U-004-303.7

3527

TREATABILITY STUDY REPORT FOR OPERABLE UNIT 2 JULY 1992

07-01-92

DOE-FN/EPA
289
REPORT

[redacted]

TREATABILITY STUDY REPORT
OPERABLE UNIT 2

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

REMEDIAL INVESTIGATION and FEASIBILITY STUDY

JULY 1992

U.S. DEPARTMENT OF ENERGY
FERNALD SITE OFFICE

DRAFT

3527

TREATABILITY STUDY REPORT
OPERABLE UNIT 2

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

REMEDIAL INVESTIGATION and FEASIBILITY STUDY

JULY 1992

U.S. DEPARTMENT OF ENERGY
FERNALD SITE OFFICE

DRAFT

2

TABLE OF CONTENTS

	Page
List of Tables	iv
List of Figures	vi
List of Acronyms	vii
Distribution List	ix
Executive Summary	ES-1
1.0 Introduction	1-1
1.1 Site Description	1-1
1.1.1 Site Name and Location	1-1
1.1.2 Site Description and History	1-1
1.1.3 Site Investigations and Activities	1-5
1.1.3.1 Geologic Investigations	1-5
1.1.3.2 Environmental Surveys	1-5
1.1.3.3 Ongoing CERCLA Removal Actions	1-6
1.2 Waste Stream Description	1-7
1.2.1 Solid Waste Landfill	1-7
1.2.2 Lime Sludge Ponds	1-12
1.2.3 Active Flyash Pile	1-12
1.2.4 Inactive Flyash Pile	1-12
1.2.5 South Field	1-12
1.3 Remedial Technology Description	1-12
1.3.1 Summary of Alternatives	1-12
1.3.1.1 Solid Waste Landfill	1-13
1.3.1.2 Lime Sludge Ponds	1-13
1.3.1.3 Flyash/South Field Area	1-14
1.3.2 Treatment Process and Scale	1-14
1.3.3 Operating Features	1-15
1.4 Previous Treatability Studies at the Site	1-16
1.5 Report Organization	
1.5.1 Sections 1 through 4	1-17
1.5.2 Appendices	1-17
2.0 Conclusions and Recommendations	2-1
2.1 Conclusions	2-1
2.2 Recommendations	2-2
3.0 Treatability Study Approach	3-1
3.1 Test Objectives and Rationale	3-1
3.1.1 Remedial Action Objectives	3-2
3.1.2 EPA Guidance	3-2

TABLE OF CONTENTS (continued)

	Page
3.1.3 Treatability Study Description	3-9
3.1.3.1 Specific Treatability Actions for Individual Waste Units within Operable Unit 2	3-11
3.1.3.2 General Selection Criteria	3-11
3.1.4 Leachate Action Levels	3-14
3.1.5 Performance Objectives and Desired Data	3-18
3.1.6 Data Quality Objectives	3-19
3.2 Experimental Design and Procedures	3-19
3.2.1 Preliminary Phase Screening (Stage 1)	3-19
3.2.1.1 Solid Waste Landfill Ash	3-23
3.2.1.2 Lime Sludge Ponds	3-28
3.2.1.3 South Field	3-28
3.2.1.4 Methods	3-28
3.2.1.5 Data Reported	3-28
3.2.2 Preliminary Screening (Stage 2)	3-29
3.2.3 Advanced Phase Testing	3-31
3.2.3.1 Reagent Mixtures	3-31
3.2.3.2 Data Requirements for Advanced Phase Testing	3-31
3.3 Equipment and Materials	3-31
3.4 Sampling and Analysis	3-35
3.4.1 Additional Sampling and Analysis Activities for Operable Unit 2	3-35
3.4.2 Additional Characterization of Waste for Treatability	3-35
3.4.3 Sample Volume for the Treatability Study	3-35
3.4.4 Geotechnical Testing	3-37
3.4.5 Quality Assurance Project Plan	3-37
3.5 Data Management	3-37
3.6 Deviations from Work Plan	3-41
3.6.1 Number of Samples Meeting UCS Requirements	3-41
3.6.2 Long-Term Study	3-41
3.6.3 Preliminary Remediation Goals	3-41
3.6.4 DQO Levels	3-41
3.6.5 Formulas	3-41
3.6.6 Requirements for Advanced Phase Testing	3-41
3.6.7 UCS Instrument Limitation	3-42
4.0 Results and Discussion	4-1
4.1 Treatability Test Results	4-2
4.1.1 Data Analysis and Interpretation	4-2
4.1.1.1 Data Plots	4-2

TABLE OF CONTENTS (continued)

	Page
4.1.1.2 Smoothing of Plotted Data	4-8
4.1.1.3 SPLOM Plot Interpretation	4-8
4.1.1.4 Empirical Equations	4-9
4.1.1.5 Actual Data Value Plots	4-10
4.1.1.6 Determination of Sample Distribution	4-11
4.1.1.7 Treatment of Nondetected Results	4-12
4.1.1.8 Upper and Lower Confidence Limits	4-12
4.1.2 Analysis of Waste Stream Characteristics	4-14
4.1.2.1 Leachability	4-22
4.1.2.2 Permeabilities	4-48
4.1.2.3 Stabilization - Solid Waste Landfill	4-49
4.1.2.4 Stabilization - Lime Sludge Ponds	4-58
4.1.2.5 Stabilization - South Field	4-80
4.1.2.6 Radon Testing	4-93
4.1.3 Comparison to Test Objectives	4-93
4.2 Quality Assurance/Quality Control	4-96
4.2.1 Run Blanks	4-96
4.2.2 Reagent Blanks	4-97
4.2.3 Spike Samples	4-97
4.2.4 Relative Percent Difference	4-98
4.2.5 Duplicate Samples	4-108
4.2.6 Completeness	4-108
4.3 Schedule/Cost for Performing the Treatability Study	4-108
4.4 Key Contacts for Operable Unit 2 Treatability Study	4-110
References	R-1
Appendix A - Characterization Data	
Appendix B - Clipper Printout	
Appendix C - Treatability Leachate Data	
Appendix D - Comparison PRG/HI/TCLP Regulatory Limits	
Appendix E - Methods	
Appendix F - Explanation of Changes for South Field Testing Criteria	

[redacted]

LIST OF TABLES

Table	Title	Page
1-1	Chemicals and Radionuclides of Potential Concern for Operable Unit 2 - Surface and Subsurface Media	1-8
3-1	Actual Number of Experiments for Cement Stabilization	3-10
3-2	Chemical, Radiological, and Physical Information to be Acquired in the Preliminary Phase	3-12
3-3	Chemical, Radiological, and Physical Information to be Acquired in the Advanced Phase	3-13
3-4	Relationship of Treatability Data to FS Evaluation Criteria	3-15
3-5	Summary of Analytical Levels	3-20
3-6	Stabilization Test Data Quality Objectives	3-21
3-7	Solid Waste Landfill Ash	3-24
3-8	Lime Sludge Ponds Waste, Preliminary Phase 1	3-25
3-9	South Field Waste	3-26
3-10	Lime Sludge Ponds, Preliminary Phase 2	3-30
3-11	Mixtures of Reagents with Clean Sand	3-32
3-12	Equipment and Materials	3-33
3-13	Additional Sampling Effort, Operable Unit 2	3-36
4-1	OU2 Solid Waste Landfill, Stage 1, Maximum and Minimum Percents of Reagents Relative to Waste	4-3
4-2	OU2 Lime Sludge Pond, Stage 1, Maximum and Minimum Percents of Reagents Relative to Waste	4-3
4-3	OU2 Lime Sludge Pond, Stage 2, Maximum and Minimum Percents of Reagents Relative to Waste	4-3
4-4	OU2 South Field, Stage 1, Maximum and Minimum Percents of Reagents Relative to Waste	4-3
4-5	OU2 Solid Waste Landfill Composition, Permeability, Bulking Factor, and UCS Results	4-4
4-6	OU2 Lime Sludge Pond, Stage 1 Composition, Permeability, Bulking Factor, and UCS Results	4-5
4-7	OU2 Lime Sludge Pond, Stage II Composition, Permeability, Bulking Factor, and UCS Results	4-6
4-8	OU2 South Field Composition, Permeability, Bulking, and UCS Results	4-7
4-9	Correlation Coefficient Test Results at a 95% Confidence Level	4-13
4-10	Critical Values for Student's t-Distribution	4-15
4-11	Solid Waste Landfill Chemical Characterization Data Comparison to Leachate Action Levels	4-16
4-12	Solid Waste Landfill Characterization Data Comparison to Radionuclide Leachate Action Levels	4-17
4-13	Lime Sludge Pond Chemical Characterization Data Comparison to Leachate Action Levels	4-18

LIST OF TABLES (Continued)

Table	Title	Page
4-14	Lime Sludge Pond Characterization Data Comparison to Radionuclide Leachate Action Levels	4-19
4-15	South Field Chemical Treatability Characterization Data Comparison to Leachate Action Levels	4-20
4-16	South Field Radionuclide Treatability Characterization Data Comparison to Leachate Action Levels	4-21
4-17	Solid Waste Landfill Treatability Comparison to Chemical Leachate Action Levels	4-23
4-18	Solid Waste Landfill Treatability Data Comparison to Radionuclide Leachate Action Levels	4-24
4-19	Lime Sludge Pond Chemical Treatability Data Comparison to Leachate Action Levels	4-25
4-20	Lime Sludge Ponds Radionuclide Treatability Data Comparison to Leachate Action Levels	4-26
4-21	South Field Chemical Treatability Data Comparison to Leachate Action Levels	4-27
4-22	South Field Treatability Data Comparison to Radionuclide Leachate Action Levels	4-28
4-23	Treated vs. Characterization Samples - Chemical Data Solid Waste Landfill - Raw Data	4-30
4-24	Treated vs. Characterization Data - Solid Waste Landfill, Raw Data	4-31
4-25	Lime Sludge Pond Comparison of Raw Data - Chemical	4-32
4-26	Lime Sludge Ponds - Chemical Characterization Data Compared to Treated Data	4-33
4-27	South Field Chemical Treated vs. Characterization Data, Raw Data	4-34
4-28	Treated vs Characterization Samples - South Field, Raw Data	4-35
4-29	Solid Waste Landfill, Treated Raw Data, Comparison to Characterization Raw Data	4-36
4-30	Solid Waste Landfill, Treated Spike & Dilution Corrected Data, Comparison to Characterization Spike Corrected Data	4-37
4-31	Lime Sludge Pond, Comparison of Raw Data Compounds Found in the Characterization and Treatability Data	4-38
4-32	South Field, Treated Dilution & Spike Corrected vs. Characterization Spike Corrected Data	4-39
4-33	Treated vs. Characterization Samples, Solid Waste Landfill	4-40
4-34	Treated vs Characterization - Solid Waste Landfill, Raw Data	4-41
4-35	Lime Sludge Pond, Comparison of Raw Characterization to Dilute Treatability - Radiological	4-42
4-36	Radiological Constituents Treatability Study, Lime Sludge Ponds, Raw Data	4-43
4-37	South Field, Comparison of Treated to Characterization Radiological Data	4-44
4-38	Solid Waste Landfill, Comparison of Treated to Characterizations, Raw and Dilution Radiological Data	4-46

LIST OF TABLES (Continued)

Table	Title	Page
4-39	Lime Sludge Pond, Comparison of Spike Corrected Characterization to Spike and Dilution Corrected Treated Data	4-47
4-40	Formulations Passing the Performance Criteria for the Solid Waste Landfill	4-60
4-41	Recommended Formulations to Meet Performance Goals for the Solid Waste Landfill	4-61
4-42	Formulations Passing the Performance Criteria for the Lime Sludge Ponds Area	4-78
4-43	Recommended Formulations to Meet Performance Goals for the Lime Sludge Ponds Area	4-79
4-44	Formulations Passing the Performance Criteria for the South Field Area	4-91
4-45	Recommended Formulations to Meet Performance Goals for the South Field Area	4-92
4-46	Percent Spike Recovery of Treatability Samples	4-99
4-47	Relative Percent Difference	4-101

LIST OF FIGURES

Figure	Title	Page
1-1	Operable Unit 2 Site Plan	1-2
3-1	Sitewide Remedial Action Objectives	3-3
3-2	The Role of Treatability Studies in the RI/FS and RD/RA Process	3-6
3-3	Relationship of the Operable Unit 2 Treatability Studies to the RI/FS Process	3-7
3-4	Flow Chart of Treatability Testing for Operable Unit 2	3-27
3-5	TDL Analytical Information	3-39
3-6	Formulation Information	3-40
4-1	Bargraph UCS vs Treatability Sample Number for the Solid Waste Landfill	4-50
4-2	Bargraph Bulking Factor vs Treatability Sample Number for the Solid Waste Landfill	4-51
4-3	SPLOM Plot for Solid Waste Landfill	4-52
4-4	3-D Plot of UCS as of Function of Normalized Flyash and Cement Loadings for Solid Waste Landfill	4-53
4-5	3-D Plot of Linear Bulking Factor as a Function of Normalized Cement and Flyash Loadings for Solid Waste Landfill	4-55
4-6	Linear Contour Plots of Bulking Factor as a Function of Normalized Cement and Fly Ash Loadings for Solid Waste Landfill	4-56
4-7	Plot of Post Bulk Factor Values vs Estimated Bulking Factor Values with a 90% Confidence Limits for the Solid Waste Landfill	4-57
4-8	Procedure for UCS vs Bulking Factor Using the DWLS for Solid Waste Landfill	4-59
4-9	Bargraph of UCS vs Treatability Sample Number for Lime Sludge Pond - Stage 1	4-62
4-10	Bargraph of UCS vs Treatability Sample Number for Lime Sludge Pond - Stage 2	4-63
4-11	Bargraph of Bulking Factor vs Treatability Sample Number for Lime Sludge Pond - Stage 1	4-64
4-12	Bargraph of Bulking Factor vs Treatability Sample Number for Lime Sludge Pond - Stage 2	4-65
4-13	SPLOM Plot for Lime Sludge Pond	4-67
4-14	Alternative Plot of UCS vs Flyash Loading for Lime Sludge Pond	4-68
4-15	3-D plots of UCS as a Function of Normalized Flyash and Cement Loadings for Lime Sludge Pond	4-69
4-16	3-D Plot of DWLS-UCS as a Function of Normalized Flyash and Cement Loadings for Lime Sludge Pond	4-70
4-17	Plot for DWLS Contour-UCS for Lime Sludge Pond	4-72
4-18	3-D Plot of DWLS-Bulking Factor as a Function of Normalized Cement and Flyash Loadings for Lime Sludge Pond	4-73

LIST OF FIGURES (Continued)

Number	Title	Page
4-19	Plot of DWLS Contour-Bulking Factor for Lime Sludge Pond	4-74
4-20	UCS vs Bulking Factor for Lime Sludge Pond - Stage 1	4-75
4-21	Plot of Bulk Factor Values vs Estimated Bulking Factor Values with 90% Confidence Limits for the Lime Sludge Pond	4-77
4-22	Bargraph of UCS vs Treatability Sample Number for South Field	4-81
4-23	Bargraph of Bulking Factor vs Treatability Sample Number for South Field	4-82
4-24	SPLOM Plot for South Field	4-83
4-25	3-D Plot of Linear-UCS as a Function of Normalized Flyash and Cement Loadings for South Field	4-84
4-26	Linear Contour Plot of UCS as a Function of Normalized Cement and Flyash Loadings for South Field	4-85
4-27	3-D Plot of Linear-Bulking Factor as a Function of Normalized Flyash and Cement for South Field	4-87
4-28	Linear Contour Plot of Bulking Factor as a Function of Normalized Cement and Flyash Loadings for South Field	4-88
4-29	UCS vs Bulking Factor for South Field	4-89
4-30	Plot of Bulking Factor Values vs Estimated Bulking Factor Values with 90% of Confidence Limits, South Field	4-90
4-31	OU2 Treatability Study Schedule	4-109
4-32	Treatability Study Management and Staffing	4-111

LIST OF ACRONYMS

AEC	Atomic Energy Commission
ARAR	applicable or relevant and appropriate requirements
ASTM	American Society of Testing and Materials
CaO	Calcium Oxide
CDF	Control density flow
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIS	Characterization Investigation Study
CLP	Contract Laboratory Program
DAF	dilution/attenuation factor
DL	Detection Limit
DOE	U.S. Department of Energy
DQO	data quality objective
DWLS	Distance weighted least square
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FFCA	Federal Facility Compliance Agreement
FMPC	Feed Materials Production Center
HI	Hazard index
HSL	Hazardous Substances List
LCL	Lower confidence limit
MCLG	maximum contaminant level goals
MDC	Minimum detectable concentration
MGLH	Multivariate general linear hypothesis
MTCLP	modified toxicity characteristic leaching procedure
NCP	National Contingency Plan
NLO	National Lead Company of Ohio
NRC	Nuclear Regulatory Commission
O&M	Operations and Maintenance
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
QCC	quality control coordinator
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RG	remediation goal
RI/FS	remedial investigation/feasibility study
ROD	record of decision
RPD	relative percent difference

RSC	Relative square contribution
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SOP	Standard operating procedure
SQL	Samples quantitation limit
SSM	shallow soil mixing
TBC	(guidance) to be considered
TC	Toxicity characteristic
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TDL	Technology Development Laboratory
THI	target hazard index
THQ	target hazard quotient
UCL	Upper confidence limit
UCS	unconfined compressive strength
WEMCO	Westinghouse Environmental Management Company of Ohio
WMCO	Westinghouse Materials Company of Ohio

DISTRIBUTION LIST

Project Director - John Wood, Fernald
Deputy Project Director - John Razor Fernald
Site Characterization Director - Douglas Harmel, Fernald
Technical Integration Director - Ed Hopson, Fernald
Operable Unit/Task Manager - Mike Higgins, Knoxville
David Smith, Fernald
Susan Rhyne, Knoxville
John Martin, Fernald
John Frazier, Knoxville
Clifford Duke, Fernald
Dan Stropes, Fernald
Fletcher Armstrong, Oak Ridge
Jerry Klein, Pittsburgh
Project QA Officer - Larry Sexton, Fernald
Technical QA Officer - Steve Alvanas, Knoxville
Site Project Files - Fernald
IT - Monroeville Project Central Files
IT - Knoxville Project Central Files
ASI - Oak Ridge Project Files

DOE COR - Jack Craig, Fernald
Johnny Reising
Robert Skalka

Parsons - Kathryn Riedel

DOE HQ - Washington, DC

U.S. EPA, Region 5 - James Saric, Chicago
OEPA - Graham Mitchell, Dayton

EXECUTIVE SUMMARY

As part of the ongoing remedial investigation/feasibility study at the Fernald Environmental Management Project (FEMP), treatability studies were conducted for solid wastes located in Operable Unit 2. As a result of the initial screening of remedial alternatives under the FS, cement stabilization was identified as a potential treatment technology for these wastes. The purpose of this study was to provide sufficient technical data on the application of this technology to complete the remedial alternative evaluation process and to support the remedy selection for Operable Unit 2. The treatability test program was defined in a Treatability Study Work Plan which was prepared in accordance with U.S. Environmental Protection Agency (EPA) guidance and subsequently approved by EPA.

The treatability test program was designed to investigate the effect of various common inorganic stabilization reagents on the performance of the treated waste. Stabilization reagents included portland cement, fly ash (from the on-property piles), sodium silicate, and two adsorbents—clinoptilolite and attapulgite. Treatment performance was determined by analyzing the stabilized waste forms for two primary and two secondary criteria. Primary criteria were material strength, as measured by unconfined compressive strength (UCS) and contaminant leachability, as measured by the EPA toxicity characteristic leaching procedure (TCLP). Secondary criteria were water permeability and volume increase, or bulking factor. A variety of other parameters were also measured to help assess the initial and curing characteristics of the stabilized waste mixtures as well as the stabilization process.

The wastes that were subjected to treatability testing represented the Solid Waste Landfill, the Lime Sludge Ponds, and the South Field. In addition, flyash from both the Active and Inactive Flyash Piles was incorporated into the testing program as a reagent in the stabilization formula. Composite samples were prepared for each material using existing boring cuttings generated during the site characterization effort, except for the Lime Sludge Ponds, for which samples were specifically taken for the treatability tests. The composite wastes were prepared for stabilization by blending, sieving and grinding to provide uniform composition and a particle size suitable for mixing with stabilization reagents. In addition, for the Solid Waste Landfill, the composite waste was ashed in a laboratory furnace to simulate the incineration pretreatment which has been included as part of the remedial alternative for this waste.

The experimental approach involved two phases of testing. Preliminary phase screening examined a wide range of reagent formulas with the resulting UCS values used to establish which formulas were potentially suitable. A modified version of the TCLP that required small amounts of sample to be analyzed for indicator compounds was performed on the screening specimens as an initial check on leachate quality. A matrix of initial formulas was developed for each waste that was intended to yield a reasonable number that met the UCS criteria. A second stage of screening using higher reagent

dosages was employed if an insufficient number of passing formulas was achieved. The advanced phase testing involved subjecting the passing formulas to standard TCLP tests, including radionuclide analysis, and permeability measurements.

The results of the study demonstrate that cement stabilization is effective as a treatment technology for Solid Waste Landfill, Lime Sludge Ponds, and South Field wastes. A number of formulas were identified for each waste that produced a stabilized waste form that met the physical and proposed leaching criteria. UCS values of 350-500 psi were achieved, concentrations of contaminants in TCLP leachates were below (and generally well below) toxicity characteristic regulatory or proposed leachate action levels, and permeabilities were below 10^{-7} cm/sec for those formulas that met the UCS criteria. Volume increase varied considerably depending on the waste and the reagents used. For formulas that met UCS and TCLP criteria, resulting in volume increases of approximately 115 percent. A variety of statistical data analysis techniques were applied to the test results to determine the relationships between the different reagents and the performance results. Increasing portland cement dosage always improved performance as measured by UCS, whereas the dosage of other reagents produced different effects depending on the reagent and the waste. FEMP flyash did not appear to be very functional as a substitute in formulas for portland cement.

The results of this treatability study meet all of the treatability study objectives and provide necessary input for remaining elements of the FS process, including contaminant transport modeling, risk assessment, and detailed technical and cost analysis of the remedial alternatives that include cement stabilization. This study has identified what types of stabilization formulas should be applicable and what the relative importance of each reagent is to the performance.

The study results are based on specific samples from each waste area and on very small scale experiments designed to meet EPA remedy screening and remedy selection guidance. Additional information is considered important for the purposes of designing a cement stabilization process for any or all of the Operable Unit 2 wastes. Further investigations as part of the remedy design testing should evaluate the effect of water and the adsorbents on performance which would potentially lead to improved formulas (e.g., lower bulking and reagent use). Evaluation of the physical characteristics of reagent-waste mixtures during and following processing (during curing) should be done using larger-scale equipment. Testing on a larger scale would also enable the effect of waste heterogeneity on the stabilization formulas to be assessed. For the Solid Waste Landfill, such testing could utilize actual incinerated waste as the feed material. Selection of optimum formulas and processing techniques will be based on this information as well as the specific performance criteria used in this study.

1.0

15A

1.0 INTRODUCTION

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires that actions selected to remedy hazardous waste sites be evaluated for their ability to "permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants." When treatment is proposed as part of one or more remedial alternatives, treatability studies provide the necessary site-specific data to support the evaluation and the CERCLA remedial activities. This document contains the remedial investigation/feasibility study (RI/FS) Treatability Study Report applicable to Operable Unit 2, located at the Fernald Environmental Management Project near Fernald, Ohio. This treatability study was performed in accordance with the Treatability Study Work Plan for Operable Unit 2, dated October 1991.

The purpose of this study was to provide additional information about stabilization of Operable Unit 2 surface/subsurface soils (media) to support the FS and subsequent remedy selection. The study was designed to demonstrate that stabilization can achieve a desired level of material strength and provide quantitative data to assess the relative effectiveness of the removal and nonremoval alternatives being evaluated. These comparisons will be performed in the detailed analysis of alternatives.

The actual tests performed for this study were conducted by the Technology Development Laboratory (TDL) of IT Corporation (IT) between September 1991 and April 1992.

1.1 SITE DESCRIPTION

1.1.1 Site Name and Location

The Feed Materials Production Center (FMPC), renamed on August 23, 1991 and hereinafter called the Fernald Environmental Management Project (FEMP), is a contractor-operated federal facility where pure uranium metals were produced for the U.S. Department of Energy (DOE) between 1951 and 1989. The FEMP property is located on 1050 acres in a rural area of Hamilton and Butler counties approximately 18 miles northwest of Cincinnati, Ohio with a production area of about 136 acres near its center. The villages of Fernald, New Baltimore, Ross, New Haven, and Shandon are all located within a few miles of the FEMP property. Figure 1-1 depicts the location of Operable Unit 2 waste disposal areas and monitoring wells within the FEMP property.

