005
BARIUM CHLORIDE	60306	W039181	S053	FTA	044	0035	00017	496	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.53	D005
BARIUM CHLORIDE	60306	W039182	S054	FTA	044	0035	00019	506	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.54	D005
BARIUM CHLORIDE	60306	W039184	S053	FTA	044	0035	00017	476	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.53	D005
BARIUM CHLORIDE	60306	W039189	S062	FTA	044	6653	00010	476	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.62	D005
BARIUM CHLORIDE	60306	W039205	S062	FTA	044	6653	00010	512	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.62	D005
BARIUM CHLORIDE	60306	W039208	S062	FTA	044	6653	00010	498	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.62	D005
BARIUM CHLORIDE	60306	W039331	S054	FTA	044	0035	00019	520	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.54	D005
BARIUM CHLORIDE	60306	W039334	S053	FTA	044	0035	00017	483	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.53	D005
BARIUM CHLORIDE	60306	W039343	S044	FTA	044	0035	00019	500	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.44	D005
BARIUM CHLORIDE	60306	W052209	S074	FTA 0	044	6295	00000	0	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		8.41	0.74	D005
BARIUM CHLORIDE	60306	W052210	S074	FTA 0	044	6295	00000	372	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		8.41	0.74	D005
BARIUM CHLORIDE	60306	W052211	S074	FTA 0	044	6295	00000	452	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		8.41	0.74	D005
BARIUM CHLORIDE	60306	W065968	S044	FTA	044	5588	00055	456	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		16.7	0.44	D005
BARIUM CHLORIDE	60306	W065969	S023	FTA	044	0046	00151	323	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.23	D005
BARIUM CHLORIDE	60306	W065970	S023	FTA	044	0046	00151	414	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.23	D005
BARIUM CHLORIDE	60306	W065971	S023	FTA	044	0046	00151	365	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.23	D005
BARIUM CHLORIDE	60306	W065972	S068	FTA	044	6294	00000	517	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		14.2	0.68	D005
BARIUM CHLORIDE	60306	W065973	S023	FTA	044	0046	00152	365	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.23	D005
BARIUM CHLORIDE	60306	W065974	S023	FTA	044	0046	00162	467	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.23	D005
BARIUM CHLORIDE	60306	W065975	S023	FTA	044	0046	00162	430	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.23	D005
BARIUM CHLORIDE	60306	W065976	S023	FTA	044	0046	00151	390	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.23	D005
BARIUM CHLORIDE	60306	W065977	S045	FTA	044	6403	00000	463	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		17	0.27	D005

SUBPROJECT	MEF #	INV #	LOT COD	DRM #	NET WT	SIZE	INVENTORY DESCRIPTION	RTR COMMENTS	U	U235	EPA CODES
BARIUM CHLORIDE	60306	W065978	S045 FTA 044 6403	00000	221	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		17	0.27	D005
BARIUM CHLORIDE	60306	W065979	S045 FTA 044 6403	00000	439	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		17	0.27	D005
BARIUM CHLORIDE	60306	W065980	S045 FTA 044 6403	00000	467	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		17	0.27	D005
BARIUM CHLORIDE	60306	W065981	S023 FTA 044 0046	00162	482	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.23	D005
BARIUM CHLORIDE	60306	W065982	S023 FTA 044 0046	00162	450	055	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.23	D005
BARIUM CHLORIDE	60306	W065983	S023 FTA 044 0046	00151	371	085	SLUDGES, SALT, SOFT, CHLORIDE (FOR PLANT 8		13.4	0.23	D005
BARIUM CHLORIDE	60306	W501819	S063 FTA 044 7110	00055	792	055	HARDENED SALT BATH SLUDGE FROM RMI	VERY DENSE MATERIAL	9.61	0.63	D005
BARIUM CHLORIDE	60306	W501820	S063 FTA 044 7110	00055	886	055	HARDENED SALT BATH SLUDGE FROM RMI	VERY DENSE MATERIAL	9.61	0.63	D005
BARIUM CHLORIDE	60306	W501821	S063 FTA 044 7110	00055	732	055	HARDENED SALT BATH SLUDGE FROM RMI	VERY DENSE MATERIAL	9.61	0.63	D005
BARIUM CHLORIDE	60306	W501822	S063 FTA 044 7110	00055	642	055	HARDENED SALT BATH SLUDGE FROM RMI	VERY DENSE MATERIAL, FURNACE SALT	9.61	0.63	D005
BARIUM CHLORIDE	60306	W501823	S063 FTA 044 7111	00055	646	055	HARDENED SALT BATH SLUDGE FROM RMI	VERY DENSE MATERIAL	8.59	0.53	D005
BARIUM CHLORIDE	60306	W501824	S063 FTA 044 7111	00055	694	055	HARDENED SALT BATH SLUDGE FROM RMI	VERY DENSE MATERIAL, FURNACE SALT	8.59	0.53	D005
BARIUM CHLORIDE	60306	W501825	S063 FTA 044 7111	00055	734	055	HARDENED SALT BATH SLUDGE FROM RMI	VERY DENSE MATERIAL	8.59	0.53	D005
BARIUM CHLORIDE	60307	W026521	X500 FTA O 060 0318	00000	215	085	FURNACE SALT, SOLIDIFIED, CHLORIDE (FOR PLA		10	0.95	D005 D008
BARIUM CHLORIDE	60307	W500169	R050 FTA P 060 8564	00006	556	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500170	R050 FTA P 060 6323	00000	679	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500520	R095 FTA 060 8527	00000	369	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500529	R095 FTA 060 8525	00000	453	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500533	R095 FTA 060 7487	00000	562	085	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500534	R095 FTA 060 7471	00000	597	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500573	R095 FTA 060 8519	00000	441	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500576	R095 FTA 060 7445	00000	589	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500585	R095 FTA 060 8509	00000	625	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500625	R095 FTA 060 7317	00000	642	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500626	R095 FTA 060 8528	00000	510	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500627	R095 FTA 060 8514	00000	647	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500634	R095 FTA 060 8579	00000	731	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500635	R095 FTA 060 8573	00000	939	055	SALT & FURNACE BRICK	DENSE	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500664	R095 FTA 060 8543	00000	475	055	SALT & FURNACE BRICK	DENSE	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500672	R095 FTA 060 8533	00000	378	085	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.95	D005 D008
BARIUM CHLORIDE	60307	W500902	R050 FTA P 060 6367	00000	600	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500906	R050 FTA P 060 7431	00000	662	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500909	R050 FTA P 060 7432	00000	688	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500911	R050 FTA P 060 7396	00000	314	085	SALT & FURNACE BRICK	TRASH, FLOOR SWEEPINGS, PLASTIC ON TOP	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500912	R050 FTA P 060 6357	00000	627	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500913	R050 FTA P 060 7430	00000	554	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500918	R050 FTA P 060 6370	00000	694	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500921	R050 FTA P 060 7437	00000	677	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500966	R050 FTA P 060 7433	00000	706	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500967	R050 FTA P 060 7395	00000	488	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500968	R050 FTA P 060 7393	00000	471	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500973	R050 FTA P 060 7434	00000	687	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500974	R050 FTA P 060 6345	00000	684	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500977	R050 FTA P 060 6348	00000	670	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W500979	R050 FTA P 060 7442	00000	566	085	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501172	R050 FTA 060 BRCH	00000	620	085	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501180	R050 FTA 060 6293	00000	638	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501181	R050 FTA 060 6291	00000	647	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501182	R050 FTA 060 5187	00000	394	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501183	R050 FTA 060 6305	00000	654	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501198	R050 FTA 060 BRCH	00001	548	085	SALT & FURNACE BRICK	METAL AND TRASH	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501199	R050 FTA 060 6330	00000	627	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501203	R050 FTA 060 6268	00000	662	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501205	R050 FTA 060 5083	00000	343	085	SALT & FURNACE BRICK	METAL AND TRASH	0.01	0.5	D005 D008