1.1.2 Site Description and History

The U.S. Atomic Energy Commission (AEC), predecessor to DOE, established the FEMP for processing uranium and its compounds from natural uranium ore concentrates and recycled recoverable residues for government needs. This integrated production complex began operations in conformance with AEC Orders in the early 1950s. In 1951, National Lead Company of Ohio (now NLO Inc.) entered into contract with AEC as Operations and Maintenance Contractor. This contractual

3527

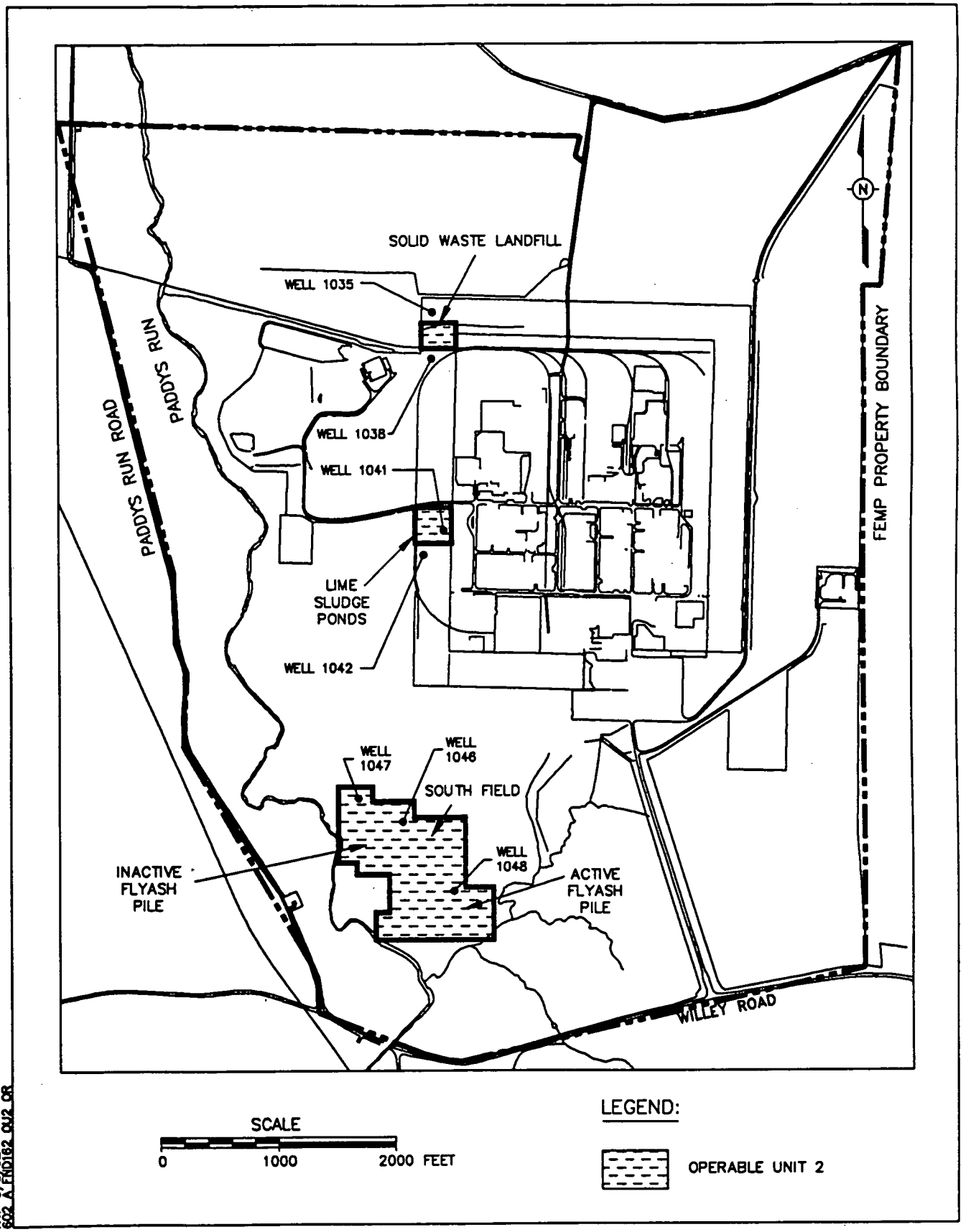


FIGURE 1-1. OPERABLE UNIT 2 SITE PLAN

relationship lasted with AEC, and eventually DOE, until January 1, 1986. Westinghouse Materials Company of Ohio (WMCO), a wholly owned subsidiary of Westinghouse Electric Corporation, then assumed management responsibilities of the site operations and facilities for a minimum of five years. In 1991 Westinghouse Electric Corporation renamed this subsidiary the Westinghouse Environmental Management Company of Ohio (WEMCO).

On July 18, 1986, a Federal Facility Compliance Agreement (FFCA) pertaining to environmental impacts associated with the FEMP was signed by DOE and the U.S. Environmental Protection Agency (EPA). The FFCA was entered into pursuant to Executive Order 12088 (43FR47707) to ensure compliance with existing environmental statutes and implementing regulations such as the Clean Air Act, the Resource Conservation and Recovery Act (RCRA), and CERCLA. In particular, the FFCA was intended to ensure that environmental impacts associated with past and present activities at the FEMP are thoroughly and adequately investigated so that appropriate remedial response actions can be formulated, assessed, and implemented. In response to the FFCA, a RI/FS was initiated pursuant to CERCLA, as amended by the Superfund Amendment and Reauthorization Act (SARA). All RI/FS activities are being conducted in conformance with EPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988a).

The 1986 FFCA was amended by a Consent Agreement under Section 120 and 106(a) of CERCLA (Consent Agreement) in order to achieve consistency with the operable unit concept and the commitments of the RI/FS program without modifying the underlying objectives. The Consent Agreement was signed on April 9, 1990 and became effective on June 29, 1990.

The Consent Agreement was then amended the next year to include revised schedules for completing the RI/FS for the five operable units. This Amended Consent Agreement was signed on September 20 and became effective on December 19, 1991.

A pilot plant was completed in 1951 and was the first operational facility at the FEMP; a metals fabrication plant (Plant 6) began operations in 1952. A sampling plant (Plant 1), the refinery (Plants 2 and 3), the green salt plant (Plant 4), two metals production plants (Plants 5 and 6), and recovery plant (Plant 8) began operations in 1953. Plant 7, where uranium hexafluoride (UF_6) was processed, and Plant 9, the special products plant, began operations in 1954.

Production peaked in 1960 at approximately 10,000 metric tons of uranium (mtu) per year. A product decline began in 1964 and reached a low in 1975 of about 1230 mtu. During the 1970s, consideration was given to closing the FEMP; therefore, capital improvements and staffing were minimized. The staffing level, which peaked at 2891 in 1956, slowly declined from 662 in 1972 to 538 in 1979. In 1981, the FEMP began planning to accommodate increased production requirements. Production

levels significantly increased and there was a rapid staff buildup in many areas for several years. Implementation of a major facilities restoration program followed. Then production ceased in the summer of 1989 and plant resources were focused on a cleanup program. In June 1991, the FEMP was officially closed as a federal production facility; however, the environmental studies and cleanup activities continue.

Historically, a variety of chemical and metallurgical processes were utilized at the FEMP for the manufacture of uranium products. During the manufacturing process, high quality uranium compounds were introduced into the FEMP processes at several points. Impure starting materials were dissolved in nitric acid and the uranium was purified through solvent extraction to yield a solution of uranyl nitrate. Evaporation and heating converted the nitrate solution to uranium trioxide (UO_3) powder. This compound was reduced with hydrogen to uranium dioxide (UO_2) and then converted to uranium tetrafluoride (UF_4) by reaction with anhydrous hydrogen fluoride. Uranium metal was produced by reacting UF_4 and magnesium metal in a refractory-lined vessel. This primary uranium metal was then remelted with scrap uranium metal to yield a purified uranium ingot. Various uranium metalworking processes were also housed on the FEMP.

From 1953 through 1955, the FEMP refinery processed pitchblende ore from the Belgian Congo. Pitchblende ore contains all progeny products of uranium decay and is particularly high in radium content. No chemical separation or purification was performed on the ore prior to arrival at the FEMP. Beginning in 1956, the refinery feedstock consisted of uranium concentrates (yellowcake) from Canada and the United States. Canadian concentrates were not processed after 1960. In the production of these concentrates, most of the uranium progeny had been removed; however, radium-226 (Ra-226) remained in the yellowcake in amounts that varied with the process.

Small amounts of thorium were produced at the FEMP on several occasions from 1954 through 1975. Thorium operations were performed in the metals fabrication plant, the recovery plant, the special projects plant, and the pilot plant. The FEMP currently serves as the thorium repository for DOE and maintains long-term storage facilities for a variety of thorium materials.

Large quantities of liquid and solid wastes were generated by the various operations at the FEMP. Before 1984, solid and slurried wastes from FEMP processes were disposed of in the on-property waste storage area. This area, which is located west of the production facilities, includes six low-level radioactive waste storage pits; two earthen-bermed concrete silos containing K-65 residues, which are high specific activity, radium-bearing residues resulting from the pitchblende refining process; one concrete silo containing metal oxides and one unused concrete silo; two lime sludge ponds; and a solid waste landfill. The waste storage area is addressed under Operable Units 1, 2, and 4.

Additional waste materials associated with uranium metals production are presently stored on property in steel drums awaiting further processing or off-site disposal at approved facilities. These wastes include oils, sludges, contaminated combustibles, filter cake, off-specification UF_4 or thorium tetrafluoride (ThF_4), reject UO_3, and other process residues. The drums, which are inspected weekly, sit on various pads and in warehouses. Contents of deteriorated drums are repackaged. Other wastes, stored in drums on contained surfaces, include spent degreasing solvents and material contaminated with polychlorinated biphenyls (PCBs).

The active and inactive flyash piles, addressed under Operable Unit 2, are located approximately 3000 feet south-southeast of the waste storage area. The active flyash pile is currently receiving flyash from the FEMP coal-fired boiler plant. An area between and adjacent to the flyash areas, known as the South Field, is believed to be the disposal site for construction and demolition debris and possibly other types of solid waste from FEMP operations. The South Field is also being addressed as a waste area under Operable Unit 2.

1.1.3 Site Investigations and Removal Activities

Several site investigations and some removal activities have been performed. Two of these investigations and the ongoing removal actions that affect Operable Unit 2 waste areas are described in the following sections.

1.1.3.1 Geologic Investigations

Geologic investigations of the area that surrounds and includes the FEMP have contributed substantial information to the RI/FS process. Fenneman (1916) performed an extensive survey of the geology of the Cincinnati area. This report describes in detail the interbedded limestone and shale bedrock and its mantle of glaciofluvial and alluvial sediments that comprise the buried channel aquifers in southwestern Ohio. Later investigators such as Durrell (1961) supported the earlier observations of Fenneman. The shape of the buried channel aquifer was further refined by Watkins and Spieker (1971) via geophysical surveys of the area around Fernald. More recent information includes various maps of the geology of Hamilton and Butler counties, Ohio, and individual quadrangle maps of areas located in those counties (Leow 1985; Vormelker 1985; Ford 1974; Swinford in preparation). Maps showing the extent and age of glacial overburden in the study area have also been produced (Brockman 1986), and the Soil Conservation Service has performed soil surveys of Butler and Hamilton counties, Ohio (USDA 1980, 1982).

1.1.3.2 Environmental Surveys

For more than 10 years, the environment in and around the FEMP has been closely monitored by DOE (Battelle et al. 1977; DOE 1985 and 1987), Oak Ridge Associated Universities (ORAU 1985), various FEMP-related committees (WMCO 1986 and 1987; Fleming and Ross 1984), and various contracted

groups (IT 1986; Weston 1986; Battelle 1981). The DOE and ORAU documents include environmental impact assessments, RI/FS studies, and environmental surveys. Internal reports of studies by NLO and WMCO include the annual Environmental Monitoring Reports and the Aquifer Contamination Control Reports (various authors 1965-present). These documents are available through DOE. The contracted studies represent more comprehensive environmental sampling and analysis programs and contain analytical results from a large number of groundwater, surface water, sediment, soil, and air samples. The analytical constituents include radionuclides, organic compounds, metals, and general water quality parameters. A sampling and analysis program to comply with RCRA provisions is also ongoing at the FEMP.

1.1.3.3 Ongoing CERCLA Removal Actions

One removal site evaluation and three removal actions that directly impact Operable Unit 2 are ongoing at the FEMP. The activities are:

- A removal site evaluation to investigate lead contamination in the South Field due to spent ammunition in the firing range
- The Active Flyash Pile Control Removal Action
- The Inactive Flyash Pile/South Field Disposal Area Removal Action
- The Waste Pit Area Storm Water Runoff Control Removal Action

A removal site evaluation to assess lead contamination due to the firing range is currently being prepared. In January and February 1992, vertical and horizontal soil borings were completed in the western embankment of the South Field, just east of the FEMP running track. Soil samples were analyzed for organic, inorganic, and radiological contaminants. This evaluation was initiated due to concerns that long-term use of the firing range may have resulted in significant lead contamination in the South Field. The removal site evaluation will assess whether lead contamination is of a nature and extent that a removal action must be initiated. The evaluation is scheduled to be completed by September 30, 1992.

The specific objective of the Active Flyash Pile Control Removal Action, a time-critical removal action, is to mitigate the potential for wind and water erosion of the existing Active Flyash Pile at the FEMP site. This will be accomplished by implementing the following activities: (1) installation of a silt trap made from permeable geotextile fabric around the toe of the flyash pile; (2) installation of a wind barrier, made from high-density polyethylene, around the top perimeter of the pile; (3) alteration of the active working surface to minimize the noncompacted area and to prevent an increase in the maximum height of the existing pile; (4) minor regrading of the pile and compacting its nonworking top surfaces; (5) application of water, foam, and binding type dust-control agents on the side slopes

and top; and (6) providing periodic routine inspection and necessary maintenance identified during inspection. Planning and design of the removal action began in December 1991. Implementation began in June 1992 and is scheduled for completion in December 1992.

The Inactive Flyash Pile/South Field Disposal Area Removal Action consists of the installation of warning signs and a chain-link barrier around the perimeter of the waste areas to control and limit access. During the course of the removal action, walk-over radiation surveys were conducted over the entire area to define those locations that should be delineated as regulated areas. Implementation activities began in September 1991 and were completed by April 30, 1992. The report to EPA was due June 30, 1992.

The Waste Pit Area Storm Water Runoff Control Removal Action, a nontime-critical removal action, is a sequence of engineering controls being implemented to control, capture, and treat contaminated storm water runoff from the waste pit area. In addition to Operable Units 1 and 4, the waste pit area encompasses a portion of Operable Unit 2, the Solid Waste Landfill and the Lime Sludge Ponds. The control measures will halt the runoff of surface waters to Paddys Run. Construction for the removal action began in 1991.

1.2 WASTE STREAM DESCRIPTION

The following subsections provide a brief summary of the characterization of the waste materials for each Operable Unit 2 waste area, based on RI data. Chemicals of potential concern for each of the five waste areas in Operable Unit 2 are listed in Table 1-1. Concentrations of contaminants determined by the 1987 site characterization data in the waste at each area are presented in Appendix A. Radionuclides, metals, cyanide, and organic compounds were detected in all areas.

Sample volumes for the treatability study came from archived drill cuttings stored on site in 55-gallon drums. The drill cuttings were segregated by boring in the specific waste area from the most recent sampling effort and were archived under RI/FS chain-of-custody protocols. The samples from the drums represented a composite sample for that specific waste area. The treatability samples used for the Lime Sludge Ponds were collected from near the locations where previous characterization samples had been taken.

1.2.1 Solid Waste Landfill

The Solid Waste Landfill was organized into five individual cells, the adjacent original disposal area, and an evaporation pond. The five cells are filled to capacity and no longer in service; a soil cover has been placed over the cells and the original disposal area. The evaporation pond, which was used for collecting storm water runoff, has been backfilled with soil.

TABLE 1-1

CHEMICALS AND RADIONUCLIDES OF POTENTIAL CONCERN FOR OPERABLE UNIT 2 - SURFACE AND SUBSURFACE MEDIA[a]

Organic Chemicals				
Volatiles				
Solid Waste Landfill	Lime Sludge Ponds	Active Flyash Pile	Inactive Flyash Pile	South Field
Acetone	Acetone	Acetone	Acetone	Acetone
2-Butanone	2-Butanone	Benzene	2-Butanone	Bromodichloromethane
Chlorobenzene	Carbon Disulfide	2-Butanone	Carbon disulfide	2-Butanone
Chloromethane	1,1-Dichloroethane	Carbon Disulfide	2-Hexanone	Chloroform
Dichlorodifluoromethane	2-Hexanone	Chloroform	4-Methyl-2-pentanone	2-Hexanone
1,1-Dichloroethane	Methylene chloride	1,1-Dichloroethene	Methylene chloride	4-Methyl-2-pentanone
1,2-Dichloroethane	Toluene	4-Methyl-2-pentanone	Toluene	Methylene chloride
1,2-Dichloroethene	1,1,2-Trichloro-1,2,2-trifluoroethane	Methylene Chloride	1,1,1-Trichloroethane	Styrene
1,4-Dioxane		Toluene	Trichloroethene	Toluene
Ethylbenzene		1,1,1-Trichloroethane		Total xylenes
2-Hexanone				
4-Methyl-2-pentanone				
Methylene chloride				
Pyridine				
Styrene				
Tetrachloroethene				
Toluene				
Trichlorofluoromethane				
Total xylenes				

TABLE 1-1
(Continued)

Semivolatiles				
Solid Waste Landfill	Lime Sludge Ponds	Active Flyash Pile	Inactive Flyash Pile	South Field
Acenaphthene	Benzoic acid	Benzoic acid	Bis(2-ethylhexyl)phthalate	Acenaphthene
Anthracene	Bis(2-ethylhexyl)phthalate	Bis(2-ethylhexyl)phthlate	Benzoic acid	Anthracene
Benzoic acid	Butylbenzylphthalate	4-Chloro-3-methylphenol	Benzo(a)anthracene	Benzoic acid
Benzo(a)anthracene	Di-n-butylphthalate	2-Chlorophenol	Benzo(a)pyrene	Benzo(a)anthracene
Benzo(a)pyrene	Phenol	Di-n-butylphthalate	Benzo(b)fluoranthene	Benzo(a)pyrene
Benzo(b)fluoranthene		Di-n-octylphthalate	Benzo(k)fluoranthene	Benzo(b)fluoranthene
Benzo(g,h,i)perylene		2-Methyl naphthalene	Chrysene	Benzo(g,h,i)perylene
Benzo(k)fluoranthene		Naphthalene	Fluoranthene	Bis(2-chloroisopropyl)ether-
Bis(2-ethyhexyl)phthalate		4-Nitrophenol	Phenol	Bis(2-ethylhexyl)phthalate
Butylbenzylphthalate		Phenanthrene	Pyrene	Chrysene
Chrysene		Phenol		Dibenz(a,h)anthracene
Dibenz(a,h)anthracene				Dibenzofuran
Dibenzofuran				Diethylphthalate
2,4-Dimethylphenol				Di-n-octylphthalate
Di-n-butyl phthalate				Fluoranthene
Di-n-octyl phthalate				Fluorene
Fluoranthene				Indeno(1,2,3-cd)pyrene
Fluorene				2-Methylnaphthalene
Indeno(1,2,3-cd)pyrene				Phenanthrene
2-Methylnaphthalene				Pyrene
2-Methylphenol				
4-Methylphenol				
Naphthalene				
n-Nitrosodiphenylamine				
Pentachlorophenol				
Phenanthrene				
Phenol				
Pyrene				

TABLE 1-1
(Continued)

Solid Waste Landfill	Lime Sludge Ponds	Active Flyash Pile	Inactive Flyash Pile	South Field
Pesticides/PCBs				
Aroclor-1242	Aroclor-1248		Aroclor-1254	Aroclor-1242
Aroclor-1248	Chlordane		Aroclor-1260	Aroclor-1254
Aroclor-1254				Aroclor-1260
Aroclor-1260				
Dioxins/Furans				
Heptachlorodibenzo-p-dioxin				
Heptachlorodibenzofuran				
1,2,3,4,6,7,8-Heptachlorodibenzofuran				
Octachlorodibenzo-p-dioxin				
Octachlorodibenzofuran				
Inorganic Chemicals				
Antimony	Antimony	Antimony	Antimony	Antimony
Boron	Boron	Arsenic	Arsenic	Boron
Cyanide	Cyanide	Beryllium	Barium	Cobalt
Lead	Mercury	Copper	Beryllium	Cyanide
Molybdenum	Silver	Cyanide	Cyanide	Lead
Nickel		Lead	Lead	Manganese
Silicon		Molybdenum	Mercury	Mercury
Silver		Nickel	Molybdenum	Molybdenum
Zinc		Selenium	Selenium	Nickel
		Silver		Silver
		Zinc		

TABLE 1-1
(Continued)

Radionuclides				
Solid Waste Landfill	Lime Sludge Ponds	Active Flyash Pile	Inactive Flyash Pile	South Field
Pu-238	Cs-137	Ra-224	Cs-137	Cs-137
Ra-226	Np-237	Ra-226	Pb-210	Pb-210
Ra-228	Pb-210	Ra-228	Pu-239/240	Pu-239/240
Sr-90	Pu-238	Sr-90	Ra-224	Ra-226
Th-228	Pu-239/240	Th-228	Ra-226	Ra-228
Th-230	Ra-226	Th-230	Ra-228	Sr-90
Th-232	Sr-90	Th-232	Sr-90	Th-228
Total thorium	Tc-99	Total Thorium	Tc-99	Th-230
Total uranium	Th-228	Total Uranium	Th-228	Th-232
U-234	Th-230	U-234	Th-230	Total uranium
U-235/236	Th-232	U-235/236	Th-232	Total thorium
U-238	Total thorium	U-238	Total thorium	U-234
	Total uranium		Total uranium	U-235/236
	U-234		U-234	U-238
	U-235/236		U-235/236	
	U-238		U-238	

[a]See final Risk Assessment Work Plan Addendum (DOE 1992).

The Solid Waste Landfill was used for the disposal of cafeteria waste, rubbish, and other types of waste from nonprocess areas. Materials reportedly accepted include nonburnable and nonradioactive solid wastes generated on property, nonradioactive construction-related rubble, and double-bagged and bulk quantities of nonradioactive asbestos (DOE 1988a; Weston 1987b). Construction rubble placed in the landfill and the soil used to cover exposed wastes may be contaminated with radionuclides (DOE 1988a). Use of the landfill was halted in early 1986.

1.2.2 Lime Sludge Ponds

The North Lime Sludge Pond is an unlined pond that receives spent lime sludge. It is approximately 90 percent filled and has a previously reported lime sludge depth of 6 to 8 feet as estimated by DOE (1988) and 5 to 7 feet as reported by Weston (1988). This pond is partially covered with water that ranges from 0 to 7 feet in depth. The volume of water can vary, depending on plant operations and precipitation. Spent lime sludge from FEMP water treatment operations, sludge from neutralization of boiler plant blowdown, and coal pile storm water runoff (WEMCO 1989) are pumped to this pond and allowed to settle.

The South Lime Sludge Pond is an unlined pond now overgrown with grass and shrubs. Borehole log information (Weston 1988) indicates the depth of the South Pond to be approximately 11.5 feet. This pond has been inactive since the mid-1960s.

1.2.3 Active Flyash Pile

This waste disposal area has received flyash resulting from the combustion of coal as part of the FEMP boiler plant operations. Flyash from the mechanical and electrostatic precipitators is combined with bottom ash and hauled to the Active Flyash Pile. It has been reported but not documented that, in the past, PCB- and uranium-contaminated waste oils were sprayed onto both flyash piles on a periodic basis as a means of dust control (DOE 1988; Weston 1987). It has not been possible to verify if the uranium present in the piles is a result of this practice.

1.2.4 Inactive Flyash Pile

This disposal area received flyash from the FEMP boiler plant starting in 1951; building rubble (such as concrete, gravel, asphalt, masonry, and steel rebar) was also discarded at this site. The historical photographs indicate that disposal activity at this location ceased between 1964 and 1968.

1.2.5 South Field

The South Field is a large, heterogeneous area that overlaps the boundary of the Inactive Flyash Pile. The South Field was reportedly used as a burial site for construction and demolition rubble and soils that may have contained low levels of radioactivity, including debris from the razing of the old administration building.