SUBPROJECT	MEF #	INV #	LOT C OD	DRM #	NET WT	SIZE	INVENTORY DESCRIPTION	RTR COMMENTS	U	U235	EPA CODES
BARIUM CHLORIDE	60307	W501245	R050 FTA 060 5103	00000	579	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501276	R050 FTA 060 5124	00000	443	085	SALT & FURNACE BRICK	VERY DENSE FLOOR SWEEPINGS	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501281	R050 FTA 060 5067	00000	559	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501317	R050 FTA 060 6334	00000	297	085	SALT & FURNACE BRICK	DENSE CHUNKS	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501321	R050 FTA 060 5146	00000	598	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501325	R050 FTA 060 BRCH	00002	513	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501327	R050 FTA 060 5108	00000	465	055	SALT & FURNACE BRICK	DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501328	R050 FTA 060 5111	00000	526	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W501677	S053 FTA 060 6903	00000	495	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	22.4	0.53	D005 D008
BARIUM CHLORIDE	60307	W501700	S053 FTA 060 6903	00000	616	055	SALT & FURNACE BRICK	DENSE MATERIAL	22.4	0.53	D005 D008
BARIUM CHLORIDE	60307	W501729	S052 FTA 060 6905	00000	30	055	SALT & FURNACE BRICK		9.74	0.55	D005 D008
BARIUM CHLORIDE	60307	W501730	S053 FTA 060 6903	00000	15	085	SALT & FURNACE BRICK	5 GAL PAIL INSIDE W/ FREE LIQUID	22.4	0.53	D005 D008
BARIUM CHLORIDE	60307	W501739	S058 FTA 060 6904	00000	251	055	SALT & FURNACE BRICK	DENSE MATERIAL	13.8	0.56	D005 D008
BARIUM CHLORIDE	60307	W501741	S058 FTA 060 6904	00000	339	055	SALT & FURNACE BRICK	DENSE MATERIAL	13.8	0.56	D005 D008
BARIUM CHLORIDE	60307	W501745	S058 FTA 060 6904	00000	582	055	SALT & FURNACE BRICK	DENSE MATERIAL	13.8	0.56	D005 D008
BARIUM CHLORIDE	60307	W501746	S053 FTA 060 6903	00000	574	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL FURNACE SALT	22.4	0.53	D005 D008
BARIUM CHLORIDE	60307	W501747	S053 FTA 060 6903	00000	420	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	22.4	0.53	D005 D008
BARIUM CHLORIDE	60307	W501748	S053 FTA 060 6903	00000	582	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	22.4	0.53	D005 D008
BARIUM CHLORIDE	60307	W501827	S063 FTA 060 7113	00068	580	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	1	0.63	D005 D008
BARIUM CHLORIDE	60307	W501828	S063 FTA 060 7113	00068	624	055	SALT & FURNACE BRICK	DENSE MATERIAL	1	0.63	D005 D008
BARIUM CHLORIDE	60307	W501833	S063 FTA 060 7113	00068	637	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	1	0.63	D005 D008
BARIUM CHLORIDE	60307	W501834	S063 FTA 060 7113	00069	328	055	SALT & FURNACE BRICK	DENSE MATERIAL	1	0.63	D005 D008
BARIUM CHLORIDE	60307	W501835	S063 FTA 060 7113	00069	554	055	SALT & FURNACE BRICK	DENSE MATERIAL	1	0.63	D005 D008
BARIUM CHLORIDE	60307	W501836	S063 FTA 060 7113	00069	555	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	1	0.63	D005 D008
BARIUM CHLORIDE	60307	W501837	S063 FTA 060 7113	00069	625	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	1	0.63	D005 D008
BARIUM CHLORIDE	60307	W501838	S063 FTA 060 7113	00069	630	055	SALT & FURNACE BRICK	VERY DENSE MATERIAL	1	0.63	D005 D008
BARIUM CHLORIDE	60307	W506424	R050 733 P 060 0347	00000	249	055	SOLID FURNACE SALT		0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W506425	R050 733 P 060 0347	00000	435	055	SOLID FURNACE SALT		0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W506426	R050 733 P 060 0347	00000	148	055	SOLID FURNACE SALT		0.01	0.5	D005 D008
BARIUM CHLORIDE	60307	W515146	S052 FTA 060 6905	00000	30	085	SALT & FURNACE BRICK		9.74	0.55	D005 D008
OXIDIZERS	1949	W514840	R050 730 P 061 0346	00000	203	085	DRAW TEMP 275		10	0.5	D001
OXIDIZERS	20145	W506158	R125 HX 0 068 0338	00000	436	085	DECANTED WATER FROM SUMP/FILTER CAKES		1	1.25	D002 D007
OXIDIZERS	20145	W506159	R125 HX 0 068 0338	00000	160	055	DECANTED WATER FROM SUMP/FILTER CAKES		1	1.25	D002 D007
OXIDIZERS	30080	W507580	R125 211 0 01 0260	00000	503	110	U-CONTAMINATED SOIL, ROCKS, ETC.	JARS	1	1.25	D001 D002 D004 D007 D008 D011
OXIDIZERS	30081	W507545	R095 235 0 00 0254	00000	851	110	DISCARD PROCESS RESIDUES, SLURRIES, ETC.	JARS	0.01	0.95	D002
OXIDIZERS	40122	W513840	R000 732 T 00 0225	00000	402	085	THORIUM TRAILER CAKES	STAT=R			D002 D005 D009
OXIDIZERS	40152	W513838	R000 362 T 10 0279	00000	86	055	THORIUM OXIDE/FLUORIDES				D005
OXIDIZERS	40152	W513839	R000 362 T 10 0279	00000	42	055	THORIUM OXIDE/FLUORIDES				D005
OXIDIZERS	40181	W506539	R000 FAK T 150 0011	00000	554	085	THORIUM NITRATE SOLUTION	STAT=A			D002 D005 D007 D008
OXIDIZERS	40181	W506540	R000 FAK T 150 0011	00000	584	085	THORIUM NITRATE SOLUTION	STAT=A			D002 D005 D007 D008
OXIDIZERS	40181	W507736	R000 718 T 090 D362	15617	3884	301	THORIUM NITRATE SOLUTION	STAT=R, GLASS JARS W/ FREE LIQUID			D002 D005 D007 D008
OXIDIZERS	40185	W507735	R000 718 T 090 C362	15575	1845	301	THORIUM NITRATE SOLID	STAT=A			D001 D005 D007 D008
OXIDIZERS	40186	W507732	R000 718 T 090 0362	15583	1658	301	IMPURE THORIUM NITRATE (SOLID)	STAT=A			D001 D007 D008
OXIDIZERS	40186	W507733	R000 718 T 090 A362	15581	1662	301	IMPURE THORIUM NITRATE (SOLID)	STAT=A			D001 D007 D008
OXIDIZERS	40186	W507734	R000 718 T 090 B362	15579	1085	301	IMPURE THORIUM NITRATE (SOLID)	STAT=A			D001 D007 D008
OXIDIZERS	40192	W514206	0000 CB T 167 0045	00000	68	010	THO2 POWDER, REFINERY FEED				D008
OXIDIZERS	60095	W042931	S045 221 022 0275	00000	313	110	CONTAMINATED TBP AND/OR KEROSENE MIXTUR		0.07	0.45	D002 D005
OXIDIZERS	60095	W042934	S045 221 022 0275	00000	346	110	CONTAMINATED TBP AND/OR KEROSENE MIXTUR		0.07	0.45	D002 D005
OXIDIZERS	60095	W501639	S045 221 022 0275	00000	383	110	TRIBUTYL PHOSPHATE/KEROSENE		0.07	0.45	D002 D005
OXIDIZERS	60095	W501640	S125 221 4 022 0310	00000	479	085	TRIBUTYL PHOSPHATE/KEROSENE		0.23	1.25	D002 D005
OXIDIZERS	60095	W501641	S125 221 4 022 0310	00000	336	085	TRIBUTYL PHOSPHATE/KEROSENE		0.23	1.25	D002 D005
OXIDIZERS	60095	W501642	S125 221 4 022 0310	00000	302	085	TRIBUTYL PHOSPHATE/KEROSENE		0.23	1.25	D002 D005
OXIDIZERS	60095	W501643	S125 221 4 022 0310	00000	358	085	TRIBUTYL PHOSPHATE/KEROSENE		0.23	1.25	D002 D005
OXIDIZERS	60095	W501644	S125 221 4 022 0310	00000	609	085	TRIBUTYL PHOSPHATE/KEROSENE		0.23	1.25	D002 D005