1.3 REMEDIAL TECHNOLOGY DESCRIPTION

1.3.1 Summary of Alternatives

The following sections discuss alternatives for each of the Operable Unit 2 waste areas. A comprehensive description of these alternatives is contained in the final Initial Screening of Alternatives Report for Operable Unit 2 (DOE 1991). The alternatives listed represent those which remained after the initial screening phase and are proposed for further analysis as part of the FS. The no-action alternative (Alternative 0) was retained for each of the waste areas as a baseline for comparison only and would involve no implementation of corrective action, although ongoing water quality monitoring would continue. Alternatives dealing with perched groundwater have been dropped or curtailed since this media has been assigned to Operable Unit 5. Alternative numbers remain the same as those used during initial screening.

1.3.1.1 Solid Waste Landfill

Alternative 1: Containment

Under this alternative, the waste would remain in place. Access restrictions, monitoring activities, capping, and runoff control would be implemented.

Alternative 5: Removal and Treatment of Waste and On-Property Disposal

This alternative combines access restrictions, monitoring, and runoff control with mechanical removal, treatment, and on-property disposal of waste materials. The technologies proposed for waste treatment are rotary kiln incineration followed by stabilization with a cement/flyash mixture, applying a process similar to that used in producing concrete in a batch plant.

Alternative 6: Removal and Treatment of Waste and Off-Site Disposal

This alternative is identical to Alternative 5 except that the removed and treated waste would be disposed of at an off-site location.

1.3.1.2 Lime Sludge Ponds

Alternative 1: Containment with In Situ Stabilization

Under this alternative the waste would be stabilized and remain in place, using shallow-soil-mixing (SSM) technology. This involves the use of a device suspended from a crane to inject and mix the lime sludges with a mixture of cement and flyash to produce a stabilized end product that could support the weight of a cap. Access restrictions, monitoring activities, capping, and runoff control also would be implemented.

Alternative 3: Removal and Treatment of Waste and On-Property Disposal

This alternative combines access restrictions, monitoring, and runoff control with mechanical removal, treatment, and on-property disposal of waste materials. The technology proposed for waste treatment

is stabilization using a cement/flyash mixture and applying a process similar to that used in producing concrete in a batch plant.

Alternative 4: Removal and Treatment of Waste and Off-Site Disposal

This alternative is identical to Alternative 3 except that the removed and treated waste would be disposed of at an off-site location.

1.3.1.3 Flyash/South Field Area

The Flyash/South Field area comprises three distinct waste areas: the Active Flyash Pile, the Inactive Flyash Pile, and the South Field. The Inactive Flyash Pile is adjacent to the South Field; the Active Flyash Pile is separated from the South Field by an unpaved road.

Alternative 1: Containment

Under this alternative the waste would remain in place. Access restrictions, monitoring activities, capping, and runoff control would be implemented.

Alternative 5: Removal and Treatment of Waste and On-Property Disposal

This alternative combines access restrictions, monitoring, and runoff control with mechanical removal, treatment, and on-property disposal of waste materials. The technology proposed for waste treatment is stabilization, using a mixture of cement and flyash and applying a process similar to that used for production of concrete in a batch plant.

Alternative 6: Removal and Treatment of Waste and Off-Site Disposal

This alternative is identical to Alternative 5, except that the removed and treated waste would be disposed of at an off-site location.

1.3.2 Treatment Process and Scale

This Operable Unit 2 treatability study focused on stabilization using cement and flyash; it did not specifically address in situ stabilization. The following discussion is a generic overview of this technology. Cement stabilization of waste involves the blending of portland cement (and possibly other inorganic additives) with waste materials to produce a treated solid that has improved physical properties with minimized leachability. The silicate compounds in cement react with water present in the waste (or added to the mixture) to create hydrated silicate compounds that crystallize and encapsulate waste particles. The cement constituents also react/interact with waste constituents to reduce their solubility through precipitation, adsorption, or other chemical mechanisms. Initially, the treated waste is a viscous, mortar-like material or wet solid, which cures and solidifies over time to a concrete like material . The resulting stabilized waste is typically a solid monolith with low

permeability to water, limited surface area, and sufficient physical strength and durability for land disposal.

When waste materials are removed for processing, the process components include:

- Excavation, pumping, or other removal operations and transfer/transport of the waste to the stabilization facility
- Pretreatment, such as blending wastes for uniform feed characteristics, removing oversize material, or chemically converting certain waste constituents to compounds that are more amenable to stabilization
- Blending of cement and other dry and potentially liquid additives with the waste using appropriate mixing equipment; and storage, handling, and metering of the various additives
- Transfer and placement of the treated waste followed by static curing to allow cementing reactions to complete
- Transfer of cured material to disposal facility (if different from curing location)

1.3.3 Operating Features

The primary operating features of a cement stabilization process are associated with the formulation of additives that are used to achieve the performance criteria as well as to meet other processing requirements. Selection of the correct stabilization formula depends on the waste characteristics, the concentration and chemical properties of the contaminants, and the interactions between the various waste constituents and the additives. Additives are often used in conjunction with cement to tailor the formula to deal with the various waste constituents that (1) would not be effectively stabilized otherwise or (2) would interfere with the desired cement reactions and detract from the physical properties that are ultimately achieved. Additives are also incorporated in stabilization formulas to improve the physical properties of the mix. Additives include flyash, sodium silicates, clays, zeolites, or other adsorbents, surfactants, and wetting agents. Water may be added to a formula if there is inadequate moisture in the waste to react with the cement and other binders.

Flyash consists of silicate and aluminosilicate compounds similar to cement, which can react to form hydrated silicates in the presence of water and calcium oxide (CaO) or cement. Flyash reacts with the CaO that is generated during the hydration of the cement, so it is often used as a primary ingredient with cement in concrete construction and waste stabilization formulas. Flyash varies greatly in composition, and its reactivity (which depends on the CaO content and particle size) varies accordingly. Although flyash, particularly if it has low CaO, reacts much slower than portland cement, it can reduce the permeability and improve the strength of concrete and cement-stabilized waste. It also modifies the flow characteristics of the mix.

Alkaline precipitation is a principal treatment mechanism that is generally relied on for application of cement stabilization technology to heavy metal wastes. The CaO initially present in cement, along with that produced during hydration reactions, results in an alkaline condition that tends to reduce the solubility of some metals. Excess CaO in a partially or completely cured cement-waste mixture can serve (as a buffer) to neutralize the acid content of a leaching solution. However, for metals that are amphoteric (solubility increases at a pH both above and below some compound-specific minimum), excess alkalinity can decrease the effectiveness of stabilization. Metals that are not effectively treated by alkaline precipitation require alternative chemical mechanisms (such as precipitation as a silicate or carbonate, or complexation or substitution reaction with the hydrated silicate matrix).

Generally, organic contaminants are not chemically reactive with the cement matrix, as many inorganic compounds are. If such waste constituents represent a problem, additives that can adsorb soluble organics or emulsify insoluble organics to enable incorporation in the cement matrix are considered.

The physical properties of the waste-additive mixture during and following treatment must also be considered in the formulation of the correct stabilization mixture. Handling and placement of the treated waste will be affected by the rate at which the cement reactions occur and by the initial concentration and type of solids in the mixture. Flyash tends to reduce the viscosity of a fresh mix because of its slow reaction. Special additives are used in concrete construction to control the setting rate and physical properties of the fresh mix, and these additives could also be applied in waste stabilization. The properties of the waste can also have a significant influence on properties of the mix. Certain constituents may retard or accelerate the curing process. The type of processing system, method of material transfer, and method of placement/disposal must be considered in making the final choice of a stabilizing formula.

Another important consideration in assessing a waste stabilization process is the volume increase that results from the addition of additives. Increased volume will require larger disposal facilities and greater transportation effort.

Volatilization of contaminants during and following addition of cement can occur due to the increase in temperature of the mix; cement hydration is an exothermic reaction. If the waste is acidic, neutralization reactions that occur with the lime content of the cement or with added lime also are exothermic. Volatile organics as well as certain volatile inorganics (e.g., ammonia) can be released from the stabilization process or the mix during curing.

1.4 PREVIOUS TREATABILITY STUDIES AT THE SITE

There have been no previous treatability studies performed for Operable Unit 2 wastes.

1.5 REPORT ORGANIZATION

1.5.1 Sections 1 through 4

Section 1 of the Treatability Study Report for Operable Unit 2 gives a brief description and history of the FEMP, along with brief descriptions of the waste areas that comprise Operable Unit 2. The latter part of Section 1 describes the alternatives that remain after completion of initial screening and presents discussions of treatment process, scale, and operating procedures of this treatability study. Section 2 presents the conclusions of this study and the resulting recommendations.

Section 3, Treatability Study Approach, includes discussions of test objectives and rationale, experimental design and procedures, equipment and materials, sampling and analysis, data management, and deviations from the Treatability Study Work Plan for Operable Unit 2. Section 4 gives the results of the study and discusses data analysis and interpretations, data quality assurance/quality control (QA/QC), costs and schedule for performing the treatability study, and key contacts. The contents of Section 4 are discussed in greater detail at the beginning of that section.

1.5.2 Appendices

This treatability study contains six appendices that provide additional information. Appendix A provides toxicity characteristic leaching procedure (TCLP) characterization data for the Operable Unit 2 areas. This appendix consists of tables presenting the raw waste data: Table A-1 contains the TCLP radiological results; Table A-2 contains TCLP inorganic raw and spike-corrected data for the waste materials; Table A-3 contains radiological data assembled for the RI; Tables A-4 and A-5 provide a compilation of TCLP volatile and semivolatile organic compounds detected, respectively; Table A-6 contains the TCLP pesticide/PCB compounds detected; Table A-7 is a listing of the general chemistry parameters; Table A-8 provides the validation qualifiers used for the characterization data; Tables A-9 through A-11 contain chemical summary statistical analyses; and Tables A-12 through A-14 contain radiological summary statistical analyses.

Appendix B is a listing of the Clipper computer output listing the formulations, chemical analyses, permeability, and UCSs. Clipper is a D-Base IV software package used to store and manipulate all of the treatability study data and comments.

Appendix C contains the treatability sample analyses. This appendix is organized into tables following a list of the qualifiers in Table C-1. Table C-2 contains the instrument detection limits; Table C-3 contains the modified TCLP (MTCLP) inorganic analyses; Table C-4 contains the TCLP inorganic analyses; Table C-5 shows the radiological analyses; Tables C-6 and C-7 contain results for the volatile and semivolatile organic analyses, respectively; Tables C-8 through C-10 contain raw chemical summary statistical analyses; Tables C-11 through C-13 contain radiological summary statistical

analyses; Tables C-14 through C-16 contain spike corrected chemical summary statistical analyses; and Tables C-17 through C-19 contain spike and dilution corrected chemical summary statistical analyses.

Appendix D contains tables comparing the results of the treatability analyses to the leachate action levels. Table D-1 is a listing of the action levels; Tables D-2 through D-5 contain ratios of the spike- and dilution-corrected data divided by the leachate action levels.

Appendix E contains all standard and nonstandard operating procedures used in the treatability study as well as the operating methods used for determining bulking factor, for determining UCS, for entering data into laboratory notebooks, and for measuring permeability, shear strength and bulking factor for nonsludge-type waste.

Appendix F contains an explanation for the limited number of tests performed on the South Field wastes.

2.0

2.0 CONCLUSIONS AND RECOMMENDATIONS

2.1 CONCLUSIONS

The treatability study to investigate cement-based stabilization as a potential remedial technology for Operable Unit 2 wastes has been completed. The test results met all the objectives identified in the Treatability Study Work Plan. Section 4.1.3 summarizes the comparison of the objectives and associated results. The results confirm that cement-based stabilization alternatives are technically feasible for the subject wastes; the primary performance requirements related to contaminant leachability and material strength were achieved. Secondary performance requirements of bulking factor and permeability were measured. Empirical formulas for bulking factor as a function of reagents were determined.

Leaching tests performed on stabilized waste samples showed that the concentrations of all contaminants of current or proposed potential concern were below, and generally well below, the TCLP and leachate action level criteria, with the exception of beryllium. For most stabilized samples, the beryllium concentration in the leachates is between 10^{-5} and 10^{-6} risk level. A comparison of leaching data between waste before and after stabilization indicates that certain metals that exceeded toxicity characteristic (TC) regulatory limits and the leachate action levels were effectively treated through stabilization.

UCS criteria were achieved for each waste area using a variety of stabilization formulas. A range of stabilization reagent loadings were determined to achieve these strength goals.

The treatability test results demonstrated that the stabilized waste samples that met the UCS criteria also had very low (e.g., 10^{-7} cm/s) water permeability.

The increase in volume resulting from cement stabilization varied considerably and was substantial, depending on the waste and the specific additives used in the formula. The Solid Waste Landfill, Lime Sludge Ponds, and the South Field formulations that resulted in stabilized waste meeting leaching and UCS performance criteria produced volume increases of at least 20, 110, and 105 percent, respectively. Much higher volume increases resulted from other formulas that also met the leaching and strength criteria. The actual values for each of the samples is included in the database printouts in Appendix B.

Evaluation of the shear strength and pocket penetrometer data for all of the formulas tested (Appendix B) shows that the stabilized waste is processable within 10 minutes of mixing (negligible shear strength) but hardens to a penetration resistance >4.5 tons per square foot (tsf) at 24 hours.

None of the reactions were highly exothermic or violent (waste form temperature rises were usually below 1°C). No bubbles were noticed, nor were there any detectable amounts of gas liberated during the mixing or curing processes. The moisture content of the waste-reagent mixtures was initially about 28 to 32% (to achieve a paste-like consistency) and decreased by about 4 to 8% during the 28-day curing period.

The varied statistical data analysis techniques applied to the test results to determine the relationships between the different reagents and the performance results indicated that increasing portland cement dosage always improved performance as measured by UCS. Dosage of other reagents produced different effects depending on the reagent and the waste. FEMP flyash did not appear to be very functional as a substitute in formulations for portland cement.

The results of this study will serve as input for the fate and transport modeling to be performed for the Operable Unit 2 FS and will provide important information to support the remedial alternative evaluation process.

2.2 RECOMMENDATIONS

Before implementation of this technology, remedial design work using vendor-specific equipment needs to be conducted. Pilot-plant studies to determine the effect of sample heterogeneity and vendor-specific reagent characteristics need to be performed. It is also recommended that further tests be performed to determine what effect the addition of water has on the strength and long-term stability of the treated waste.

In this study, enough water was added to make the waste and reagent mixture into a paste that could be easily mixed and fluid enough to add to the mold for curing. The moisture content of the mixture ranged from approximately 22 to 45 percent. The optimum water addition to maximize the UCS was not determined. Additional tests with the desired formula(s) may be done to determine the appropriate range of water additions to maximize the UCS.

Attapulgite and clinoptilolite were added to decrease the leachability of metals in the treated waste. Analysis of the treatability data, however, indicates that the leachability is below the anticipated leachate action levels for the site, so addition of these reagents should not be necessary. Also, the addition of these reagents may have a detrimental effect on the UCS. It is therefore recommended that a larger-scale test with no addition of attapulgite and clinoptilolite be performed to prove that there is not a leachability problem.

3.0

35A

3.0 TREATABILITY STUDY APPROACH

3.1 TEST OBJECTIVES AND RATIONALE

Under Section 121(b) of CERCLA as amended by SARA, the EPA is required to evaluate remedial actions that "permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants." To this end, treatability studies provide valuable site-specific data necessary to support CERCLA remedial activities when treatment is proposed as part of one or more remedial alternatives. Treatability studies serve two primary purposes: to aid in the selection of the remedy; and to aid in the implementation of the selected remedy.

As stated in EPA's "Handbook for Remedial Action at Waste Disposal Sites" (EPA 1985) stabilization and solidification refer to treatment processes that are designed to accomplish one or more of the following results: (1) improve the handling and physical characteristics of the waste, as in the sorption of the free liquids; (2) decrease the surface area of the waste mass across which transfer or loss of contaminants can occur; and/or (3) limit the solubility of any hazardous constituents of the waste by pH adjustment or sorption phenomena. For purposes of this report, the term stabilization will be used to describe the treatment technology evaluated herein.

The purpose of this treatability testing program is to develop data to assess the performance of various stabilization reagents on Operable Unit wastes. The study is designed to demonstrate whether stabilization can achieve desired material strength and leachability attributes. Quantitative data produced by this study will provide required input for geochemical and other computer modeling of groundwater contaminant transport. The results of the contaminant transport modeling will be used to quantitatively assess the relative effectiveness of the removal and nonremoval alternatives evaluated during the FS. These comparisons (which will be performed in the detailed analysis of alternatives) will include an analysis to determine whether applicable or relevant and appropriate requirements (ARARs) for groundwater are being met for each of the various alternatives being studied. Long-term risks to human health and the environment will also be compared.

The study is composed of two parts: preliminary phase (to support remedy screening) and advanced phase (to support remedy selection). The preliminary phase involves evaluating a range of stabilization mix formulas that meet the proposed strength and leaching criteria. The advanced phase involves performing TCLP analyses on stabilized waste using representative formulas determined in the preliminary phase. The data resulting from this treatability study will be used to support the FS through comparison of leachate test results from the advanced phase testing with leaching results from tests performed on representative samples of unstabilized Operable Unit 2 wastes. The data will also support the FS by establishing or identifying the following:

- Confirmation of technology applicability to Operable Unit 2 waste
- Compliance of technology with ARARs
- Analytical results to be used for fate and transport modeling
- Leachability data to support residual risk calculations
- Refinement of process requirements for cost estimation purposes
- Initial database for use in subsequent remedy design studies

3.1.1 Remedial Action Objectives

Remedial action objectives (RAOs) include medium-specific cleanup goals for protecting human health and the environment. They address the contaminants of concern as well as exposure routes and receptors identified in the baseline risk assessment. The primary purpose of RAOs is to ensure site-wide compliance with:

- Chemical-specific ARARs and guidance to be considered (TBC)
- EPA guidance for risk to public health from hazardous substances
- Regulatory standards for control of radiation exposure and radioactive contamination in the environment

The RAOs for Operable Unit 2 must cover all radiological and chemical constituents. Alternatives for remediation must meet airborne RAOs as well as drinking water RAOs. The RAOs presented in Figure 3-1 include the following:

- Waste
- Air
- Soil
- Sediment
- Surface water
- Groundwater

3.1.2 EPA Guidance

The EPA's "Guide for Conducting Treatability Studies Under CERCLA" (EPA 1988d) outlines a three-tiered approach to conducting treatability studies for a Superfund site. The original interpretation of the approach can be seen in Figure 3-2. The remedy evaluation phase of the RI/FS, in accordance with the EPA guidance, may require three tiers of treatability testing:

- Remedy screening
- Remedy selection
- Remedy design

The three levels of treatability testing are divided into pre-Record of Decision (ROD) and post-ROD studies. The remedy screening and remedy selection testing are pre-ROD studies, and the remedy design studies are post-ROD. Figure 3-3 reflects an updated approach recommended by de Percin, Bates, and Smith of EPA in their article "Designing Treatability Studies for CERCLA Sites: Three

MEDIA		REMEDIAL ACTION OBJECTIVE
1. WASTES	1-1	For Human Health: Prevent exposure to noncarcinogens which would result in a Hazard Index greater than or equal to 0.20, and/or combined risks from exposure to carcinogens greater than 1.0E-04, using 1.0E-06 as a point of departure.
	1-2	Prevent migration of contaminants which would result in groundwater concentrations greater than the maximum contaminant levels (MCLs) or non-zero MCL goals (MCLGs) or that would result in a Hazard Index greater than or equal to 0.20, and/or combined risks from exposure to carcinogens greater than 1.0E-04, using 1.0E-06 as a point of departure.
	1-3	Prevent current and future direct radiation doses from exceeding 100 mrem/yr.
	1-4	For Environmental Protection: Prevent migration of contaminants that would result in surface water levels greater than ambient water quality criteria.
	1-5	Prevent current and future direct radiation doses from causing detectable chronic effects.
2. AIR	2-1	For Human Health: Prevent inhalation of contaminants which would result in a Hazard Index greater than or equal to 0.20, and/or combined risks from exposure to carcinogens greater than 1.0E-04, using 1.0E-06 as a point of departure.
	2-2	Prevent doses from radionuclide emissions at the FEMP from exceeding a 10 mrem/yr dose, and radon flux from exceeding 20 pCi/square meter/second.
	2-3	For Environmental Protection: Prevent current and future radiation emissions from causing detectable chronic effects.

602 A FND290D OU2 TK05 OR

FIGURE 3-1. SITE-WIDE REMEDIAL ACTION OBJECTIVES

MEDIA		REMEDIAL ACTION OBJECTIVE
3. SOILS		For Human Health:
	3-1	Prevent inhalation of/ingestion of/direct contact with soils surrounding the OU2 wastes which would result in a Hazard Index greater than or equal to 0.20, and/or combined risks from exposure to carcinogens greater than 1.0E-04, using 1.0E-06 as a point of departure.
	3-2	Prevent migration of contaminants which would result in groundwater concentrations greater than the MCLs or non-zero MCLGs or that would result in a Hazard Index greater than or equal to 0.20, and/or combined risks from exposure to carcinogens greater than 1.0E-04, using 1.0E-06 as the point of departure.
	3-3	Prevent radium concentrations from exceeding 5 pCi/g in the first 15 cm of soil, and 15 pCi/g at lower depths. Prevent concentrations of other nuclides from exceeding levels that would result in doses greater than 100 mrem/yr.
		For Environmental Protection:
	3-4	Prevent migration of contaminants that would result in surface water contamination levels greater than ambient water quality criteria.
4. SEDIMENTS		For Human Health:
	4-1	Prevent ingestion of/direct contact with sediment contaminants which would result in a Hazard Index greater than or equal to 0.20, and/or combined risks from exposure to carcinogens greater than 1.0E-04, using 1.0E-06 as the point of departure.
		For Environmental Protection:
	4-2	Prevent releases of contaminants from sediments that would result in surface water contamination levels greater than ambient water quality criteria.

602 A FND290E OU2 TK05 OR

FIGURE 3-1. SITE-WIDE REMEDIAL ACTION OBJECTIVES (continued)

MEDIA		REMEDIAL ACTION OBJECTIVE
5. SURFACE WATER	5-1	***For Human Health:*** Prevent leaching to surface water that would result in exposures to non-carcinogens which would result in a Hazard Index greater than or equal to 0.20, and/or combined risks from exposure to carcinogens greater than 1.0E-04, using 1.0E-06 as the point of departure.
	5-2	***For Environmental Protection:*** Restore surface water to below ambient water quality criteria.
6. GROUNDWATER	6-1	***For Human Health:*** Prevent leaching to groundwater that would result in contaminant levels greater than the MCLs, MCLGs or TBCs, or which would result in a Hazard Index greater than or equal to 0.20, and/or combined risks from exposure to carcinogens greater than 1.0E-04, using 1.0E-06 as the point of departure.
	6-2	***For Environmental Protection:*** Restore groundwater aquifer to contaminant concentrations below the MCLs.