SUBPROJECT	MEF #	INV #	LOT CODE	DRM #	NET WT	SIZE	INVENTORY DESCRIPTION	RTR COMMENTS	U%	U235	EPA CODES
OXIDIZERS	60095	W501645	S125 221 4 022 0310	00000	435	085	TRIBUTYL PHOSPHATE/KEROSENE		0.23	1.25	D002 D005
OXIDIZERS	60095	W501646	S125 221 4 022 0310	00000	486	085	TRIBUTYL PHOSPHATE/KEROSENE		0.23	1.25	D002 D005
OXIDIZERS	60095	W506599	S045 221 022 0275	00000	50	055	CLEAN-UP MATERIAL		0.07	0.45	D002 D005
OXIDIZERS	60160	W049908	N000 FAL 1 160 0001	00000	38	085	IMPURE URANYL OR THORIUM NITRATE - SOLID		55.3	0.71	D002 D005
OXIDIZERS	60160	W060173	S073 CBJ 0 160 0061	00000	13	005	IMPURE URANYL OR THORIUM NITRATE - SOLID		61.9	0.73	D001
OXIDIZERS	60160	W060174	S072 CBJ 0 160 0061	00000	9	005	IMPURE URANYL OR THORIUM NITRATE - SOLID		73.7	0.72	D001
OXIDIZERS	60193	W049852	S071 732 1 150 0343	00001	25	085	URANYL OR THORIUM NITRATE SOLUTION	LIQUID IN VILES & JARS, DRUM MARKES AS DR	30.4	0.71	D001

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APPENDIX D

GENERIC SAMPLING AND ANALYSIS PLAN

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FERNALD MIXED WASTE CHEMICAL TREATMENT PROJECT

NEUTRALIZATION/PRECIPITATION/DEACTIVATION/STABILIZATION

Generic Sampling and Analysis Plan

Revision 0

June 18, 1996

PERMA-FIX Environmental Services, Inc. (PESI)

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FERNALD MIXED WASTE CHEMICAL TREATMENT PROJECT

NEUTRALIZATION/PRECIPITATION/DEACTIVATION/STABILIZATION

GENERIC SAMPLING & ANALYSIS PLAN

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Date

FERNALD MIXED WASTE CHEMICAL TREATMENT PROJECT
NEUTRALIZATION/PRECIPITATION/DEACTIVATION/STABILIZATION

Generic Sampling and Analysis Plan

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FERNALD MIXED WASTE CHEMICAL TREATMENT PROJECT
NEUTRALIZATION/PRECIPITATION/DEACTIVATION/STABILIZATION

GENERIC SAMPLING AND ANALYSIS PLAN

1.0 INTRODUCTION

This Generic Sampling and Analysis Plan provides the rationale and detailed approach for conducting sampling and analysis activities for the Fernald Mixed Waste Chemical Treatment Project (Neutralization/Precipitation/Deactivation/Stabilization [NPDS]). These activities will be conducted to acquire the necessary data to confirm the treatment adequacy of the mixed wastes processed during this project. This plan applies only to sampling for the purpose of analysis in a chemical laboratory. In-process quality control testing, in real time, is addressed in other sections of the Technology-Specific Work Plan and in applicable Process Operations Procedures.

1.1 Purpose

The purpose of sampling and analysis is to provide evidence that the process and the design treatment recipe have met the Waste Acceptance Criteria of NTS, which are to demonstrate documented compliance with Title 40, Code of Federal Regulations (CFR) 261 through 268. All waste will be considered mixed waste until chemical analysis can document that the waste contains no characteristics of hazardous wastes as identified in 40 CFR 261.