FIGURE 3-1. SITE-WIDE REMEDIAL ACTION OBJECTIVES (continued)

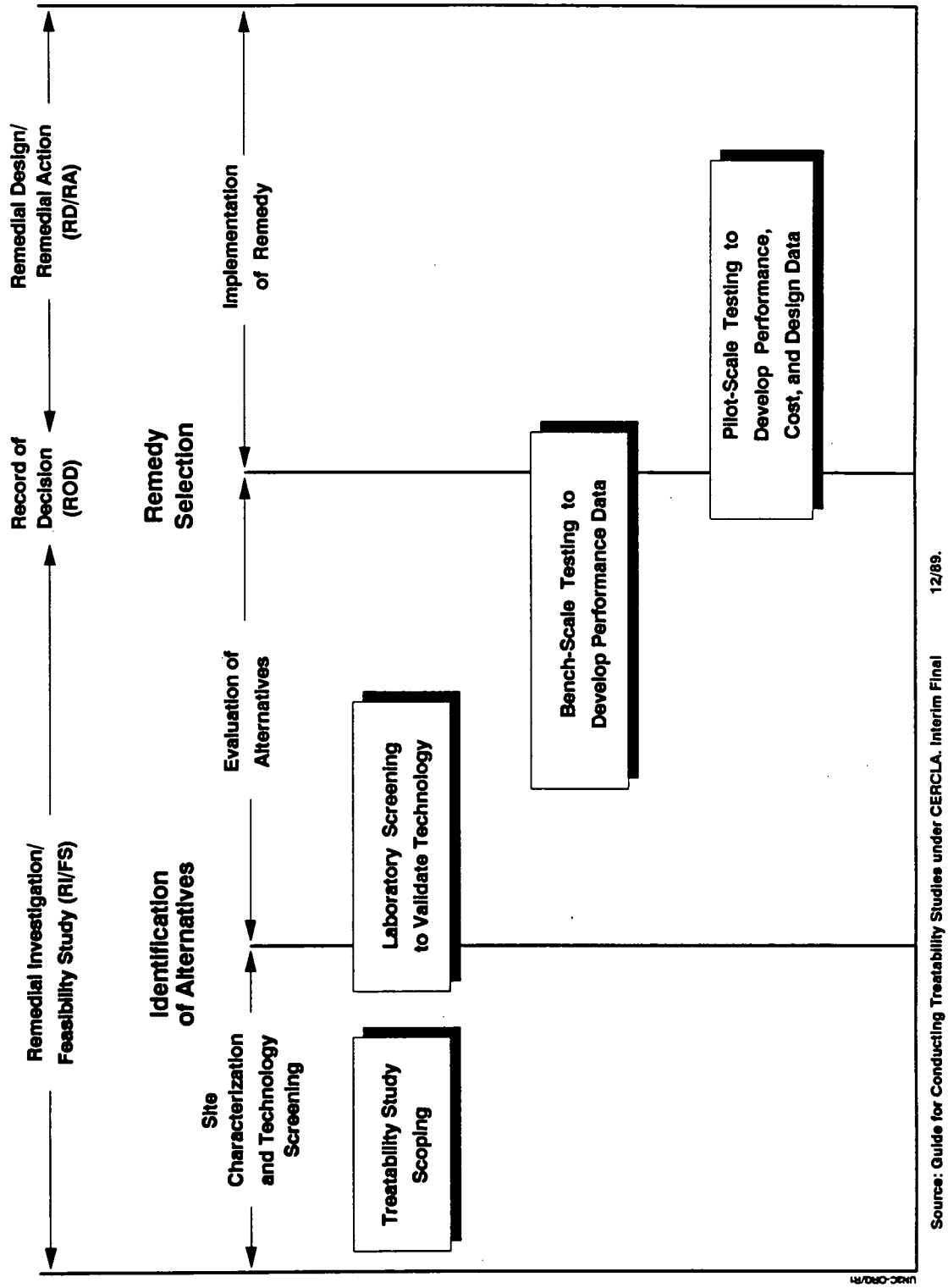
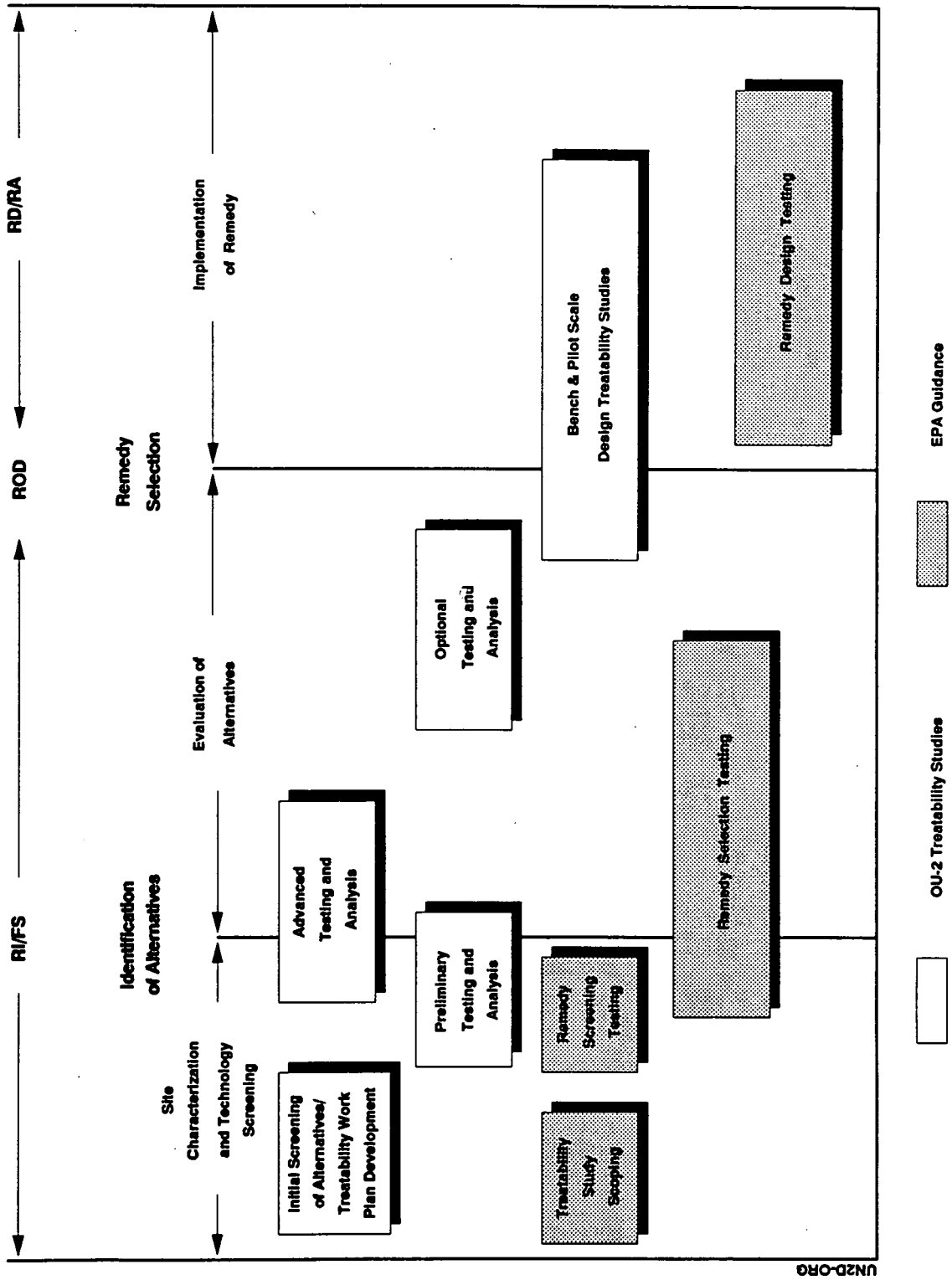


Figure 3-2. THE ROLE OF TREATABILITY STUDIES IN THE RI/FS AND RD/RA PROCESS

3527



Source for EPA Guidance: dePercin, P.E.; E. Bates; and D. Smith 1991;Designing Treatability Studies for CERCLA Sites: Three Critical Issues," Journal of the Air and Waste Management Association, Vol. 41, No. 5.

Figure 3-3. RELALATIONSHIP OF THE OPERABLE UNIT 2 TREATABILITY STUDIES TO THE RI/FS PROCESS

Critical Issues," (de Percin et al. 1991). Figure 3-3 illustrates these three levels of treatability testing and how this treatability study compares with these requirements.

Pre-ROD treatability studies provide the critical performance and cost data needed to evaluate all potentially applicable treatment alternatives and select an alternative for remedial action based on the nine FS evaluation criteria. The detailed analysis of alternatives phase of the FS follows the development and screening of alternatives and precedes the actual selection of a remedy in the ROD. During the detailed analysis, all remedial alternatives are evaluated based on the nine FS evaluation criteria. These criteria are as follows:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

These criteria are described in detail in "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988).

Remedy screening is the first step in the tiered approach. Its purpose is to determine the feasibility of a treatment alternative for the contaminants/matrix of interest. Typically, these tests are conducted under conditions that are favorable to the technology. These small-scale studies are designed to provide a qualitative evaluation of the technology and are conducted with minimal levels of QA/QC. Tests conducted under this tier are generic in nature (not vendor specific). If the feasibility of the treatment cannot be demonstrated, the alternative generally should be eliminated at this time.

The remedy selection tier of the treatability study program is designed to determine whether a treatment alternative can meet the operable unit's cleanup criteria and at what cost. The purpose of this tier is to generate the performance and cost data necessary for remedy evaluation in the detailed analysis of alternatives phase of the FS. The cost data developed in this tier should support cost estimates of +50 percent to -30 percent accuracy. The FS cost estimate for Operable Unit 2 will be based on the effective formulation determined from this study. The performance data will be used to determine whether this technology will meet ARARs and cleanup goals. Remedy selection studies are typically small scale, incorporating generic tests using bench- or pilot-scale equipment in either the laboratory or the field. The study costs are higher than those encountered in the remedy screening tier and longer durations to complete. The levels of QA/QC are moderate to high, because the data from these studies will be used to support the ROD.

In the post-ROD remedy design tier treatability study, detailed scale-up design, performance, and cost data are generated to implement and optimize the selected remedy. Remedy design studies are performed after the ROD, usually as part of the remedy implementation. These studies are performed on full-scale or near full-scale equipment, for the purpose of generating detailed, scale-up design and cost data. These studies should focus on optimizing process parameters, and is not a part of this treatability study. Remedy design studies require moderate to high QA/QC and are typically vendor specific.

This report covers the remedy screening and remedy selection tiers of the treatability studies as described in the EPA guidance. The remedy screening is performed in the preliminary phase and the remedy selection is performed in the advanced phase treatability study.

3.1.3 Treatability Study Description

The primary goal of the treatability study is to support remedy selection during the FS by providing data about the waste treatment under consideration. This information is used in conjunction with other aspects of the proposed alternatives' designs to select the most promising treatment technologies for further consideration.

Tests used to determine whether a waste/additive formula was acceptable were: UCS, MTCLP, and TLCP. The UCS and MTCLP were used in the preliminary phases; TCLP was used in the advanced phases. MTCLP, a modified version of the TCLP, is described in Appendix E of the Work Plan. The number of tests or experiments performed is shown in Table 3-1.

The goal of each phase was to identify at least six formulas that would pass the above tests. Stage 2 was included in the Work Plan to allow for testing of additional formulas in the event that Stage 1 did not produce enough successful formulas. Stage 2 was performed for the Lime Sludge Ponds. Stage 2 also would have been required for the South Field, but verbal approval was given by the EPA on December 3, 1991, to relax the six-sample UCS requirement for the South Field. Only four met the preliminary phase requirement.

Wastes used in the treatability study were collected at the FEMP and shipped to the treatability laboratory. Treatability samples were mixed and tested as described in Section 3.2. Flyash from the active and inactive piles was included as reagents because flyash typically has pozzolanic properties. Other additives or reagents used were portland cement, sodium silicate, clinoptilolite, and attapulgite. Sodium silicate was added to increase the strength and rate of set of the stabilized material, and attapulgite and clinoptilolite were added to reduce leachability.

Other tests or measurements made during sample preparation include pH and Eh (oxidation/reduction potential) of the untreated and treated wastes.

TABLE 3-1

ACTUAL NUMBER OF EXPERIMENTS FOR CEMENT STABILIZATION

	Remedy Screening (Preliminary)				Remedy Selection (Advanced)	
	Stage I		Stage II			
Waste Type	UCS (28-day cured sample)	MTCLP	UCS (28-day cured sample)	MTCLP	TCLP	Permeability
Solid Waste Landfill	12	12	0	0	11	6
Lime Sludge Ponds	16	16	9	9	20	6
South Field	12	12	0	0	7	6
Subtotal	40	40	9	9	38	18
Duplicate (20%)	9	9	2	2	11	4
Total	49	49	11	11	49	22

The radiological and chemical constituents analyzed for in the preliminary phase are listed in Table 3-2; those for advanced phase analyses are listed in Table 3-3.

3.1.3.1 Specific Treatability Actions for Individual Waste Units Within Operable Unit 2

Solid Waste Landfill

Alternative 5 included rotary kiln incineration before stabilization. Samples of landfill waste were incinerated to ash (ashed) in a laboratory furnace in order to generate samples for stabilization studies. The waste samples were weighed upon receipt and certain types of materials (e.g., rubber or metallic fragments) that required segregation before ashing were weighed both before and after ashing so that the reduction in mass could be estimated. The ash was mixed with other reagents and the analyses were performed as discussed in Section 3.2.

Lime Sludge Ponds

Lime sludge waste was mixed with other reagents and the analyses were performed as discussed in Section 3.2.

South Field

South Field waste was mixed with other reagents and the analyses were performed as discussed in Section 3.2.

Active and Inactive Flyash Piles

Specific tests involving stabilization of FEMP flyash/bottom ash alone were not included as part of this study, because FEMP flyash (from the Active Flyash Pile) is being used as one of the reagents. Should this reagent mixture prove effective for Operable Unit 2 (and/or other operable units), it is likely that a substantial quantity of FEMP flyash will be utilized in the stabilization of Operable Unit 2 and/or other operable unit wastes. Waste from the Inactive Flyash Pile also is being considered for the study (on a more limited scale) and is a potential source, should the Active Flyash Pile be depleted. It is noteworthy that ash from the Active Flyash Pile is being examined for potential use as an additive for treatment of Operable Units 1 and 4 wastes (for cement stabilization and vitrification technologies) and as an additive in controlled density flow (CDF) material (used in backfill and slope stability applications). Should any of these technologies prove viable, the need for stabilization of FEMP flyash may become nonexistent.

3.1.3.2 General Selection Criteria

Treatability

The most promising formulas for cement stabilization will have UCS values of approximately 500 psi after a 28-day curing period, relatively low permeability, and minimal volume increase relative to the

TABLE 3-2

CHEMICAL, RADIOLOGICAL, AND PHYSICAL INFORMATION TO BE ACQUIRED IN THE PRELIMINARY PHASE

Modified TCLP List for Cement Stabilization	
Metals	Radiological Parameters
Arsenic (As)	Uranium by IC[a]
Barium (Ba)	Gross alpha
Cadmium (Cd)	Gross beta
Chromium (Cr)	
Lead (Pb)	
Mercury (Hg)	
Selenium (Se)	
Silver (Ag)	
Physical parameters	
Bulking factor	
Temperature rise	
Unconfined compressive strength	
Shear strength	

[a]Ion chromatography

TABLE 3-3

CHEMICAL, RADIOLOGICAL, AND PHYSICAL INFORMATION
TO BE ACQUIRED IN THE ADVANCED PHASE

TCLP Organic List[a]	TCLP Inorganic		
	Metals		Radiological Parameters
TCL[b] Volatiles	Aluminum (Al)	Magnesium (Mg)	Cesium (Cs)-137
TCL Semivolatiles	Antimony (Sb)	Manganese (Mn)	Lead (Pb)-210
TCL Pesticides/PCBs	Arsenic (As)	Mercury (Hg)	Plutonium (Pu)-238
	Barium (Ba)	Molybdenum (Mo)	Radium (Ra)-226
	Beryllium (Be)	Potassium (K)	Radium (Ra)-228
	Boron (B)	Nickel (Ni)	Strontium (Sr)-90
	Calcium (Ca)	Selenium (Se)	Thorium (Th)-total
	Cadmium (Cd)	Silicon (Si)	Uranium (U)-total
	Chromium (Cr)	Silver (Ag)	
	Cobalt (Co)	Sodium (Na)	Gross alpha
	Copper (Cu)	Thallium (Tl)	Gross beta
	Cyanide (CN)	Vanadium (V)	
	Lead (Pb)	Zinc (Zn)	

Physical Parameters :

Bulking factor
Temperature rise
Shear Strength
UCS
Permeability

[a]TCLP organics will not be analyzed if the compounds are not found in the characterization study portion of the work plan (Section 6.0).
[b]Target Compound List (TCL).

other formulas investigated in the study. The 28-day curing period is based on standard concrete industry design and construction practices (Troxell et al. 1968). The curing period is also specified in the Nuclear Regulatory Commission Technical Paper on Waste Form (NRC 1991).

Feasibility Study

The best technology will be determined by comparing multiple criteria during the detailed analysis of alternatives. The relationship between the data generated during treatability studies and the FS evaluation criteria is shown in Table 3-4 and discussed below:

- Data generated from UCS and leachability testing under this study will be used for evaluating overall protection of human health and the environment and compliance with ARARs in the FS.

- Treatability testing that relates to a technology's long-term effectiveness and permanence includes its UCS for handling and disposal purposes; its leachability as measured by TCLP; and the extent to which it transmits water, based on permeability. The waste form also influences long-term stability.

- The ability of a technology or formula to reduce the toxicity, mobility, or volume will be measured by indicators such as bulking factor for volume determination, leachate analysis for toxicity determinations, and permeability for mobility reduction.

- Short-term effectiveness is impacted primarily by bulking factor (an indicator of the volume of treated waste that must be handled and disposed of) and performance of the specific technology chosen.

- The implementability of a particular technology is influenced by the volume of waste to be handled as measured by bulking factor, shear strength, and temperature rise, and by the waste form itself. As with implementability, cost is impacted by the technology selected and the volume of waste to be treated.

- The final two evaluation criteria, state and community acceptance, are influenced by the results of all the data and by the other seven criteria.

Additional information on use of evaluation criteria and treatability data in the feasibility study process can be found in "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988).

3.1.4 Leachate Action Levels

Leachate action levels are developed to act as reference points for evaluating treatability data and are designed to be protective of human health and the environment and to comply with ARARs. They are developed early in the process and are based on readily available information (EPA 1991a). These action levels are used by engineers as design criteria during development and selection of remedial alternatives. Leachate action levels are a subset of RAOs that are site-specific (qualitative goals that

TABLE 3-4

RELATIONSHIP OF TREATABILITY DATA TO FS EVALUATION CRITERIA

FS Evaluation Criteria	Treatability Data			
	Compressive Strength (UCS)	Leachate Analysis (TCLP)	Bulking Factor (% volume change)	Permeability
Overall protection of human health and the environment	X	X		X
Compliance with ARARs	X	X		
Long-term effectiveness and permanence	X	X		X
Reduction of toxicity, mobility, or volume		X	X	X
Short-term effectiveness			X	
Implementability			X	
Cost			X	
State acceptance	X	X	X	X
Community acceptance	X	X	X	X

define the extent of cleanup required to achieve a CERCLA response action) (EPA 1988). RAOs address contaminants of concern, media of concern and potential exposure pathways as well as leachate action levels.

Leachate action levels are chemical-specific, medium-specific numerical concentration limits that should address all contaminants and all pathways found to be of concern during the baseline risk assessment process. Remediation goals are defined in the National Contingency Plan (NCP) at 40CFR300.430(3)(2)(i). Leachate action levels are based on readily available environmental or health-based ARARs that would be TC regulatory levels for leachate. TC regulatory levels do not exist for many chemicals in Operable Unit 2 waste areas, so risk-based leachate action levels were developed.

A single set of initial leachate action levels was developed for all operable units at FEMP. Because the initial levels are general for the site (not operable unit-specific) they are based on general default exposure pathways and equation assumptions recommended in Vol. 1 of EPA's Risk Assessment Guidance for Superfund (EPA 1991a), and the exposure parameters presented in the Risk Assessment Work Plan Addendum (DOE 1992).

Leachate action levels were developed based on the potential for chemicals to leach into the bedrock aquifer or a receiving surface water body, thus equating water in the shallow zones to "leachate." Leachate is regulated by the EPA under 40CFR261 with the use of the TC regulatory levels. TC regulatory levels are based on the acceptable drinking water concentrations multiplied by a dilution attenuation factor (DAF) which accounts for the degree of attenuation and dilution that a compound is expected to undergo during transport to the drinking water aquifer or receiving stream (EPA 1986c). The default DAF for developing TC regulatory levels is 100. To develop risk-based leachate action levels, acceptable groundwater concentrations were multiplied by 100. Acceptable groundwater concentrations were determined with the following equations, the same used to develop leachate action levels for drinking water.

For noncarcinogens, the exposure equation is:

$$C_w = (THI)(BW)(AT)(365\ days/yr)(EF)(ED)[(1/RfD_o)(IR_w)]$$

where

C_w = Leachate action level concentration in water (mg/L)
THI = Target Hazard Index (0.20)
RfD_o = Oral reference dose (mg/kg/day) (chemical-specific)
BW = Adult body weight (70 kg)
AT = Averaging time (ED x 365 days)
EF = Exposure frequency (350 days/yr)

ED = Exposure duration (70yr)
IR_w = Daily water ingestion rate (2L/day)

For chemical carcinogens, the exposure equation is:

$$C_w = (TR)(BW)(AT)(365\ days/year)/(ED)(EF)[(SF_o)(IR_w)]$$

where

C_w = Leachate action level concentration in water(mg/L)
TR = Target risk (1×10^{-5} and 1×10^{-6}).
BW = Adult body weight (70kg)
AT = Averaging time (ED x 365 days)
EF = Exposure frequency (350 days/yr)
ED = Exposure duration (70yr)
SF_o = Oral slope factor $(mg/kg/day)^{-1}$ (chemical specific)
IR_w = Daily water ingestion rate (2L/day)

For radionuclides, with the exception of radon, the exposure equation is:

$$C_w = (TR)/(EF)(ED)(SF)_o)(IR_w)$$

where

C_w = Leachate action level concentration in water (pCi/L)
TR = Target risk (1×10^{-5} and 1×10^{-6}).
EF = Exposure frequency (350 days/yr)
ED = Exposure duration (70yr)
SF_o = Oral slope factor (risk/pCi)
IR_w = Daily water ingestion rate (2L/day)

In developing risk-based leachate action levels, target cancer risk levels were established for carcinogens and a target hazard quotient (THQ) and target hazard index (THI) (the sum of the THQs) was established for noncarcinogens. EPA suggests a default target risk of 10^{-6} (EPA 1991b). This risk, 10^{-6}, is used as a target risk for the FEMP leachate action levels. In addition, leachate action levels also have been developed using a target risk of 10^{-5}, which falls within the acceptable range under CERCLA of 10^{-4} to 10^{-6}.

For noncarcinogenic toxicants, the EPA indicates that the cumulative site hazard index (HI) should be less than 1. However, while total noncancer risk cannot exceed an HI of 1, no direct guidance is available on apportioning the allowable level among the various chemicals in the various environmental media. The most applicable regulatory guidance comes from the Office of Drinking Water, which in calculating maximum contaminant level goals (MCLGs), uses a relative source contribution (RSC) factor to account for the contribution from other sources of exposure (EPA 1989b). If sufficient data are not available to evaluate the drinking water exposure relative to other exposures,

the Office of Drinking Water assumes other exposures account for 80 percent of the total, leaving 20 percent for water. Thus the default RSC is 20 percent (0.20).

This method can be adapted to the development of leachate action levels for noncarcinogens. Because it is not known what additional sources are contributing to total exposure, the default RSC of 0.20 will be used to develop individual chemical/media-specific leachate action levels, helping to ensure that the total HI from each exposure does not exceed 1. Thus, the THQ for medium-specific, noncarcinogenic effects will be 0.2, helping to ensure that the THI is less than or equal to 1, as recommended by EPA (1991a).

Leachate action levels are based on drinking water exposures. In addition, under the RCRA program the regulatory level identifies as hazardous waste any solid waste that produces a leachate, using the TCLP analysis, that exceeds specified threshold concentrations listed in 40CFR261.24. TC regulatory levels are based on the acceptable drinking water concentrations multiplied by the dilution attenuation factor (DAF), which accounts for the degree of attenuation and dilution that a compound is expected to undergo during transport in the aquifer to a human receptor at a downgradient drinking water well (EPA 1986).

Risk-based and ARAR-based acceptable drinking water concentrations are used to develop leachate action levels. Groundwater concentrations are multiplied by the default DAF of 100 (EPA 1986a) to develop leachate action levels. Leachate action levels are given in Appendix D, Table D-1.

3.1.5 Performance Objectives and Desired Data

Specific test objectives were established to evaluate the performance of the various stabilization mixtures in the areas of leachability, UCS, and final waste form volume. These objectives were used to determine whether a particular reagent mixture produced an acceptable waste form. The specific objectives of the preliminary and advanced treatability phases were:

- To develop a database of leachate concentrations of hazardous and radioactive materials for various combinations of stabilized waste forms
- To develop a database of stabilization reagents and relative quantities required to minimize leachable concentrations of radionuclides and HSL constituents from the final waste form
- To establish the proof of process and applicability of the selected stabilization technology
- To screen a large number of parameters and identify those that will be critical for future bench-scale studies
- To determine an envelope of cement stabilization reagents and relative quantities required, so that the final waste form achieves a UCS of approximately 500 psi.

- To minimize the final volume of treated waste
- To provide data for use in the FS to estimate the volumes of treated waste that will be generated by each process
- To develop preliminary reagent mixtures for use in future treatability studies
- To provide information for the development of preliminary cost and design data for the FS
- To provide leaching characteristics of stabilized and unstabilized waste for use in fate and transport modeling using results obtained from the TCLP
- To develop the following preliminary process parameters for use in future treatability studies: (1) shear strength, (2) waste form temperature rise, (3) general description of waste before and after reagent addition, (4) permeability of stabilized waste, (5) percentage of water in the waste, (6) pH of the leachate solution, and (7) information about amounts of off-gassing during mixing or curing.
- To provide the chemical and radiological data specified by Table 3-3

3.1.6 Data Quality Objectives

Concentration-based performance objectives and the resulting testing phase are driven by the remediation goals (RG) established for the site. Data quality objective (DQO) analytical levels are defined in EPA's "Guide for Conducting Treatability Studies Under CERCLA" (EPA 1989d). This guidance states that the requisite analytical levels are dictated by the types and magnitudes of decisions to be made based on the data and objectives of the screening. A description of the analytical levels is presented in Table 3-5 (an excerpt from the EPA's guide).