1.2 Objectives

The sampling and analysis objectives during treatment of mixed wastes are to evaluate the stabilization of RCRA heavy metals, by the treatment process and the design treatment recipe employed.

1.3 Scope

This plan describes the division of responsibilities between Perma-Fix and FEMP Site personnel in the collection, storage, custody transfer and analysis of samples for waste acceptance purposes. For each Material Evaluation Form (MEF) waste category, an MEF-specific Sampling and Analysis Plan will be developed in accordance with the *FEMP Containerized Waste Sampling and Analysis Plan, Rev.1*, the project-specific requirements described below, and the supporting procedures in the Procedures Manual. Two types of grab samples will be collected during this project, as specified in the MEF-specific Sampling and Analysis Plan. Grab samples will either be collected directly from the mixing drum before its contents are emptied into a White Metal Box, or from the White Metal Box at randomly

selected grid locations. In the conduct of sampling and analysis according to the MEF-specific Sampling and Analysis Plan, the responsibilities will be divided as described in the next section.

2.0 DIVISION OF RESPONSIBILITIES

All sampling of waste for waste acceptance purposes will be performed in strict compliance with the written MEF-specific Sampling and Analysis Plan developed by the FEMP Waste Characterization Group. The responsibilities remain unchanged regardless of whether the grab samples are collected from the mixing drum or from the filled White Metal Box.

2.1 Development of MEF-Specific Sampling and Analysis Plans

Prior to the beginning of processing for any MEF waste category, the FEMP Waste Characterization Group will develop MEF-specific Sampling and Analysis Plans to be followed by the Perma-Fix and FEMP personnel involved in the sampling. In developing these plans, the Waste Characterization Group will randomly select the containers to be sampled, will establish sample numbering protocol, will specify the number, size, and types of sampling containers to be filled, and the analyses to be performed. Copies of each MEF-specific Sampling and Analysis Plan will be provided to the Perma-Fix crew.

2.2 Identification of Waste Containers to be Sampled

Since the treatment process employed in this project often requires that waste be removed from its original container and repackaged for treatment, the identity of the waste to be sampled must be actively maintained throughout the treatment process. When waste is brought into the project area, the Perma-Fix and FEMP crews jointly identify the waste containers selected for sampling by their container inventory numbers. These containers are segregated so that none of them are inadvertently processed before the sampling campaign begins. After the MEF-specific Sampling and Analysis Plans have been received, the selected waste containers are grouped for processing so that the sampling campaign may be completed all in the same day of operation, and the containers are marked with colored stickers bearing the following information.

MEF Number
Original Drum Inventory Number
Assigned Sample Number

If the waste is to be repackaged before treatment, a duplicate identification label will be prepared and attached to the mixing drum after it has been filled with the waste from the original drum. In this way, the mixing drum has a visible marking on its exterior that shows the operator at the treated waste decanting station, all of the identity information he needs to properly sample the treated waste.

2.3 Sample Collection and Logging

When mixing drums that have been marked for sampling are brought to the Decanting Area, the Perma-Fix operator at that location will follow the MEF-specific Sampling and Analysis Plan in collecting and packaging samples of the treated waste. He will either sample the waste directly from the mixing drum before decanting, or from grid locations in the White Metal Box after the box has been filled. Before sampling, the operator will prepare each sample container and mark the lid and side of the container with the assigned sample number, using a permanent marking pen. At the time each sample is collected, the operator will record the following information in the Operations Log Book, along with a brief narrative of the sampling activity and any significant observations.

Date and Time of Sampling
Original Drum Inventory Number
MEF Number
Mixing Drum Number
Sample Number
White Metal Box Serial Number

When sampling is complete, the operator will provide the log book to the observer from the FEMP Waste Characterization Group who will copy the information into his or her sampling log.