Data quality needs are used to establish DQOs. The implementation of an appropriate QA/QC program is required to ensure that data of known and documented quality are generated. DQOs will define the QA/QC level for the treatability testing and analysis. Table 3-6 is a list of tests and associated DQOs for chemical stabilization; SOPs and nonstandard test methods are described in Appendix E.

3.2 EXPERIMENTAL DESIGN AND PROCEDURES

3.2.1 Preliminary Phase (Stage 1)

There are many unknown variables in the activity levels of the Operable Unit 2 waste, as well as the performance of the proposed reagents with the waste. A matrix of experimental tests was created to decrease the number of formulas, based on their effectiveness in treating the waste. The treatability study provided a range of formulas for the stabilization technology, which will be evaluated during the remedial design phase. If the test results indicated that a particular combination of reagents would not produce the desired results, then that formula was eliminated from consideration. The most effective formulas will be used during the FS process to estimate the cost of the technology being evaluated.

TABLE 3-5

SUMMARY OF ANALYTICAL LEVELS

Level I	
Type of analysis	Field screening or analysis with portable instruments.
Limitations	Usually not compound-specific, but results are available in real time. Not quantifiable.
Data quality	Can provide an indication of contamination presence. Few QA/QC requirements.
Level II	
Type of analysis	Field analysis with more sophisticated portable instruments or mobile laboratory. Organics by GC; inorganics by AA, ICP, or XRF.
Limitations	Detection limits vary from low parts per million to low parts per billion. Tentative identification of compounds. Techniques/instruments limited mostly to volatile organics and metals.
Data quality	Depends on QA/QC steps employed. Data typically reported in concentration ranges.
Level III	
Type of analysis	Organics/inorganics performed in an off-site analytical laboratory. May or may not use CLP procedures. Laboratory may or may not be a CLP laboratory.
Limitations	Tentative compound identification in some cases.
Data quality	Detection limits similar to CLP. Rigorous QA/QC.
Level IV	
Type of analysis	HSL organics/inorganics by GC/MS, AA, ICP. Low parts-per-billion detection limits. CLP analysis.
Limitations	Tentative identification of non-HSL parameters. Validation of laboratory results may take several weeks.
Data quality	Goal is data of known quality. Rigorous QA/QC.
Level V	
Type of analysis	Analysis by nonstandard methods.
Limitations	May require method development or modification. Method-specific detection limits. Will probably require special lead time.
Data quality	Method-specific

Source: EPA, "Guide for Conducting Treatability Studies under CERCLA," December 1989.

TABLE 3-6

STABILIZATION TEST DATA QUALITY OBJECTIVES

PRELIMINARY (REMEDY SCREENING)			
TEST	APPENDIX	DQO/COMMENT	DQO LEVEL
Bulking Factor	E	Minimize waste volume increase. To estimate the volume of waste that will be generated.	V
Modified Toxicity Characteristic Leaching Procedure (MTCLP)	E	During the screening phases, to determine the relative leachability of hazardous and radiological constituents associated with the various stabilization reagent formulations.	V
Waste Form Temperature Rise	E	Preliminary process parameters	I
Shear Strength	E	Preliminary process parameters	I
Unconfined Compressive Strength (UCS)	E	To determine the unconfined compressive strength associated with each of the reagent formulations	II
pH, Eh	E	Preliminary process parameter	I

TABLE 3-6

(Continued)

ADVANCED (REMEDY SELECTION)			
TEST	APPENDIX	DQO/COMMENT	DQO LEVEL
Bulking Factor	E	Minimize waste volume increase. To estimate the volume of waste that will be generated.	V
Unconfined Compressive Strength	E	To determine the unconfined compressive strength associated with each of the stabilization reagent formulations.	III
Full TCLP	See QAPP	To determine leachability of each of the stabilization reagent formulations. To provide data for the FS risk assessment calculations.	V*
Permeability	E	To provide data for the FS risk assessment calculations	III
Waste Form Temperature Rise	E	To provide preliminary process parameters	I
Shear Strength	E	To provide preliminary process parameters	I
Radon Emanation	E	To determine effect of stabilization on radon emanation	V
pH, Eh	E	Preliminary process parameter	I

*DCR in approval process

Tables 3-7 through 3-9 present the formulas used in Stage 1. In Stage 1, 12 formulas were prepared for the Solid Waste Landfill, 16 formulas were prepared for the Lime Sludge Ponds, and 12 formulas were prepared for the South Field. A run number was assigned to each formula (the recipe for a treatability sample) as a convenient way of tracking the samples. Samples from the Operable Unit 2 Active Flyash Pile were utilized in this study for resource recovery purposes. The overall volume increase for Operable Unit 2 can be minimized by using this source of material for stabilization. For comparative purposes, some samples of inactive flyash were substituted for active flyash. Generally, water/cement ratios were approximately 0.3, and flyash/cement ratios ranged from 2 to 4. Because of differing moisture contents and other constituents, the amount of water added depended on the waste form.

To prepare the waste from each area for the treatment process, it was sieved through 0.375-inch mesh, and obvious debris was removed. The waste was then ground up and sieved through 0.187-inch mesh and mixed with the stabilization reagents in a planetary mixer. Water was added until the mixture became soft and paste-like (the amount of water added was recorded). A description of the waste also was recorded, before and after mixing, and observations as to vapor or gases generated during the mixing were also noted. Shear strength was measured using a Torvane within 10 minutes of the end of the mixing. Temperature rise, moisture content of the treated mixture, pH, and Eh were measured. The treated mixture was then poured into two 2-inch by 4-inch cylindrical plastic molds and a plastic cup to approximately one-third capacity. They were compacted using a vibrating table for one minute, and this procedure was repeated twice until the containers were full. The mold surfaces were flattened, and the containers were sealed with lids and taped shut. The mixture in the cup was tested for penetration resistance after 1, 3, 7, and 14 days, using a pocket penetrometer. Photographs of the treated mixtures and molds were taken. The treated samples in the molds were then allowed to cure at ambient temperature. After 28 days (Troxell et al. 1968), one of each set of two test cylinders was cut open, and the solidified material was subjected to UCS tests, as per SOP TDL 1109. If fewer than six formulas for each waste stream were judged to be successful, then Stage 2 (see Section 3.2.2) was initiated and new formulations were prepared (with higher loadings of portland cement) before proceeding to the advanced phase where samples were subjected to TCLP and permeability testing. In practice, this was done only for the Lime Sludge Ponds, for which nine additional mixtures were prepared. Only four formulas from the South Field met the UCS criteria; however, new formulas were not prepared for Stage 2 since EPA verbally approved using only the four formulations from Stage 1. A flow chart of the overall testing process is shown in Figure 3-4, and details of the waste-reagent mixing procedure are in Appendix E.

3.2.1.1 Solid Waste Landfill Ash

Before sieving, the waste from the solid waste landfill was placed in a furnace for two hours at approximately 200°C and then for two more hours at 550°C. This ashing process, conducted in accord-

TABLE 3-7

SOLID WASTE LANDFILL ASH, PRELIMINARY STAGE I

Constituents for Stabilization Per Sample in Grams						
Run No.	Waste (Ash)	Type I Portland Cement	FEMP Flyash	Sodium Silicate	Attapulgite and Clinoptilolite Each	Water Required
1	300	75	150	0	15	194.5
2	300	75	150	15	0	154
3	300	75	150	15	15	157
4	300	75	75	0	15	170
5	300	75	75	15	0	142.5
6	300	150	150	0	5	160
7	300	150	150	15	0	170
8	300	150	75	0	5	140
9	300	150	75	15	0	150
10	300	45	90	0	3	145
11	300	45	90	9	0	127.5
12	300	45	90	9	3	135

TABLE 3-8

LIME SLUDGE PONDS WASTE, PRELIMINARY STAGE I

Constituents for Stabilization Per Sample in Grams						
Run No.	Waste[a]	Type II Portland Cement	FEMP Flyash	Sodium Silicate	Attapulgite and Clinoptilolite Each	Water Required
1	300	75	150	0	15	108
2	300	75	150	15	0	75
3	300	75	150	15	15	118.5
4	300	75	75	0	15	119
5	300	75	75	15	0	75
6	300	150	150	0	15	100
7	300	150	150	15	0	90
8	300	150	75	0	15	140
9	300	150	75	15	0	75
10	300	45	90	0	9	90
11	300	45	90	9	0	50
12	300	45	90	9	9	80
13	300	150[b]	150	0	15	130
14	300	150[b]	150	15	0	100
15	300	75[b]	75	0	0	100
16	300	75[b]	75	15	15	105

[a]Wet weight of waste
[b]Portland Type I cement

TABLE 3-9

SOUTH FIELD WASTE, PRELIMINARY STAGE I

Constituents for Stabilization Per Sample in Grams						
Run No.	Waste[a]	Type I Portland Cement	FEMP Flyash	Sodium Silicate	Attapulgite and Clinoptilolite Each	Water Required
1	300	75	150	0	15	200
2	300	75	150	15	0	180
3	300	75	150	15	15	180
4	300	75	75	0	15	225
5	300	75	75	15	0	150
6	300	150	150	0	15	225
7	300	150	150	15	0	165
8	300	150	75	0	15	225
9	300	150	75	15	0	180
10	300	75	150[b]	0	9	195
11	300	75	150[b]	9	0	180
12	300	75	150[b]	9	9	195

[a]Wet weight of waste
[b]Substitute flyash from inactive pile for flyash from the active pile

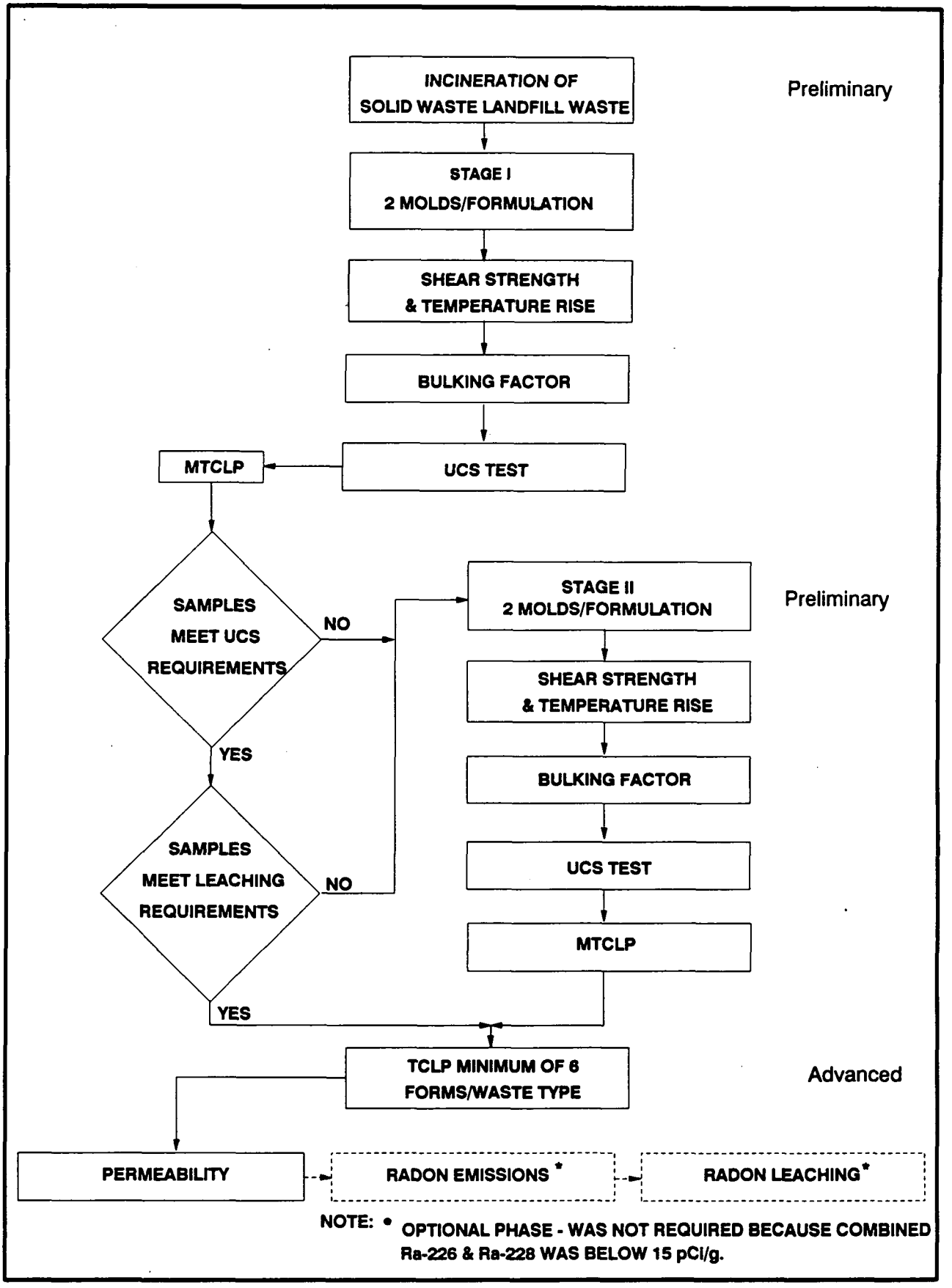


FIGURE 3-4. FLOW CHART OF TREATABILITY TESTING FOR OPERABLE UNIT 2

ance with American Society of Testing and Materials (ASTM) 2974-87, was not intended to directly simulate full-scale incineration, but rather to produce ash for the stabilization treatability studies. Twelve composite samples of the landfill ash were dosed with stabilization reagents according to the matrix in Table 3-7. Three duplicate mixtures were made for QA purposes, and flyash from the active pile was used in the experiments. These samples were subjected to MTCLP tests (Table 3-2). The results are in Appendix C.

3.2.1.2 Lime Sludge Ponds

Sixteen mixtures and three QA duplicates were prepared according to the stabilization matrix in Table 3-8. Flyash from the active pile was used. Type II portland cement, instead of Type I, was used due to possible sulfate reactions between the reagents and the sludge wastes. These samples were subjected to MTCLP tests (Table 3-2). The results are in Appendix C.

3.2.1.3 South Field

Twelve composites and three QA duplicate samples were prepared, as per the matrix in Table 3-9. Type I portland cement was used for these mixtures. Flyash from the inactive pile was substituted in three composites and one duplicate. These samples were subjected to MTCLP tests (Table 3-2). The results are in Appendix C.

3.2.1.4 Methods

The following methods are described in Appendix E:

- UCS
- Laboratory Notebook Recording Procedures
- Analytical Logbook Recording Procedure
- Standard Laboratory Sieves: specification, calibration, and maintenance
- Calibration of Thermometers
- Bulking Factor Procedure for Nonsludge Type Waste
- MTCLP
- Waste and Reagent Mixing Procedure
- Stabilization Waste Form Temperature Rise Generic Procedure
- Permeability
- Generic pH and Eh Procedure
- Proposed Radon Emissions from Stabilized Solids
- Proposed Measurement of Radon Leaching in Water
- Shear Strength
- Generic Uranium by Ion Chromatography (IC) with Post-Column Reaction and Phosphorescence or Fluorescence Detection

3.2.1.5 Data Reported

The following data were recorded during the preliminary phase of cement stabilization:

- UCS, measured by a Soiltest U-590 or U-610 instrument (SOP TDL 1109, Appendix E)
- Bulking factor
- Waste form temperature rise (after the waste and reagents were mixed)
- General description of the waste form before and after the reagents were mixed, including any grinding of the sample to meet particle size requirements for UCS
- Approximate shear strength, measured within 10 minutes after the waste and reagents are mixed
- Physical characteristics (percent moisture and bulk density of the treated waste)
- Amount of water added to each waste form
- MTCLP (for preliminary phase), including metals, uranium by IC, gross alpha, gross beta
- Maximum particle size treated; weight and percentage of material sieved from the raw waste before treatment
- Description of vapor(s) and/or gases released during the mixing and mixture-curing processes
- pH and Eh (oxidation/reduction potential in millivolts) of the treated reagent-waste mixture (before it was added to the molds)
- pH of the MTCLP and TCLP extraction fluids; pH of the TCLP extraction fluid determination test
- pH and Eh of a slightly wet water-waste mixture
- TCLP metals results for reagents combined with clean sand (or quartz)
- Amounts of reagents and wastes used in each formulation

The measured temperature rise is a qualitative test, conducted as a screening test as an early indicator of potential problems and hazards during scale-up. Further investigations of the actual temperature rise may be made during the remedy design phase, when larger equipment (which has a design similar to full-scale equipment) would be used.

3.2.2 Preliminary Phase (Stage 2)

For the Lime Sludge Ponds, results from Stage 1 did not yield six mixtures with compressive strengths equal to approximately 500 psi. Hence, another experimental matrix (Table 3-10) was designed to gather these data. The additional testing (Stage 2) consisted of nine formulas as well as two duplicate mixtures. The test procedures and data requirements were the same as Stage 1. Two molds were cast

TABLE 3-10

LIME SLUDGE PONDS, PRELIMINARY STAGE 2

Constituents for Stabilization Per Sample in Grams						
Run No.	Waste[a]	Type II Portland Cement	Type I Portland Cement	Sodium Silicate	Attapulgite and Clinoptilolite Each	Water Required
1	300	225	0	0	15	103.1
2	300	225	0	15	0	50.0
3	300	225	0	15	15	125.1
4	300	150	0	0	15	61.1
5	300	150	0	15	0	25.0
6	300	150	0	15	15	25.5
7	300	0	151.5	0	15	59.8
8	300	0	150	15	0	0
9	300	0	150	15	15	30.0

[a]Wet weight of waste

for each formula, one of which was used for the Stage 2 UCS test. Crushed samples of the cured molds were subjected to MTCLP analyses.

Stage 2 was not needed for the Solid Waste Landfill ash because Stage 1 yielded an adequate number of mixtures meeting or exceeding the UCS criteria. For the South Field waste, requirements were relaxed to four samples that passed the UCS criteria in accordance with a DOE memo (see Appendix F), so Stage 2 was not performed on the South Field.

3.2.3 Advanced Phase Testing

The formulas that passed the preliminary phase Stage 1 or Stage 2 UCS and MTCLP analyses were subjected to advanced phase testing. The following numbers of samples from Stage 1 were subjected to TCLP analyses in the advanced phase:

- Solid Waste Landfill - Eleven samples plus three duplicates
- Lime Sludge Ponds - Eleven samples plus 3 duplicates
- South Field - Seven samples plus three duplicates

Only the Lime Sludge samples were required to advance to Stage 2. All of the above samples from Stage 1, plus 11 from Stage 2 were subjected to the TCLP analyses in the advanced phase. The advanced phase also included permeability testing for 22 samples (see Table 3-1).

3.2.3.1 Reagent Mixtures

To assess the potential contamination contribution of the reagents, blanks, consisting of seven combinations of clean sand, portland cement (Type I and II), attapulgite, clinoptilolite, sodium silicate, and water (i.e., no FEMP waste) were made according to the matrix in Table 3-11, and one sample of each mixture was subjected to TCLP analyses (Table 3-3). Each of the above reagents was also subjected to TCLP analyses as potential contaminants.

3.2.3.2 Data Requirements for Advanced Phase Testing

During advanced phase testing, the following information was recorded:

- Results of TCLP analyses performed on stabilized waste samples
- Permeability tests on stabilized waste samples
- Radon emissions tests were not performed because the combined Ra-226 and Ra-228 content of the stabilized waste was less than 15 pCi/g

3.3 EQUIPMENT AND MATERIALS

Table 3-12 lists the major equipment and materials used for the treatability study.

TABLE 3-11

MIXTURES OF REAGENTS WITH CLEAN SAND

Constituents for Stabilization Per Sample in Grams						
Run No.	Sand	Type I Portland Cement	Type II Portland Cement	Sodium Silicate	Attapulgite and Clinoptilolite Each	Water Required
1	450	150	-	0	5	150
2	390	45.2	-	9.2	3.2	132
3	450	-	150	15	0	135
4	390	-	45.2	9.2	9.2	111.6
5	450	150	-	0	15	157.5
6	375	75	-	0	15	140
7	450	150	-	0	15	165

TABLE 3-12

EQUIPMENT AND MATERIALS[a]

Number of Items	Description
Multiple	Porcelain evaporation dishes, 145 mm diameter x 48 mm high, 385 ml capacity
Two	Furnaces, Lindberg Model #51828, programmable
1 or more	Scale, calibrated, Sartorius Model LC 2200 S/P, B3100 S/P, LC 4200S, and analytical balance
Multiple	Crucible tongs, 250 mm long, stainless steel
1	Soil Mill, Humboldt Manufacturings
1	Planetary Mixer, Kitchen-Aid Model K54SS
Two	Digital pH meters, Hach #19000-00 and Jenco #6009
Multiple	pH electrode, Orion standard line combination type, with epoxy body and BNC connector (#91-56)
Multiple	pH pen, Nester Instruments #120719
Multiple	ORP electrode
Multiple	Oxidation reduction potential tester, Cole Parmer #WD0065000
1	Thermometer, calibrated and traceable
1	Torvane shear device, Soiltest Model CL-600
1	Vibrating table, Lydron Model BP51D1
Multiple	Two-inch by four-inch Jatco Co. plastic molds for UCS
1	Microwave drying oven, CEM AVC Model 80
Multiple	Spatulas, mixing and weighing type
Multiple	Plastic containers, 5 oz. and 8 oz., with caps
1	Laboratory hydraulic press, Carver, 12-ton
Two	Shaker tables, Eberbach Model 6010
Multiple	Hammers
Multiple	Sterile disposable conical centrifuge tubes, 50 ml. capacity, with plug seal screw caps
Multiple	Syringes, Becton-Dickinson, 10 ml., with luer slip lock but without needles
Multiple	Acrodisc syringe filters, 0.8 m, Gelman Sciences

TABLE 3-12

(Continued)

Number of Items	Description
Multiple	Pipette bulbs, pipettes, volumetric flasks, graduated cylinders, beakers, funnels, scintillation vials, bottles, stirring bars, gloves, lab coats, and other lab equipment
Two	Motorized Unconfined Compression Apparatus, Soiltest Model UC 590 and UC 610, with Proving Rings #PR-15 (1500 lb. capacity)
Multiple	Pocket penetrometer, Soiltest Models CL-700A and CT-421
1	Dremel Cutting Tool, Model 850
1	Vernier
1	Digital hot plate/stirrer, PMC dataplate
Multiple	Sieves, 9.5 mm sieve designated std., 0.375" sieve opening (Tyler designation 0.371"), 8" diameter, full height, and 4.75 mm sieve designated std., 0.187" sieve opening (Tyler designation #4), 8" diameter, full height
Two Sets	Standard weights, Class S and check
Bottles	Glacial acetic acid, Mallinckrodt
Bottles	TCLP fluids #1 and #2 (made up from glacial acetic acid)
Bottles	Sodium hydroxide, 1N, volumetric solution, Mallinckrodt
Bottles	Hydrochloric acid, 1N, volumetric solution, Mallinckrodt
Bottles	Nitric acid, concentrated, Mallinckrodt and Baker
Bottles	Phosphoric acid, 39 weight percent, Mallinckrodt
Multiple	pH buffers, Mallinckrodt and Scientific Products, pH 4.01, 7.00, 10.00
1	Ion chromatograph consisting of parts: Dionex liquid chromatographic module, post-column delivery system, P-E LS30 luminescence detector (in phosphorescence mode), Dionex columns (CS 5 analytical and CG 5 guard), Milton Roy Constametric HPLC Pump
1	Gross Alpha and Beta activity counter, Canberra Model #2404F
Multiple	Permeability, flexible wall permeammeter, Brainard-Kilman, cell #S-480, Panel S-500
1	Eberline air monitor, Model #5A

[a]Additional equipment used to perform analytical tests (e.g., GC, GC/MS, ICP, etc.) are not listed. Additional equipment requirements are also listed in the standard operating procedures contained in Appendix D.