2.4 Sample Storage and Security

When sampling is complete, the operator will transfer the sample containers to a storage cabinet inside the project exclusion zone, and will remove the lid of each sample container. The samples are stored with the lids off to aid in setting and curing, and to match the conditions of the waste in the White Metal Boxes, which remain open until setting and initial curing are complete. While the samples are in the cabinet, it will be kept locked, and only the operator who collected the samples will have the key. At the beginning and end of each operating shift, the operator will check the samples to determine whether they have set and are curing properly. When set has been achieved and all free water has been bound, the lids will be placed back on the containers and arrangements will be made with the FEMP Waste Characterization Group for custody transfer.

2.5 Custody Documentation and Transfer

Since the Perma-Fix Team is responsible for sampling and the FEMP Waste Characterization Group is responsible for sample transportation and analysis, it is necessary that transfer of samples from one party to another be fully documented. Documentation must completely identify the sample(s), the date and time of sampling, the sampler's name, the laboratory analyses requested for each sample, the date and time at which custody of the sample transfers to another party, and the identity of each party having custody.

For this project, chain-of-custody will be in accordance with the *FEMP Containerized Waste Sampling and Analysis Plan, Rev.1*. When properly executed, an unbroken evidentiary trail for the sample is provided from the time of collection to the time of analysis and reporting. At each transfer of sample custody, the party relinquishing custody of the sample signs a Chain-of-Custody Form and records the date and time of the transfer, and the party receiving the sample does the same. The procedures for completing the Chain-of-Custody Form are included in Section 7.0 of the Procedures Manual.

There are three primary means of documenting sampling and sample custody transfers; the Chain-of-Custody Form and the Operations Log Book discussed above, and the Operations Log Sheet. The Operations Log Sheet is a document which travels with the waste containers through the process, and is used by the operator at each work station to make a permanent record of required data, test results, and observations. Since the Operations Log Sheet contains a record of the Original Waste Container Inventory Number, the Waste Group Number, the MEF Number, the Mixing Drum ID Number, the White Metal Box ID Number, and the Sample ID Number, it provides a backup record for sample and waste traceability. The combination of the Chain-of-Custody Form, the Operations Log Book, the Operations Log Sheet, and the Laboratory Analysis Report for a specific waste sample provides complete documentation of the treatment, sampling and analysis of the waste in question.

Additional documentation and sample security requirements under the *FEMP Containerized Waste Sampling and Analysis Plan, Rev.1* include sealing the lids with tape, attaching a sample-specific label to the container, and attaching an initialed and dated tamper-revealing tape across the lid/container joint. The FEMP Waste Characterization Group will provide the completed sample container labels and the other sealing materials. The Perma-Fix operator will attach the labels, and sealing materials to each sample container prior to custody transfer.

All documentation will be completed in waterproof black or blue ink. Corrections must be marked with a single line, dated, and initialed. Handwritten documents must be legible. Serialized documents are not to be destroyed or discarded, even if illegible or inaccurate. Voided entries must be maintained with project files.

2.6 Analysis of Samples

Each waste acceptance grab sample will be extracted by the Toxicity Characteristic Leaching Procedure (TCLP) and the extract will be analyzed as needed for waste acceptance purposes. For waste acceptance samples, the analytes will be selected based on the NTS Waste Acceptance Criteria, as set forth in *Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements*, NVO-325 (Rev.1). Laboratory analysis will be performed by the FEMP or their subcontractor, but not by Perma-Fix.

2.7 Reporting, Data Validation and Record Keeping

Laboratory analytical results will be reported by the laboratory directly to the FEMP Waste Characterization Group. A subcontractor will validate the data and issue a final analysis report. The preliminary results, the final validated results, the MEF-specific Sampling and Analysis Plan, and pertinent sampling log information will be maintained in a file in the custody of the FEMP Waste Characterization Group. This file will be the official data archive. Copies of file information will be provided to Perma-Fix for their project file.

3.0 REFERENCES

The following documents are incorporated into this Generic Sampling and Analysis Plan by reference.

1. *FEMP Containerized Waste Sampling and Analysis Plan, Rev. 1*

2. *Test Method for Evaluating Solid Waste (SW-846)*

3. *Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements, NVO-325 (Rev. 1)*