3.4 SAMPLING AND ANALYSIS

3.4.1 Additional Sampling and Analysis Activities for Operable Unit 2

The data from the earlier Characterization Investigation Study (CIS) conducted by Roy F. Weston, Inc. (Weston 1987) was used to estimate the volumes and boundaries of waste contained in Operable Unit 2. A review of the CIS data revealed the need for additional data; therefore, a program for conducting additional sampling for Operable Unit 2 was prepared by DOE and approved by the EPA. The drum cuttings, which were archived from the sampling program, were used as samples for the treatability study. The Sampling and Analysis Plan (SAP) (DCR 41 to the RI/FS Work Plan) specifies five borings in the Solid Waste Landfill, four in both the Active and Inactive Flyash Piles, four in the Lime Sludge Ponds, and eight in the South Field. Table 3-13 is a summary of the additional sampling activities conducted for Operable Unit 2.

3.4.2 Additional Characterization of Waste for Treatability

The analysis of treated waste material discussed in Section 3.2 of this report specifies the use of the TCLP extraction as a basis for determining the concentrations of constituents (including radiological) leaching from treated waste forms. The characterization of waste (analysis of untreated waste) discussed in Section 1.2 did not include a radiological analysis of samples subjected to a TCLP extraction. Waste material used for treatability studies was subjected to a TCLP extraction with a radiological analysis, as defined in Table 3-3, being conducted on the extract in order to provide a baseline analysis for each of the disposal areas.

For the Solid Waste Landfill, the ashing for Stage 1 was performed before sample preparation for solidification. A total of five random samples were submitted for TCLP extraction and full radiological analysis of untreated waste after the waste was ashed.

For flyash from the inactive pile, two samples were submitted for TCLP extraction and full radiological analysis of untreated waste. Flyash from the inactive pile was used on a limited basis in the study.

Three samples each from the remaining waste areas and the Active Flyash Pile were submitted for TCLP extraction and radiological analysis of untreated wastes. Comparison of these results with those from the treated samples were used to determine the effectiveness of the treatment technology.

3.4.3 Sample Volume for the Treatability Study

Samples for the treatability study came from archived drill cuttings stored on site in 55-gallon drums. The use of archived drill cuttings was necessary because treatability sample volume requirements were much greater than the sample material available. Additionally, the cuttings were used because schedule requirements did not provide the time necessary to develop, obtain approval for, and complete additional sampling of the Operable Unit 2 areas. The drill cuttings from the recent sampling effort had been

TABLE 3-13

ADDITIONAL SAMPLING EFFORT, OPERABLE UNIT 2

Location	No.of borings	Approx. Depth (ft)	Purpose	Sample Type	No. Samples per Boring	Sample Parameters
Solid Waste Landfill	5	15-20	Sample waste; determine depth of landfill, sample leachate	Fill soil	3	Full Rad,/Extended HSL, TOC, App. IX,
					1	TCLP[a]
				Liquid/leachate	1	Extended HSL, Full, Rad, General Groundwater, App. IX
Active Flyash Pile	4	15-20	Evaluate spatial distribution/variability, sample leachate	Fill/soil	3	Full Rad/Full HSL, TOC,
					1(composite)	TCLP, EP Tox[b]
				Liquid/leachate	1	Full HSL, Full Rad, General Groundwater
Inactive Flyash Pile	4	25-35	As above	As above	As above	As above
Lime Sludge Ponds	2	2	Sample lime sludge	Lime Sludge	1 (per pond)	TCLP
	2	2	Sample lime sludge	Lime Sludge	1 (per pond)	Full Rad/Full HSL, App. IX
			Sample Surface Water	Surface Water	1 (north pond)	Full HSL, Full Rad, General Water Quality
					1 (north pond)	App. IX[c]
South Field	4	2	Sample fill	Waste	1	TCLP[d],
	2	5	Sample fill	Waste	2	Extended HSL
					1	TCLP
	2	20	Sample fill	Fill/Soil	4	Extended HSL[e],
					1	TCLP[f]

[a]TCLP test of metals, pesticides and herbicides will be conducted on a composite sample - volatile and semi-volatiles will be tested for on the interval displaying the highest HNu readings or the mid- point of the boring.
[b]A composite sample will be tested for TCLP, EP Tox, and corrosivity, ignitability, and reactivity using the same criteria listed in footnote 1.
[c]The sample will be analyzed for all App. IX parameters not covered by the previous analyses of Lime Sludge Pond water.
[d]These samples were recently collected and sent for analyses of RCRA characteristics; TCLP, EP, Tox ignitability, corrosivity, and reactivity.
[e]Samples for extended HSL analyses will be collected from the horizon in each interval that yields the highest HNu readings. If no preference is indicated, then samples will be collected from the mid-point of each interval.
[f]The sample will be collected from the base of the boring, immediately above the fill/soil interface.

archived under RI/FS chain-of-custody protocols. The drill cuttings are considered representative of the borings that are, in turn, considered representative of each of the operable unit waste areas.

Sample volumes were collected from each of the drums from borings representing a specific waste area, excluding the Lime Sludge Ponds. For instance, all drummed cuttings from the Solid Waste Landfill and the South Field were sampled to create the treatability composite sample for those areas. The sample of lime sludge to be used for the treatability study was collected from the ponds near locations where the characterization samples were taken. Drummed cuttings from the Active and Inactive Flyash Piles were also sampled to create the treatability composite samples that were used as reagents in the stabilization of the other Operable Unit 2 wastes.

3.4.4 Geotechnical Testing

Geotechnical testing for flyash is contained in the SAP for Operable Unit 2. Included in this program is grain-size analysis for the flyash (ASTM D-422). Grain-size testing for the Solid Waste Landfill, the Lime Sludge Ponds, and the South Field was conducted as part of the treatability study in accordance with ASTM D-422. In addition, one sample from each of those areas, one from the Active Flyash Pile, and one from the Inactive Flyash Pile were analyzed for plastic limits and moisture contents. These data are located in Appendix B.

3.4.5 Quality Assurance Project Plan

Details of the QA procedures followed during the sampling and analysis, and the QC procedures to achieve them, may be found in the RI/FS Quality Assurance Project Plan (QAPP). Other QA/QC details are included in Section 4.2 of this report.

3.5 DATA MANAGEMENT

This section pertains to work performed at IT's Technology Development Laboratory (TDL) and Environmental Technology Development Center. Two types of laboratory notebooks were used for this project. All laboratory notebooks are uniquely numbered and have sequentially numbered pages.

Project-specific notebooks were signed out by the facility quality control coordinator (QCC) to the individuals working on the project. All daily laboratory activities associated with the project were recorded in the project-specific notebooks. Separate nonproject-specific logbooks were used to record the injection or introduction of samples into analytical instrumentation. These logbooks also were used to record maintenance or problems with instruments. At the completion of the project, the project-specific laboratory notebooks and logbooks were returned to the facility QCC for retention. Instrument logbooks will be returned to the facility QCC when the books are filled.

All data were written into standard laboratory notebooks or onto standard formatted data entry sheets. These data were entered into a database using computer software designed for the FEMP treatability data.

The sample tracking software is a user friendly program designed for easy storage and retrieval of sample information. The stored information can be updated by the user. It is designed to operate on a personal computer. Sample information is broken into four components: general sample information, date information, TDL analytical information, and formula information.

General sample information consists mainly of the various sample numbers that are associated with a treatability sample number. The date information component stores activity dates associated with the treatability sample number (i.e., date the mold was poured, cured, crushed, shipped, analyzed, etc.). TDL analytical information is shown in Figure 3-5 and formulation information in Figure 3-6.

The output from this sample tracking software consists of various reports. One report lists all the information contained in any or all of the four components described above. A schedule report can be generated which allows the project manager to schedule project activities based upon actual or projected activity completion dates. Another report can be quickly prepared for UCS data calculations and its corresponding graphic representation. The last report allows the user to pick any data item which is stored in the system and match it with pertinent criteria to produce a database file. This database file interfaces directly with SYSTAT statistical software, which is used to analyze the data both numerically and graphically.

The sample tracking software is written in Clipper 5.01. Clipper is available from the Nantucket Corporation, Los Angles, California. Although this version is designed specifically for the FEMP, it can be altered to accommodate other project-specific needs. All records management and reporting followed standard QA/QC protocol. Standard QA/QC protocol, as it applies to testing within the laboratory, followed these guidelines:

- One hundred percent verification on all numerical results transcriptions; calculations were checked and recalculated.
- Data verification through test reasonableness — Summaries of all test results for individual reports were reviewed by the operations supervisor to determine the presence of any data that were considered as outliers.
- Routine instrument calibration was performed in accordance with the QAPP
- Use of trained personnel to conduct tests — All technicians were trained in the application of standard laboratory procedures for analyses as well as in the QA measures implemented for internal QC checks.

One hundred percent validation was performed to Level V analytical support levels relative to stabilized waste samples on full TCLP data.

10162413

EDIT TDL ANALYTICAL INFORMATION

pH of Waste:	8.70		
Eh of Waste(mV):	175.0	Bulk Density:	1.7700
pH of Fly Ash:	7.10	Permeability:	0.0
Eh of Fly Ash(mV):	375	EXTRACTION FLUIDS	
pH of Mixture:	11.99	pH of MTCLP deter. test:	2.55
Eh of Mixture(mV):	-45.0	pH of MTCLP:	11.05
Moisture Content of Waste(%):	0.37	Type(I/II):	1
Moisture Content of Fly Ash(%):	-9.99		
Moisture Content of Mixture(%):	-9.99	Gross Alpha(dpm):	0.0
Temperature Rise(C):	0.0	Gross Beta(dpm):	0.6
Tme between mix. & tmp. measur.:	-99.99	Gross Alpha(pCi/l):	0.0
Shear Strength(t/sq.ft.):	0.00	Gross Beta(pCi/l):	67.6
1 Day Pocket Pen.meter(t/sq.ft.):	>700.0	Total Uranium(ppm):	0.0000
UCS(psi):	380.0		
Moisture Content, Crushed(%):	23.53		
Bulking Factor(%):	158.5		

Comment:

F7,RETURN = Accept changes

Figure 3-5

3527

10162413

EDIT FORMULATION INFORMATION(g)

Amount of Waste:	600.0	Clinoptilolite G.G.#:	910345
Amount of Soil:	0.0	Amt. of Sodium Hydroxide:	0.0
Soil Origin(ON/OFF):		Amount of Water:	389.0
Type of Cement(1-5):	1	Hand Mix:	N
Amount of Cement:	150.0	Sieve size(inches):	0.187
Cement G.G. #:	910481		
Fly Ash Origin(SITE/COMM):	SITE	Wt. not passing seive:	0.00
Amount of Fly Ash:	300.0	% not passing seive:	0.00
Fly Ash G.G.#(if required):		Temp. of Oven:	0.0
Amount of Sodium Silicate:	0.0	Time of sample heating:	0.0
Sodium Silicate G.G.#:			
Amount of Attapulgite:	30.0		
Attapulgite G.G.#:	910483		
Amount of Clinoptilolite:	30.0		

Comment: SOLID WASTE LANDFILL, RUN 1
Gen. Descrip. of waste: Before: dry After: paste-like

F7,RETURN = Accept changes

Figure 3-6

3.6 DEVIATIONS FROM THE WORK PLAN

3.6.1 Number of Samples Meeting UCS Requirements

The Work Plan states that a minimum of six samples are required to successfully pass Stage 1 before Stage 2 can be eliminated. For the South Field, four samples met the UCS requirement of approximately 500 psi, and a Stage 2 was not performed. The reasons for relaxing the six-sample requirement are given in the DOE letter in Appendix F. The approach defined in this letter was verbally approved by EPA on December 3, 1991.

3.6.2 Long-Term Study

Three long-term samples were prepared for the Lime Sludge Ponds for UCS testing. These samples were UCS tested after 90 days of curing. This test was conducted because of concerns that sulfate in the lime sludge would cause long-term detrimental effects on the stabilized waste matrix. No detrimental effects were found.

3.6.3 Preliminary Remediation Goals

The Work Plan presented preliminary remediation goals (PRGs) for leachate but since the Work Plan was developed, EPA has provided additional guidance on PRGs (EPA 1991). The new guidance is specific on the definition of PRGs and that definition does not include goals for leachate; therefore, the leachate goals presented in this report are referred to as "leachate action levels" in order to minimize confusion when referring to the values. The leachate action levels are given in Appendix D and were used to evaluate the effectiveness of various formulations.

3.6.4 DQO Levels

The DQO analytical level for TCLP analysis was revised from Level IV to V. A document change request is in the approval process. Blank extraction fluid was spiked as specified in the Work Plan, instead of the sample matrix, as specified in Contract Laboratory Procedure (CLP) protocol.

3.6.5 Formulas

The formulas given in the Work Plan were not followed exactly. Quantities were typically weighed out to within a gram or less of that specified. Actual quantities used are given in this report (Tables 3-7, 3-8, 3-9 and 3-11).

3.6.6 Requirements for Advanced Phase Testing

According to the Work Plan, advanced phase testing (TCLP) was not to begin until after the MTCLP results were obtained. However, the samples which passed the UCS criteria were submitted for advanced phase TCLP analysis before preliminary phase MTCLP results were received. This was required because there is a two-week maximum holding time between sample collection and extraction. The time required for MTCLP extraction, analysis, and data transmittal was in excess of two weeks. All samples did pass the MTCLP.

3.6.7 UCS Instrument Limitation

The UC-610 instrument was used to measure the UCS of Operable Unit 2 treatability samples, with double proving rings of a 1500-pound-load capacity. Hence, the highest UCS achievable for 2-inch diameter molds was 478 psi (1500 divided by π^2 inches). A decision was made to use 480 psi as the reportable upper limit, although the manufacturer (Soil Test) said it could be run at 110 percent of the rated capacity.

4.0

7A

4.0 RESULTS AND DISCUSSION

The overall objective of this treatability testing program was to develop data to assess the performance of various reagents in the stabilization of Operable Unit 2 wastes. The Work Plan identified specific test objectives so that the performance of the various stabilization mixtures could be evaluated in the areas of three response variables - leachability, UCS, and final waste form volume. These performance objectives were used to determine whether a particular reagent mixture produced an acceptable waste form.

The reagent mixtures or ranges of reagent mixtures producing an UCS of ≈500 psi and minimal volume increase, and leachates meeting the leachate action level criteria, were identified for each of the Operable Unit 2 waste areas.

This section of the treatability study report describes the results of the testing program. The section also explains the relationship between the reagents added to the wastes and the resulting characteristics of the treated material compared to the performance objectives.

Section 4.1 presents the treatability test results. Summaries of the formulas used to perform the tests and summaries of the TCLP results for the untreated waste samples from the Solid Waste Landfill, Lime Sludge Ponds, Active and Inactive Flyash Piles, and the South Field are presented. Wastes from the Solid Waste Landfill, the Lime Sludge Ponds, and the South Field were tested. Flyash from the active and inactive piles was used as an additive in the formulations; this flyash was not tested independently. The results for UCS, leachability, permeability, and bulking factor are presented for each waste area separately. Section 4.1 end with a summary comparison of test results with test objectives.

Section 4.2 presents the QA/QC results. Section 4.3 discusses the schedule and cost for performing the treatability test program. Section 4.4 identifies the project organization and personnel who participated in the treatability test effort.

The FEMP characterization data generated for the RI is shown in Appendix A. The treatability study stabilization data (formulations, UCSs, permeabilities, and mixing information) are included in Appendix B. These data are stored in database files written in Clipper. (Refer to Section 3.5 for a description of the Clipper program.) Appendix C contains the MTCLP and TCLP leaching data on the treated material. Appendix D contains comparisons of the MTCLP and TCLP leaching data to leachate action levels (HI = 0.2 and risk = 10^{-6}) and TC regulatory limits.

4.1 TREATABILITY TEST RESULTS

Experimental Design

In order to determine trends of the response variables (e.g., UCS values) as a function of the reagent loadings and to determine the envelope of reagents that would meet the performance criteria, experiments were designed to yield widely varying values of the response variables. This was accomplished by using a wide range of reagent loadings. In Tables 4-1 through 4-4, the percentage (weight divided by weight [w/w]) of each reagent weight relative to the wet weight of waste is presented. In Stage 1, the range of cement and flyash varied from 15 to 50 and 25 to 50 percent, respectively. The adsorbents (attapulgite and clinoptilolite) and set/strength accelerator (sodium silicate) percentages ranged from 0 to 5 percent.

Stage 2 tests were performed for the Lime Sludge Pond only. The percentage of cement loading maximum value was increased to 75 percent and flyash was removed from the mixture. Attapulgite, clinoptilolite, and sodium silicate ranges were the same as in Stage 1.

Tables 4-5 through 4-8 list the formulas, run numbers, UCS, bulking factor, and permeability values for the treatability study. Portland cement was added to solidify the waste, to add silicates to react with the metals, and to maintain the treated waste in an alkaline form to decrease the leachability of the metals of concern. When the cement was used in conjunction with flyash, they functioned to increase the strength and decrease the permeability of the treated waste. The flyash also may have decreased the effect of inhibitors (e.g., sulfates and oil) on the cement setting and strength formation reactions. Site flyash from the active and inactive flyash piles was used in an effort to determine its effectiveness in achieving an adequate stabilized waste form. Sodium silicate was added to react with the metals and lower their solubilities. The soluble silicates additive may also have increased the treated wastes bearing strength, decreased the bulking factor, and lowered the effect of inhibitors (e.g., sulfate) for a given cement/flyash additive loading. Attapulgite and clinoptilolite were added to adsorb metals and to decrease the leachability of metals in the treated waste.

4.1.1 Data Analysis and Interpretation

4.1.1.1 Data Plots

Most of the plot and regression analysis text is taken directly from the SYSTAT and SYGRAPH manuals. (Wilkinson, Leland, SYSTAT: The System for Statistics Evaluation, IL: SYSTAT, Inc., 1988.) Several plots were used to assist in analysis of the data, i.e., bar graphs, scatterplots, SPLOM, and influence plots. Bar graphs indicate the relative magnitude of a variable by the height of each bar. Scatterplots show relationships between two variables. The SPLOM plots are presented to graphically display potential trends in the data. SPLOM stands for "ScatterPLOt Matrix." It is also called a "casement plot." SPLOM plots are helpful when there are many variables to plot against each other in scatterplots by arranging the data in row and column order. They are not designed for quantitative analyses. The influence of a point in a scatterplot on the correlation coefficient is the amount the

TABLE 4-1

OU2 SOLID WASTE LANDFILL, STAGE 1
MAXIMUM AND MINIMUM PERCENTS OF REAGENTS RELATIVE TO WASTE

	Cement (%)	Flyash (%)	Sodium Silicate (%)	Attapulgite (%)	Clinoptilotie (%)
Maximum	15	25	0	0	0
Minimum	50	50	5	5	5

TABLE 4-2

OU2 LIME SLUDGE POND, STAGE 1
MAXIMUM AND MINIMUM PERCENTS OF REAGENTS RELATIVE TO WASTE

	Cement (%)	Flyash (%)	Sodium Silicate (%)	Attapulgite (%)	Clinoptilotie (%)
Maximum	15	25	0	0	0
Minimum	50	50	5	5	5

TABLE 4-3

OU2 LIME SLUDGE POND STAGE 2
MAXIMUM AND MINIMUM PERCENTS OF REAGENTS RELATIVE TO WASTE

	Cement (%)	Flyash (%)	Sodium Silicate (%)	Attapulgite (%)	Clinoptilotie (%)
Maximum	50	0	0	0	0
Minimum	75	0	5	5	

TABLE 4-4

OU2 SOUTH FIELD, STAGE 1
MAXIMUM AND MINIMUM PERCENTS OF REAGENTS RELATIVE TO WASTE

	Cement (%)	Flyash (%)	Sodium Silicate (%)	Attapulgite (%)	Clinoptilotie (%)
Maximum	15	25	0	0	0
Minimum	50	50	5	5	5

TABLE 4-5

OU2 SOLID WASTE LANDFILL COMPOSITION, PERMABILITY, BULKING FACTOR, AND UCS RESULTS

Treatability Sample #	Run #	Waste (a) Ash (g)	Type 1 Portland coment (g)	FEMP Flyash (g)	Sodium Silicate (g)	Attapulgite (g)	Clinoptilolite (g)	Water (g)	Permenability (cm/s)	Bulking Factor (%)	UCS (psi)
10163613	10	600	90	180	0	6	6	290	NA	99	220
10166613	12	600	90	180	18	6	6	270	NA	102	304
10312413	12DUP	600	90	180	18	6	6	290	NA	107	329
10162413	1	600	150	300	0	30	30	389	NA	159	380
10166413	11	600	90	180	18	0	0	255	NA	96	383
10163013	7	600	300	300	30	0	0	340	<9.1E-10	166	385
10162713	4	600	150	150	0	30	30	340	NA	118	397
10162513	2	600	150	300	30	0	0	308	3.6E-04	137	446
10162913	6	600	300	300	0	10	10	320	NA	156	450
10162613	3	600	150	300	30	30	30	314	2.6E-08	152	454
10163213	8	600	300	150	0	10	10	280	1.1E-10	121	474
10163413	9	600	300	150	30	0	0	300	8.1E-10	129	>480
10162813	5	600	150	150	30	0	0	285	2.5E-08	107	>480
10312213	7DUP	600	300	300	30	0	0	350	1.3E-07	166	>480
10312013	3DUP	600	150	300	30	30	30	320	4.2E-08	157	>480

(a) Wet weight of waste

NA = Not Analyzed

TABLE 4-6

OU2 LIME SLUDGE POND, STAGE 1
COMPOSITION, PERMEABILITY, BULKING FACTOR, AND UCS RESULTS

Treatability Sample #	Run #	Waste (a) Ash (g)	Type 1 Portland coment (g)	FEMP Flyash (g)	Sodium Silicate (g)	Attapulgite (g)	Clinoptilolite (g)	Water (g)	Permenability (cm/s)	Bulking Factor (%)	UCS (psi)
10166213	12	600	90	180	18	18	18	160	NA	66	87
10166013	11	600	90	180	18	0	0	100	NA	50	94
10165813	10	600	90	180	0	18	18	180	NA	59	104
10311613	10DUP	600	90	180	0	18	18	180	NA	53	116
10165013	5	600	150	150	18	0	0	150	NA	59	120
10167613	15	600	225(b)	225	30	0	0	200	NA	46	166
10311813	16DUP	600	150(b)	150	0	30	30	210	1.7E-08	78	185
10311413	5DUP	600	150	150	30	0	0	150	NA	53	189
10166813	1	600	150	300	0	30	30	216	NA	95	192
10167813	16	600	150(b)	150	30	30	30	210	6.5E-8	72	194
10164813	4	600	150	150	0	30	30	238	NA	69	195
10164613	3	600	150	300	30	30	30	237	NA	93	231
10164413	2	600	150	300	30	0	0	150	NA	71	251
10165213	6	600	300(b)	300	0	30	30	200	NA	107	313
10167413	14	600	300	300	30	0	0	200	NA	99	314
10165413	7	600	300	300	30	0	0	180	8.9E-08	97	381
10167013	9	600	300	150	30	0	0	150	6.4E-08	68	407
10167213	13	600	300(b)	300	0	30	30	260	NA	110	466
10165613	8	600	300	150	0	30	30	280	1.0E-07	88	>480

(a) Wet weight of waste
(b) Portland Type 1 Cement.
NA = Not Analyzed

FER/OU2TS/SA.WP758.4F/7-12-92

TABLE 4-7

OU2 LIME SLUDGE POND, STAGE II
COMPOSITION, PERMEABILITY, BULKING FACTOR, AND UCS RESULTS

Treatability Sample #	Run #	Waste (a) Ash (g)	Type 1 Portland coment (g)	FEMP Flyash (g)	Sodium Silicate (g)	Attapulgite (g)	Clinoptilolite (g)	Water (g)	Permenability (cm/s)	Bulking Factor (%)	UCS (psi)
10371813	4	600	300	0	0	30	30	122	3.7E-08	40	>480
10373013	7DUP	601	304(b)	0	0	31	30	129	NA	48	>480
10372213	6	599	300	0	30	30	30	51	NA	35	>480
10371213	3	600	450	0	30	30	30	250	NA	85	>480
10372013	5	600	300	0	31	0	0	50	8.5E-09	24	>480
10371613	1	600	450	0	0	30	30	206	NA	68	>480
10372413	7	600	304(b)	0	0	31	30	120	NA	46	>480
10372613	8	600	300(b)	0	30	0	0	0	NA	22	>480
10371413	2	600	450	0	30	0	0	100	NA	47	>480
10372813	9	601	300(b)	0	30	30	30	60	NA	31	>480
10373213	3DUP	600	450	0	30	30	31	252	NA	90	>480

(a) Wet weight of waste

(b) Portland Type 1 Cement.

NA = Not Analyzed

TABLE 4-8

OU2 SOUTHFIELD
COMPOSITION, PERMEABILITY, BULKING, AND UCS RESULTS

Treatability Sample #	Run #	Waste(a) (g)	Type I Portland Cement (g)	FEMP Flyash (g)	Sodium Silicate (g)	Attapulgite (g)	Clinoptilolite (g)	Water (g)	Permeability (cm/s)	Bulking Factor (%)	UCS (psi)
10310613	12	600.0	150.0	300(b)	18.0	18.0	18.0	390.0	NA	168.4	158
10310813	10DUP	600.0	150.0	300.0	0.0	18.0	18.0	390.0	NA	159.9	176
10168813	4	600.0	150.0	150.0	0.0	30.0	30.0	450.0	4.70e-08	144.9	209
10310213	10	600.0	150.0	300(b)	0.0	18.0	18.0	390.0	NA	157.2	219
10169413	7	600.0	300.0	300.0	30.0	0.0	0.0	330.0	NA	174.9	220
10310413	11	600.0	150.0	300(b)	18.0	0.0	0.0	360.0	6.70e-08	150.5	237
10168413	1	600.0	150.0	300.0	0.0	30.0	30.0	400.0	NA	170	238
10168613	3	600.0	150.0	300.0	30.0	30.0	30.0	360.0	NA	168.9	249
10311013	3DUP	600.0	150.0	300.0	30.0	30.0	30.0	360.0	NA	165.8	281
10168213	2	600.0	150.0	300.0	30.0	0.0	0.0	360.0	1.50e-07	154	296
10169013	5	600.0	150.0	150.0	30.0	0.0	0.0	300.0	NA	112.9	354
10169213	6	600.0	300.0	300.0	0.0	30.0	30.0	450.0	1.50e-08	194.4	469
10169813	9	600.0	300.0	150.0	30.0	0.0	0.0	360.0	7.20e-08	150.6	>480
10311213	6DUP	600.0	300.0	300.0	0.0	30.0	30.0	450.0	8.30e-10	192.6	>480
10169613	8	600.0	300.0	150.0	0.0	30.0	30.0	450.0	9.40e-08	173.9	>480

(a) Wet weight of waste.
(b) Substitute Inactive Flyash for Active Flyash.
NA = Not Analyzed

FER/OU2TS/SA.WP758.4H/7-12-92

correlation would change if that point were deleted. Plotting influences can help determine whether a linear fit to the scatterplot is relatively robust or is dependent on just a few points. The size of the plotting symbol represents the extent of influence of each point on the Pearson correlation coefficient. Any large points that appear in the plot, they should be scrutinized before conclusions concerning the correlation are drawn.

Data was also smoothed to assist in determining trends. Linear regression , inverse squared distance smoothing, and distance weighted least square smoothing were used.

4.1.1.2 Smoothing of Plotted Data

Regression fits a function to data such that the value predicted by the function at each observed value of X is as close as possible to the observed value of Y at the same value of X. Ordinary linear regression uses a straight line for the function and makes the squared discrepancies between predicted and observed Y values as small as possible. The equation for this function looks is:

$$Y = a + bX,$$

where a is a constant term and b is a slope coefficient.

A confidence interval on a linear regression line was often used. When the confidence interval is set to 90 percent, SYGRAPH draws upper and lower hyperbolic bands around the actual fitted line. These bands mean that: if the discrepancies (residuals) between the fitted and observed values for Y at each X are normally distributed and independent of each other and have the same spread (variance), then 90 times out of a hundred, confidence intervals constructed by SYGRAPH from data sampled similarly the same way you found these data will cover the true regression line relating Y to X.

With inverse squared distance smoothing, the height of the curve at a smoothing point is the weighted average of the Y values at X values, where the weights are the squared Euclidean distances from the data points to the smoothing point on the X axis. This is sometimes called Shepard's method of interpolation.

Distance weighted least squares (DWLSs) fit a surface through a set of points by least squares. Unlike linear or low order polynomial smoothing, however, the surface is allowed to flex locally to fit the data better.

4.1.1.3 SPLOM Plot Interpretation

Figures 4-3 and 4-13 (see Page 4-51, and 4-67) are SPLOM plots combined with Influence plots where the bulking factor (BULKFACT), which is defined as the percent volume increase, and UCS values (in pounds per square inch [psi]) are plotted versus the normalized reagent loadings. The

reagent loadings were normalized to allow for direct comparisons of each reagent on a uniform basis. The reagent loadings are normalized to 100 grams of wet weight of waste. The new reagent variable names, NPAT, NPCL, NPFA, NPH2O, NPPC and NPPQ, correspond to the normalized attapulgite, clinoptilolite, flyash, water, Portland cement, and sodium silicate loadings, respectively. The weights of reagents were normalized by dividing the weights of the reagents by the weight of the waste, then multiplying by 100. A linear least square regression line and the 90 percent confidence intervals are applied to the data in each plot. If the slope of the line is positive, increasing the reagent loading tends to increase the UCS or bulking factor values. The reverse is true for a negative slope. A horizontal line indicates that the reagent loading has little effect on the UCS or bulking factor. An indicator of the significance (validity) of the trend indicated by the slope of the line is the shape of the confidence interval lines. The significance is greater if the confidence interval lines are close together and most of the data points fall inside the region bounded by the confidence interval lines. An example of most of the data points falling inside narrow confidence interval lines is the relationship between NPPC and psi for the Lime Sludge Pond in Figure 4-13. In addition, the size of the points are all approximately equal. Thus no one data point has undue influence on the slope of the line. The conclusion that increasing the cement loading increases the UCS can therefore be considered valid. An example of lower significance is NPPQ versus BULKFACT (Figure 4-13), where the confidence intervals lines are wide and most of the data points fall outside the confidence intervals. Also, the size of the data points vary in the Influence plot. Since the confidence intervals are wide and some data points have undue effect on the slope of the regression line, the results are ambiguous. This type of SPLOM plot shows UCS and bulking factor as a function of only one reagent loading. There are other reagents added to the mixture which also affect the UCS and bulking factor. The procedure does not take into account any of the other reagent loadings or combined effects of the reagents. Part of the scatter of the data in these plots is the result of changing several reagent loadings at the same time. The plots are used to show general trends of the data and which reagents had a major effect on the UCS and bulking factor values.

4.1.1.4 Empirical Equations

Empirical equations were developed for bulking factor by using the Multivariate General Linear Hypothesis (MGLH) procedure in SYSTAT. MGLH can estimate and test any univariate or multivariate general linear model.

The model for linear regression is:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_p x_p + \varepsilon$$

The matrix form of this model is:

$$\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon}$$

where y is a dependent variable vector, X is a vector or matrix of one or more independent variables, ß is a vector of regression coefficients, and ε is a vector of random errors. The X_1, X_2, ...for this study are the percentages (w/w) of all reagents in waste/reagent mixture. The B's and ε are calculated by the MGLH program. All combinations of each reagent percentage and cross terms of each reagents are tested for significance for improving the model.

The program calculates the Multiple R, Squared Multiple R, and Adjusted Squared Multiple R for the model. The Squared Multiple R denotes the proportion of variance in the dependent variable accounted for by the independent variables in the linear model. The closer these values are to -1 or 1, the better the fit of the model.

The Adjusted Squared Multiple R reduces this proportion to a level expected when using this model in a new sample from the same population. The formula for this adjusted multiple correlation statistic is:

$$1 - \frac{(1-R^2)(n-1)}{(n-P)}$$

where n is the number of cases and p is the number of predictors, including the constant.

The regression coefficients for independent variables are found next to the independent variable names. For each independent variable, the probability "P(2 TAIL)" that the variable is significant is calculated. Values less than 0.05 were acceptable for this project.

The F-ratio for the model is also calculated. The larger the F-ratio, the better the fit of the model to the measured data.

4.1.1.5 Actual Data Value Plots

The actual data values also are plotted versus the predicted values to visually assist in determining the validity of the model. The data and predicted values are linear regressed with 90 percent confidence intervals. If the model explained all of the variation, the slope of the line would be at a 45-degree angle and all of the data points would fall on the linear regression line. The more points inside the 90 percent confidence intervals, the more rigorous the fit of the data.

The best fit model has the fewest independent variable, maximum Multiple Squared R, minimum P(TAIL) for each reagent (independent variable), and maximum F-ratio. In addition, the residual (actual minus predicted values) should not follow any pattern.

An example of MGLH output from the Solid Waste Landfill follows. The regression had a Squared Multiple R of 0.824, Coefficients for PFA and PPC of 5.559 and 2.986, respectively, a P(2 TAIL) less than 0.05, and F-ratio of 61.004.

ASSUMING MIXTURE MODEL

DEP VAR:BULKFACT N: 15 MULTIPLE R: 0.908 SQUARED MULTIPLE R: 0.824

ADJUSTED SQUARED MULTIPLE R: .811 STANDARD ERROR OF ESTIMATE: 11.374

VARIABLE	COEFFICIENT	STD ERROR	STD COEF	TOLERANCE	T	P(2 TAIL)
PFA	5.559	0.380	3.724	0.209	14.635	0.000
PPC	2.986	0.453	1.678	0.209	6.595	0.000

ANALYSIS OF VARIANCE

SOURCE	SUM-OF-SQUARES	DF	MEAN-SQUARE	F-RATIO	P
REGRESSION	7891.796	1	7891.796	61.004	0.000
RESIDUAL	1681.757	13	129.366		

DURBIN-WATSON D STATISTIC 1.959

FIRST ORDER AUTOCORRELATION -.069

The above example provides statistical analysis of bulking factor as the independent variable and flyash and portland cement as the dependent variables and is useful for assessing multiple regression models. The empirical model from this example is:

$$\text{Bulkfact} = 5.559 \times \text{PFA} + 2.986 \times \text{PPC}$$

4.1.1.6 Determination of Sample Distribution

Each data set was evaluated to determine the probability distribution (normal or lognormal) that best describes the data set. The method used consisted of the construction of a probability plot of the data set. If a straight line fits the plotted points reasonably well, a normal distribution will be assumed. If the data do not follow a straight line on the probability plot, the data will be log-transformed and replotted. Although a visual inspection of the probability plot is often sufficient to determine whether the plotted points follow a straight line, a quantitative determination of the "linearity" of the data is performed.

The quantitative evaluation of the probability plots was performed by calculating the correlation coefficient of the plotted points on the normal probability plot or on the lognormal probability plot. The correlation coefficient was compared with a critical value that depended on sample size (n) and the chosen confidence level α (equal to 0.05) (Looney and Gulledge 1985). The values that the correlation coefficient must meet or exceed in order to conclude that the distribution is normal or lognormal are given in Table 4-9.

4.1.1.7 Treatment of Nondetected Results

Analytical results are presented as "nondetects" whenever chemical concentrations in samples do not exceed the detection or quantitation levels for the analytical procedures for those samples. There are numerous terms used to describe the detection or quantitation levels (EPA 1989a). Sample quantitation limits (SQLs) are the most relevant quantitation limits for evaluating nondetected chemicals. SQLs take into account sample characteristics, sample preparation, and analytical adjustments. Generally, the detection limit (DL) (the lowest amount of a chemical that can be "seen" above the normal, random noise of an analytical instrument or method) is multiplied by a factor of three to five to obtain the SQL (EPA 1989a).

For radionuclides, the minimum detectable concentration (MDC) corresponds most directly to the SQL for chemicals. The MDC is the estimate of the activity concentration that can be practically achieved under a specified set of typical measurement parameters. These parameters include the sample size, counting time, counting efficiency, self-absorption and decay corrections, chemical yield, and other factors involved in determining activity concentrations (EPA 1980). For the purposes of evaluating data in the Treatability Study, the term "SQL" was used for both chemicals and radionuclides.

Although EPA's Risk Assessment Guidance for Superfund Part A, Human Health Evaluation Manual allows for best professional judgement in determining the most appropriate assignment of values for nondetected results (EPA 1989a), EPA Region V has requested that a value of one-half the SQL be assigned for each non-detected result. Statistical treatment of background data for risk assessments will therefore conform with the methodology requested by EPA Region V.

4.1.1.8 Upper and Lower Confidence Limits

In order to construct the upper and lower confidence limits (UCL and LCL), a determination of the distribution type (normal or lognormal) must be made. Data reported as nondetects will be assigned a value of SQL for the purpose of calculating the UCL and LCL.

The UCL and LCL were calculated for a normal distribution as follows:

$$UCL = \bar{x} + t_{1-\alpha,\, n-1} \cdot (s/\sqrt{n})$$

$$LCL = \bar{x} - t_{1-\alpha,\, n-1} \cdot (s/\sqrt{n})$$

TABLE 4-9

CORRELATION COEFFICIENT TEST RESULTS AT A 95% CONFIDENCE LEVEL[a]

n	Value	n	Value
3	0.879	26	0.960
4	0.868	27	0.961
5	0.880	28	0.962
6	0.888	29	0.963
7	0.898	30	0.964
8	0.906	31	0.965
9	0.912	32	0.966
10	0.918	33	0.967
11	0.923	34	0.968
12	0.928	35	0.969
13	0.932	40	0.972
14	0.935	45	0.974
15	0.939	50	0.977
16	0.941	55	0.979
17	0.944	60	0.980
18	0.946	65	0.981
19	0.949	70	0.983
20	0.951	75	0.984
21	0.952	80	0.985
22	0.954	85	0.985
23	0.956	90	0.986
24	0.957	95	0.987
25	0.959	100	0.987

[a] (Looney and Gulledge 1985)

where

$\bar{x}$	=	sample arithmetic mean
$t_{1-\alpha, n-1}$	=	critical value for Student's t-Distribution (given in Table 4-10)
α	=	0.05 (i.e., $1-\alpha = 0.95$ or 95% confidence limit for a one-tailed test)
n	=	number of samples in the set
s	=	sample standard deviation

The UCL and LCL were calculated for a lognormal distribution as follows:

$$UCL = e^{\bar{y}+\frac{1}{2}s_y^2+H_{0.95}\cdot s_y/(n-1)^{\frac{1}{2}}}$$

$$LCL = e^{\bar{y}-\frac{1}{2}s_y^2+H_{0.95}\cdot s_y/n-1)^{\frac{1}{2}}}$$

where

$\bar{y}$	=	$\Sigma y/n$ = sample arithmetic mean of the log-transformed data, $y = \ln x$
s_y	=	sample standard deviation of the log-transformed data
n	=	number of samples in the data set
$H_{0.95}$	=	value for computing the one-sided upper 95% confidence limit on a lognormal mean from standard statistical tables

4.1.2 Analysis of Waste Stream Characteristics

Summaries of the FEMP characterization data generated for the RI are shown in Appendix A. These data are analyzed in detail the draft Operable Unit 2 RI Report. The percentage of UCL concentrations of the TC regulatory and leachate action level criteria are provided in Tables 4-11 through 4-16. Only constituents of concern (Table 1-1) are addressed in Tables 4-11 through 4-16. The concentration in the leachate exceeds the leaching criteria, if the percentage is greater than 100. If all of the leachate concentration values for a particular compound or element were nondetectable, the data are not presented in the tables.

All three waste areas met or exceeded the TC regulatory levels. There were samples which had leachate concentrations in excess of the leachate action levels. In the Solid Waste Landfill, none of the chemical constituents exceeded the leachate action levels. However, the uranium concentration exceeded the leachate action level by at least one order of magnitude. None of the radionuclides exceeded the leachate action level in the Lime Sludge Pond. One organic compound exceeded the leachate action level, i.e., 1,1-dichloroethene. In the South Field, only silver exceeded the leachate action level of radionuclide and chemical constituents.

TABLE 4-10

CRITICAL VALUES FOR STUDENT'S t-DISTRIBUTION[a]

n-1	$t_{0.95,\ n-1}$	n-1	$t_{0.95,\ n-1}$
1	6.314	16	1.746
2	2.920	17	1.740
3	2.353	18	1.734
4	2.132	19	1.729
5	2.015	20	1.725
6	1.943	21	1.721
7	1.895	22	1.717
8	1.860	23	1.714
9	1.833	24	1.711
10	1.812	25	1.708
11	1.796	30	1.697
12	1.782	40	1.684
13	1.771	60	1.671
14	1.761	120	1.658
15	1.753	∞	1.645

[a] (Koopmans 1987)

TABLE 4-11

SOLID WASTE LANDFILL CHEMICAL CHARACTERIZATION DATA COMPARISON TO LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI = 0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Reg. Leachate Action Levels
2-Butanone mg/L	0.01			0.002
Lead	31.24			3.12
Pentachlorophenol	0.04	2.67	26.67	0.01
Silver	3.91			1.56
Zinc	0.18			

TABLE 4-12

SOLID WASTE LANDFILL
CHARACTERIZATION DATA COMPARISON TO
RADIONUCLIDE LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI = 0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Reg. Leachate Action Levels
Ra-226 pCi/L		2.46	24.59	
Ra-228		1.68	16.78	
Th-228		13.74	1.37	
Th-230		0.25	2.46	
U-234		830.00	8300.00	
U-235/236		100.00	1000.00	
U-238		858.00	8580.00	
U-Total				

TABLE 4-13

LIME SLUDGE POND CHEMICAL CHARACTERIZATION DATA COMPARISON TO LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI = 0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Reg. Leachate Action Levels
1,1-Dichlorethene	0.16	18.33	110.00	1.57
2-Butanone	0.02			0.00
Acetone	0.001			
Silver	7.70			
Tetrachloroethene	0.03	0.29	2.86	0.29
Toluene	0.0007			

TABLE 4-14

LIME SLUDGE POND
CHARACTERIZATION DATA COMPARISON TO
RADIONUCLIDE LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI = 0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Reg. Leachate Action Levels
Ra-226		1.15	11.52	
Th-228		10.40	10.40	
Th-230		1.67	16.71	
U-234		1.21	12.12	
U-235/236		0.15	1.49	
U-238		0.85	8.49	
U-Total	0.70			

TABLE 4-15

SOUTH FIELD CHEMICAL TREATABILITY CHARACTERIZATION DATA COMPARISON TO LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI = 0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Reg. Leachate Action Levels
2-Butanone	0.01			
4-Methyl-2-pentanone	0.04			
Acetone	1.33			
Boron	0.97			
Cobalt	0.92			
Cyanide	0.06			
Manganese	0.03			
Methylene Chloride	0.12	0.94	9.35	
Molybdenum	1.20			
Nickel	0.16			
Silver	5.33			2.13

TABLE 4-16

SOUTH FIELD RADIONUCLIDE TREATABILITY CHARACTERIZATION DATA COMPARISON TO LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI = 0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Reg. Leachate Action Levels
Th-Total				

4.1.2.1 Leachability

Stabilized Sample TCLP Leachate Analysis

The MTCLP and TCLP leachability data of the stabilized waste are presented in Appendix C. The MTCLP results are presented in two different formats: results of actual analysis of the extract and results adjusted for dilution by stabilization reagents. Appendix C also contains results on TCL volatiles, TCL semivolatiles, TCL pesticides/PCBs, metals, and radionuclides. The TCLP results are presented in three different formats: actual analysis of the extract, results adjusted for spike recovery, and results adjusted for spike recovery and dilution by stabilization reagents. Samples are "spiked" (i.e., dosed with a known concentration of compounds being analyzed) and then analyzed. Comparison of the analysis of the spike sample with the known spike concentration gives the spike recovery. Recoveries or results for unspiked samples will have approximately the same recovery rate as the spiked sample. For example, analysis of a sample with an actual concentration of 100 ppm of X may give a result of 80 ppm. The spike recoveries give the information needed to adjust the 80 ppm to 100 ppm. The correction for dilution is made because addition of the stabilizing reagents reduces the concentrations of the various constituents of concern. In order to determine if leachate concentration reductions are due to treatability or dilution, the results are adjusted for dilution.

Full TCLP and radiological analysis of reagent blanks were conducted to determine possible contributions from the reagents to the leachate quality of the treated waste. Additional experimental blanks were produced using seven mixtures of reagents on which TCLP and radiological analysis were performed to determine if potential contamination could be introduced by the experimental equipment or procedures. These mixtures were made in the same equipment and allowed to cure in the same type of molds the treated waste would cure in. "Clean" sand (i.e., sand sold for use in a child's sand box) was substituted in these mixtures for the site waste and site flyash. Appendix C contains the leaching data for the reagents blanks and experimental blanks. The leachates from all reagents and mixtures cured with sand have contaminant levels below the leachate action levels. The reagents which were mixed with water and cured have leachates with similar or lower concentrations of contaminants than the reagents by themselves. The reagents are not adding significant concentrations of metal, organic, or radionuclides to the waste - reagent mixtures that would cause the mixtures to fail the proposed leachate criteria.

Comparisons of leachate concentrations from samples with formulas with UCS values greater than 400 psi are presented in Tables 4-17 through 4-22. The percentage of the UCL concentrations of the TC and leachate action level criteria are provided in these tables. Only constituents of concern (Table 1-1) are addressed in these tables. If the percentage is greater than 100, the concentration in the leachate exceeds the leaching criteria. Data for compounds or elements are not presented in the tables if all of the leachate concentration values for the compounds or elements were nondetectable. All formulas for

TABLE 4-17

SOLID WASTE LANDFILL
TREATABILITY DATA COMPARISON TO
CHEMICAL LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI=0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Reg. Levels
1,1-Dichloroethane	0.03			
2-Butanone	0.01			0.002
4-Methyl-2-pentanone	0.07			
Acetone	0.59			
Acetone^m	0.31			
Antimony	32.58			
Benzoic Acid	0.001			
Bis(2-ethylhexyl)Phthalate	0.07	0.48	4.79	
Cyanide	0.04			
Di-n-butylphthalate	0.60			
Methylene Chloride	0.51	4.09	40.91	
Molybdenum	1.22			
Nickel	0.13			
Phenol	0.001			
Silver	4.44			1.78
Toluene	0.002			
Zinc	0.08			

TABLE 4-18

SOLID WASTE LANDFILL
TREATABILITY DATA COMPARISON TO
RADIONUCLIDE LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI = 0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Ref. Levels
Ra-228		5.05	50.50	
Th-228		0	0	
Th-230		0	0	
Th-232		4.2	42	

TABLE 4-19

LIME SLUDGE POND CHEMICAL
TREATABILITY DATA COMPARISON TO
LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI = 0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Reg. Levels
2-Butanone	0.02			0.003
Acetone	0.47			
Benzic Acid	0.0009			
Boron	0.29			
Carbon Disulfide	0.001			
Cyanide	0.02			
Molybdenum	0.80			
Phenol	0.001			
Silver	5.23			2.09
Toluene	0.002			

TABLE 4-20

LIME SLUDGE PONDS RADIONUCLIDE TREATABILITY DATA COMPARISON TO LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI = 0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Reg. Levels
Th-228		0	0	
Th-230		0	0	
Th-232		0.19	1.9	

TABLE 4-21

SOUTH FIELD CHEMICAL
TREATABILITY DATA COMPARISON TO
LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI = 0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Reg. Levels
2-Butanone	0.01			
Chloroform	0.01	0.02	0.17	0.02
Lead	0.01			0.58
Silver	217.85			87.14
Silver[m]	0.01			0.003

[m] Statistics for constituent with outliners rejected

TABLE 4-22

SOUTH FIELD
TREATABILITY DATA COMPARISON TO
RADIONUCLIDE LEACHATE ACTION LEVELS

Constituent of Concern	Percent of 95% CI to HI = 0.20 Leachate Action Levels	Percent of 95% CI to E-5 Leachate Action Levels	Percent of 95% CI to E-6 Leachate Action Levels	Percent of 95% CI to TC Reg. Levels
Ra-226		1.17	11.72	
Th-228		3.90	3.90	
Th-230		0.47	4.71	
U-234		1.28	12.80	
U-235/236		0.15	1.45	
U-238		1.24	12.41	

the three waste areas passed the TC regulatory and leachate action level criteria except for one Ra-226 analysis.

The one case where the Ra-226 concentration exceeded the 10^{-5} risk leachate action level value was from the Solid Waste Landfill (Run 12D) and used the lowest loading of cement tested on the waste. Its duplicate, Run 12, had a nondetectable level of Ra-226. All other radionuclides in Runs 12 and 12D were below 17 percent of the 10^{-6} risk leachate action level values. The difference between the duplicates may be due to sample heterogeneity.

Comparison of Stabilized and Characterization Leachate Samples

Chemical

Tables 4-23 through 4-28 contain the summary statistics for the sample distribution for the Solid Waste Landfill, Lime Sludge Ponds, and South Field. This information is provided to describe the sample distribution of the characterization data. The UCL and LCL was used to determine if the leachate from the treated sample was of the same sample population as the untreated sample. These tables are separated into two groups. The first contains the chemicals observed in either the characterization or the treated samples; the next group of tables contains the chemicals that were observed in both the characterization and treated samples. Tables 4-29 through 4-32 contain the percent reductions based on the median values. If the 95 percent confidence intervals overlap, the characterization and treated sample population overlap.

In the Solid Waste Landfill, the leachability of tetrachloroethene, lead, zinc and several other compounds or elements increased. In the Lime Sludge Ponds the silver leachability was decreased. The leachability of 2-butanone, acetone, and toluene increased in the treated samples. In the South Field samples, 2-butanone and silver concentration in the treated sample leachate increased. All these leachate concentrations are small and are well below the leachate action levels. The differences are likely due to sample heterogeneity.

Radiological

Tables 4-33 through 4-37 contain the summary statistics for the sample distribution for the Solid Waste Landfill, Lime Sludge Ponds, and South Field. This information is provided to describe the sample distribution of the characterization data. The UCL and LCL were used to determine if the leachate from the treated sample was of the same sample population as the untreated sample. These tables are separated into two groups. The first contains radionuclides observed in either the characterization or the treated samples; the next group of table contains the radionuclide analyses that were observed in both the characterization and treated samples. Tables 4-38 through 4-39 contain the percent reductions achieved in the treated samples versus the characterization and treated sample population overlap.

TABLE 4-23

TREATED VS. CHARACTERIZATION SAMPLES -CHEMICAL DATA
SOLID WASTE LANDFILL - RAW DATA

Chemical	Frequency of Detection	Range of Detection (ug/L)	Dist[c]	Mean[d] (ug/L)	Median (ug/L0	Lower 95% Ci on (ug/L)	Upper 95% CI on Mean (ug/L)	Coef of Var (%)
Chemicals Detected in Characterization and Missing in Treatablity Data								
Tetrachloroethene	5/5	1 - 30	L[l]	1.974	1	0.463[i]	8.418	190.72
Lead	4/4	2.3 - 89.5	L[l]	14.68	40.35	1.38[i]	156.2[i]	109.07
Chemicals Detected in Treatability and Missing in Characterization Data								
1,1-Dichlorethane	1/1	2 - 2	[h]	[h]	2	2[h]	2[h]	.
2-Hexanone	4/4	1 - 3	L[i]	2.06	2.5	1.119	3.79[i]	42.552
4-Methyl-2-pentanone	7/7	1 - 16	L	5.571	2	1.203	28.241[i]	111.06
Acetone	15/15	18 - 660	L[k]	209.53	160	127.89	415.69	72.669
Acetone[m]	14/14	18 - 340	N	177.36	160	134.38	220.33	51.194
Antimony	9/9	31.6 - 113	L	63.544	55	42.756	97.725	48.8
Benzoic Acid	1/15	10 - 10	L[l]	23.519	50	21.12	26.19[i]	16.137
Bis(2-ethylhexyl) Phthalate	3/3	5 - 10	L[l]	7.663	9	4.083[i]	14.384[i]	33.072
Cyanide	4/4	2.1 - 7.7	L[l]	3.645	3.4	1.849[i]	7.185	60.975
Di-n-butylpthalate	1/1	420 - 420	[h]	[h]	420	420[h]	420[h]	.
Methylene Chloride	15/15	28 - 330	N	158.2	180	111.87	204.53	64.401
Melybdenum	8/8	21.8 - 40.9	N	32.45	34.15	28.229	36.671	19.418
Nickel	3/3	20.2 - 24.4	L[l]	22.399	22.8	19.062[i]	26.32[i]	9.435
Phenol	1/15	5 - 5	L[l]	5	10	5[i]	5	0
Tolune	2/15	1 - 1	L[l]	2.212	5	1.911	2.562[i]	22.948

3527

TABLE 4-24

TREATED VS. CHARACTERIZATION DATA - SOLID WASTE LANDFILL, RAW DATA

Chemical	Frequency of Detection	Range of Detection ($\mu g/L$)	Dist.[a]	Mean[b] ($\mu g/L$)	Median ($\mu g/L$)	Lower 95% CI on ($\mu g/L$)	Upper 95% CI on ($\mu g/L$)	Coef. of Var. (%)
Treated Samples Raw Data								
2-Butanone	6 /6	2 - 4	L[d]	2.57	2.5	2.018	3.273	30.619
Silicon	7 /7	3880 - 19100	N	13637	15600	9842.3	17432	37.888
Silver	9 /9	57.6 - 101	N	79.067	77.2	69.249	88.885	20.033
Zinc	8 /9	7.1 - 143	N	81.011	109	45.785	116.24	70.151
Characterization Samples Raw Data								
2-Butanone	8 /8	1 - 7	N	3.625	4	2.337	4.913	53.038
Silicon	5 /5	2937 - 4340	L[d]	3442.8	3460	2951.8	4015.4	16.54
Silver	6 /6	72.6 - 81.4	L[d]	75.613	74.9	73.098	78.214	4.187
Zinc	4 /4	68.1 - 263	L[d]	122.18	123.35	55.292[c]	269.98[c]	64.844

[a]Distribution: N = Normal; L = Lognormal

[b]If the distribution is normal or if the distribution is lognormal, the number of detects $\geq$7, and frequency of detection $\geq$50%, an arithmetic mean is given. If the distribution is lognormal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[d]Data set contains fewer than seven observations or more than 50% nondetects, therefore, the distribution could not be definitively determined. It is treated as lognormal.

TABLE 4-25

LIME SLUDGE POND COMPARISON OF RAW DATA - CHEMICAL

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[c]	Mean[d] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef of Var (%)
LIST OF COMPOUNDS DETECTED IN THE TREATED BUT NOT OBSERVED IN THE CHARACTERIZATION SAMPLES								
2-Hexanone	4 /4	1 -1	L[l]	1	1	1	1	0
Antimony	14 /14	66 -93	L	76	73.8	71.94	80.31	11.53
Benzoic acid	11 /14	4 -64 L		16.4	10	9.943	26.32	95.153
Boron	9 /9	168 -225	L	194	194	183.3	206.2	9.144
Carbon disulfide	1 /1	1 -1	h	h	1	1[h]	1[h]	
Cyanide	8 /8	2.4 -6	N	4.1	3.85	3.325	4.875	28.23
Methylene Chloride	14 /14	30 -120	L	56.3	52	43.02	74.13	50.46
Phenol	3 /14	4 -5	L[l]	4.92	10	4.784	5.062[i]	5.423

[c]Distribution: N = Normal; L = Lognormal.

[d]If the distribution is normal or if the distribution is log-normal, the number of detects ≥ 7, and frequency of detection ≥ 50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects < 7 or the frequency of detection is < 50%, a geometric mean is given.

[h]Not applicable if sample size ≤ 2.

[i]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[l]Data set contains fewer than seven observations or more than 50% non-detects, therefore the distribution could not be definitely determined. It is treated as log-normal.

TABLE 4-26

LIME SLUDGE PONDS - CHEMICAL CHARACERTIZATION DATA COMPARED TO TREATED DATA

Chemical	Frequency of Detection	Range of Detection (ug/L)	Dist[a]	Mean[b] (ug/L)	Median (ug/L)	Lower 95% CI on Mean (ug/L)	Upper 95% CI on Mean (ug/L)	Coef. of Var. (%)
			Treated Waste Samples					
2-Butanaone	14/14	1 - 9	N	5.36	6.5	4.131	6.6	48
Acetone	14/14	100 - 760	L[e]	237	170	165.01170	326	77
Toluene	3/14	1 - 1	L[f]	2.05	5	1.708	2.5[d]	99
2-Butanone	1/1	6 - 6	c	c	6	6.000[c]	6[c]	NA
Acetone	1/1	1 - 1	c	c	1	1.000[c]	1[c]	NA
Tolune	1/1	1 -1	c	c	1	1.000[c]	1[c]	NA

NA - Not applicable

[a]Distribution: N = Normal; L= Lognormal

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ■ 7, and frequency of detection ■ 50%

[c]Not apllicable if sample size < 2

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Distribution failed the Correlation Coefficient Test and therefore could not be definitively determined.

[f]Data set contains fewer than seven observations or more than 50% non-detects, therefore the distribution

TABLE 4-27

SOUTH FIELD CHEMICAL TREATED VS. CHARACTERIZATION DATA, RAW DATA

Chemical	Frequency of Detection	Range of Detection ($\mu g/L$)	Dist[a]	Mean[b] ($\mu g/L$)	Median ($\mu g/L$)	Lower 95% CI on Mean ($\mu g/L$)	Upper 95% CI on Mean ($\mu g/L$)	Coef. of Var. (%)
LIST OF COMPOUNDS FROM THE TREATABILITY STUDY BUT NOT IN THE CHARACTERIZATION DATA.								
4-Methyl-2-pentanone	1 /1	14 - 14	c	c	14	14[c]	14[d]	NA
Acetone	4 /4	24 - 510	L^1	179.07	310	34.513	929.07[d]	75.979
Antimony	4 /4	45.4 - 87.6	L[e]	62.61	63.75	42.681[d]	91.844[d]	31.945
Boron	3 /3	169 - 398	L[e]	297.89	393	130.2[d]	681.53[d]	40.873
Cobalt	2 /2	16.2 - 18.3	c	c	17.25	16.2[c]	18.3[c]	8.608
Cyanide	3 /3	2 - 8.2	L[e]	3.354	2.3	0.904[d]	12.437[d]	83.909
Manganese	4 /4	12.6 - 17.3	L[e]	14.714	14.8	12.039[d]	17.984[d]	16.948
Methylene chloride	4 /4	24 - 46	L[e]	34.095	35	24.865	46.751[d]	25.767
Molybdenum	4 /4	17.2 - 35.1	L[e]	23.66	23.45	15.595[d]	35.897[d]	35.237
Nickel	2 /2	31.7 - 32.8	c	c	32.25	31.7[c]	32.8[c]	2.412
LIST OF COMPOUNDS FROM THE CHARACTERIZATION DATA BUT NOT IN THE TREATABILITY STUDY.								
Cadmium	6 /8	0.002 - 7	L[e]	0.019	0.014	0.004	0.103	279.46
Chloroform	1 /1	1 - 1	c	c	1	1[c]	1[c]	NA
Lead	4 /4	0.083 - 81.1	L[e]	0.632	0.154	0.014[d]	28.927	198.72
Pentachlorophenol	3 /3	13 - 20	L[e]	16.083	16	11.185[d]	23.126	21.501
Selenium	6 /6	0.097 - 138	L[e]	0.41	0.14	0.039[d]	4.305	243.56
Tetrachloroethene	1 /1	1 - 1	c	c	1	1[c]	1[c]	NA

[a]Distribution L: Lognormal
[b]If the distribution is normal or if the distribution is lognormal, the number of detects ≥ 7, and frequency of detection $\geq 50\%$, an arithmetic mean is given. If the distribution is lognormal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.
[c]Not applicable if sample size ≤ 2.
[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration
[e]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as lognormal.

TABLE 4-28

TREATED VS CHARACTERIZATION SAMPLES - SOUTH FIELD, RAW DATA

Chemical	Frequency of Detection	Range of Detection (g/L)	Dist[a]	Mean[b] (g/L)	Median (g/L)	Lower 95% CI on Mean (g/L)	Upper 95% CI on Mean (g/L)
Treated Data							
2-Butanone	4 /4	1 - 6	L[d]	2.449	2.5	1.013	5.92
Silver	4 /4	79.4 - 103	L[d]	90.048	90.3	76.005[c]	106.69[c]
Characterization Data							
2-Butanone	12 /12	1 - 10	L[e]	3	2	2.019	4.313
Silver	8 /8	0.024 - 66.2	L[e]	8.362	0.112	0.003[c]	4357
Silver[e]	7 /7	0.024 - 0.142	N	0.099	0.095	0.069	0.13

[a]Distribution: L = Lognormal
[b]If the distribution is normal or if the distribution is lognormal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is lognormal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given
[c]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration
[d]Distribution failed the Correlation Coefficient Test and therefore could not be definitively determined
[e]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as lognormal

TABLE 4-29

SOLID WASTE LANDFILL
TREATED RAW DATA
COMPARISON TO CHARACTERIZATION RAW DATA

Chemical	Median Percent Reduction (%)	Overlap of 95% CI (Y/N)
2-Butanone	37.50	Y
Silicon	0.00	N
Silver	0.00	Y
Zinc	11.63	Y

TABLE 4-30

SOLID WASTE LANDFILL
TREATED SPIKE & DILUTION CORRECTED DATA
COMPARISON TO CHARACTERIZATION SPIKE CORRECTED DATA

Chemical	Median Percent Reduction (%)	Overlap of 95% CI (Y/N)
2-Butanone	0.00	Y
Silver	0.00	Y

TABLE 4-31

LIME SLUDGE POND COMPARISON OF RAW DATA COMPOUNDS FOUND IN THE CHARACTERIZATION AND TREATABILITY DATA

Chemical	Median Percent Reduct, (%)	Overlap of 95% CI (Y/N)
2-Butanone	-8.33	Y
Acetone	-16900	N
Silver	31.1	N
Toluene	-400	N

TABLE 4-32

SOUTH FIELD
TREATED DILUTION & SPIKE CORRECTED
VS. CHARACTERIZATION SPIKE CORRECTED DATA

	Median % Reduction (%)	Overlapping Populations (Y/N)
2-Butanone	0.00	N
Silver	0.00	N
Silver	0.00	N

TABLE 4-33

TREATED VS. CHARACTERIZATION SAMPLES
SOLID WASTE LANDFILL

Radionuclide	Frequency of Detection	Range of Detection (pCi/L)	Dist[c]	Mean[d] (pCi/L)	Median (pCi/L)	Lower 95% CI on Mean (pCi/L)	Upper 95% CI on Mean (pCi/L)	Coef of Var (%)
Radionuclides which were detected in Treatability but not in Characterization Data								
Th-Total	1/10	9.42 - 9.42	L[l]	3.63	7.5	2.627[i]	5.017	52276
Radionuclides which were detected in Characterization but not in Treatablity Data								
Ra-22	5/5	1.63 - 5.26	L[l]	3.247	3.38	2.144	4.918	38.186
Th-228	1/5	1.99 - 1.99	L[l]	0.709	1.2	0.406[i]	1.237	77.079
Th-230	3/5	1.02 - 4.67	L[l]	1.1186	1.02	0.477[i]	2.949	100.96
Th-230	2/2	2031 - 8300	[h]	[h]	5165.5	2031[h]	8300[h]	85.817
U-235/236	2/2	178 - 1000	[h]	[h]	589	178[h]	1000[h]	98.683
U2-238	2/2	2528 - 8580	[h]	[h]	5554	2528[h]	8580[h]	77.051
U-Total[n]	5/5	6850 - 1000	L[l]	40180	75400	13895	116189[i]	68.069

TABLE 4-34

TREATED VS CHARACTERIZATION - SOLID WASTE LANDFILL, RAD DATA

Radionuclide	Frequency of Detection	Range of Detection (pCi/L)	Dist[a]	Mean[b] (pCi/L)	Median (pCi/L)	Lower 95% CI on Mean (pCi/L)	Upper 95% CI on Mean (pCi/L)	Coef. of Var.(%)
Treated Samples - Raw Data								
Gross beta	8 /10	37.1 - 93.5	L	46.93	47.5	15.014[c]	305.57[c]	61.863
Ra-228	2 /9	14.3 - 41.3	L[d]	5.834	7.9	3.369[c]	10.1	134.5
Characterization Samples - Raw Data								
Gross beta	5 /5	1470 - 7150	L[d]	4359.8	5170	2407	7896.8[c]	42.702
Ra-228	2 /5	3.44 - 3.68	L[d]	2.185	3.44	1.423[c]	3.356	45.947

[a]Distribution: L = Lognormal

[b]If the distribution is normal or if the distribution is lognormal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is lognormal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given

[c]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration

[d]Data set contains fewer than seven observations or more than 50% nondetects, therefore th distribution could not definitively determined. It is treated as log normal.

TABLE 4-35

LIME SLUDGE POND
COMPARISON OF RAW CHARACTERIZATION
TO DILUTE TREATABILITY - RADIOLOGICAL

Radionuclide	Frequency of Detection	Range of Detection ($\mu g/L$)	Dist[c]	Mean[d] ($\mu g/L$)	Median ($\mu g/L$)	Lower 95% CI on Mean ($\mu g/L$)	Upper 95% CI on Mean ($\mu g/L$)	Coef of Var (%)
LIST OF RADIONUCLIDES FROM THE CHARACTERIZATION BUT NOT OBSERVED IN THE TREATED DATA								
Ra–226	1 /3	1.61 -1.6	L[l]	0.74	1	0.237[i]	2.3[i]	73.662
Th–228	3 /3	3.34 -7.2	L[l]	4.9	4.87	2.559[i]	9.36[i]	37.92
Th–230	3 /3	3.1 -13	L[l]	5.07	3.24	1.284[i]	20.1[i]	88.042
U–234	3 /3	5.91 -10	L[l]	7.43	6.75	4.559[i]	12.1[i]	30.447
U–235/236	1 /3	1.15 -1.2	L[l]	0.66	1	0.293[i]	1.49[i]	52.364
U–238	3 /3	3.61 -6.8	L[l]	4.98	5.02	2.918[i]	8.49[i]	31.08
LIST OF RADIONUCLIDES FROM THE TREATED BUT NOT OBSERVED IN THE CHARACTERIZATION DATA								
Th-Total[n]	1 /5	34.91 -35	L[l]	13.3	29.04	2.607[i]	22.6[i]	89.599

[c]Distribution: N = Normal; L = Lognormal.
[d]If the distribution is normal or if the distribution is log-normal, the number of detects ≥ 7, and frequency of detection ≥ 50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects < 7 or the frequency of detection is < 50%, a geometric mean is given.
[i]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.
[l]Data set contains fewer than seven observations or more than 50% non-detects, therefore the distribution could not be definitively determined. It is treated as log-normal.
[n]All values for U-Total and Th-Total are reported in $\mu g/L$.

35527

TABLE 4-36

RADIOLOGICAL CONSTITUENTS TREATABLITY STUDY
LIME SLUDGE PONDS, RAW DATA

Chemical	Frequency of Detection	Range of Detection (pCi/L)	Dist[a]	Mean[b] (pCi/L)	Median (pCi/L)	Lower 95% CI on Mean (pCi/L)	Upper 95% CI on Mean (pCi/L)	Coef. of Var. (%)
				Treated Samples				
U-Total[e]	1/12	1.690 - 1.690	L[c]	0.553	1.000	0.461[d]	0.664	57.334
				Characterization Samples				
U-Total	3/3	8.06 - 12.4	L[c]	9.89	9.69	6.969[d]	14.24[d]	21.829

4-43

[a]Distribution: N = Normal; L= Lognormal

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ■ 7, and frequency of detection ■ 50%

[c]Data set contains fewer than seven observations or more than 50% non-detects, therefore the distribution

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]All Values for U-Total and Th-Total are reported in (pCi/L)

3527

TABLE 4-37

SOUTH FIELD
COMPARISON OF TREATED TO CHARACTERIZATION
RADIOLOGICAL DATA

Radionuclide	Frequency of Detection	Range of Detection (pCi/L)	Dist[c] (pCi/L)	Mean[d] (pCi/L)	Median (pCi/L)	Lower 95% CI on Mean (pCi/L)	Upper 95% CI on Mean (pCi/L)	Coef of Var. (%)
Radionuclides Detected in the Treated Samples but not in the Characterization Samples								
Gross beta	3 /4	58.7 -69.8	L[1]	47.553	60.55	23.979 [i]	94.301 [i]	42.294
Th-Total	1 /4	1.59 -1.59	L[1]	1.888	3.7	1.461 [i]	2.441 [i]	21.844
Radionuclides Detected in the Characterization Samples but not in the Treated Samples								
Gross alpha	1 /3	45.7 -45.7	L[1]	32.483	50	19.282 [i]	54.723 [i]	32.178
Ra-226	3 /3	1.34 -1.98	L[1]	1.671	1.76	1.193 [i]	2.343 [i]	19.203
Th-228	3 /3	2.52 -3.12	L[1]	2.884	3.05	2.366 [i]	3.514 [i]	11.326
Th-230	2 /3	1.74 -2.63	L[1]	1.318	1.74	0.307 [i]	5.657[i]	65.9
U-234	3 /3	11.5 -12.4	L[1]	11.994	12.1	11.242 [i]	12.797 [i]	3.819
U-235/236	1 /3	1.13 -1.13	L[1]	0.656	1	0.297 [i]	1.451 [i]	51.23
U-238	3 /3	10.1 -11.7	L[1]	10.947	11.1	9.654 [i]	12.412 [i]	7.37
U-Total	3 /3	23 -30.2	L[1]	25.826	24.8	20.375 [i]	32.736 [i]	14.412

[a] If a blank data are available.

[c] Distribution: N= Normal; L = Log-normal

[d] If the distribution is normal or if the distribution is log-normal, the number, the number of defects ≥7, and frequency of detection 50%, and arithmetic mean is given. If the distribution is log-normal and either the number of detects < 7 or the frequency of detection is < 50%, a geometric mean is given.

[e] If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and the frequency of detection 50%, an arithmetic upper 95% confidence interval (CI) on the mean is given. If the distribution is log-normal and either the number of detects < 7 or the frequency of detection is < 50%, a geometric upper 95% CI on the mean is given

121

[h] Not applicable if sample size is 2

[i] Note that the upper or lower 95% CI on the mean exceeds the maximum detected concentration.

[j] Frequency of detection is less than 5%.

[k] Distribution failed the Correlation Coefficient Test and therefore could not be determined. It is treated as log-normal.

[l] Data set contains fewer than seven observations or more than 50% non-detects, therefore the distribution could not be definitively determined. It is treated as log-normal.

[m] Statistics for constituent with outlines rejected

[n] Units for Th-Total and U-total is ug-1.

TABLE 4-38

SOLID WASTE LANDFILL
COMPARISON OF TREATED TO CHARACTERIZATIONS
RAW AND DILUTION RADIOLOGICAL DATA

Radionuclide	Median Percent Reduction	Overlapping Populations
	Raw Data Comparison	
Gross Beta	99	No
Ra-228	-130	No
	Dilution Corrected Data	
Gross Beta	98	No
Ra-228	-313	No

TABLE 4-39

LIME SLUDGE POND
COMPARISON OF SPIKE CORRECTED CHARACTERIZATION
TO SPIKE AND DILUTION CORRECTED TREATED DATA

Radiological Constituent	Percent Reduct, (%)	Overlapping of 95% CI (Y/N)
U-Total	82.14	N

The Solid Waste Landfill and the Lime Sludge Ponds had reductions in Ra-226, Th-228, Th-230, and uranium. Th-total was observed in the treated sample but not in the characterization samples. In the Solid Waste Landfill Ra-228 showed an increase in leachability. This result is due to one sample and is discussed in the previous section.

The South Field samples had no radionuclides in common between the characterization and the treated samples. Gross beta and total thorium were measured in the treated samples but not in the characterization samples.

General

The data in Tables 4-5 through 4-8 indicate that the ratio of the weight of attapulgite or clinoptilolite to the weight of cement varied from 0 to 20 percent. To minimize potentially detrimental effects of clays on the UCS, the weight of clay in the mixture should typically not exceed 10 percent of the weight of cement. However, loadings of clays greater than 10 percent of the weight of cement may be necessary to control the metals' leachability in some cases. For Operable Unit 2 wastes, analytical results indicate that there does not appear to be a metals' leachability problem in the treated materials. The concentrations of most metals in the TCLP leachate are below the 10^{-6} leachate action levels or HI = 0.20 leachate action levels. Since the leaching of the metals does not appear to be a problem, the combined attapulgite and clinoptilolite loadings should be maintained below 10 percent of the weight of cement added to minimize the potentially detrimental effect on the UCS. Even if sorbents are not necessary to control leachability, the addition of these or other sorbents may be beneficial to improve the flowability of the treated waste during mixing. Addition of low loadings of sorbent may be beneficial for the adsorption of excess water (e.g., in the Lime Sludge Pond), potentially permitting lower loadings of cement to the waste.

4.1.2.2 Permeabilities

Ninety-five percent (21 of 22 tests) of the permeability results from the three Operable Unit 2 areas were less than 1.5×10^{-7} cm/s. There was one outlier sample with a 3.6×10^{-4} cm/s value from the Solid Waste Landfill (TDL Sample Number 10162513). (Using a t-Test, this sample was shown to be an outlier at the 95 percent confidence level.) The 10^{-4} cm/sec sample had visible transverse cracks across its width (approximately 120 degrees around the sample) and cracks which partially transversed the length of the sample. These fractures may have allowed water to more easily transverse the cylindrical monolith. Tables 4-5 through 4-8 present the permeability data, along with the bulking factor and UCS results.

EPA's "Handbook for Stabilization/Solidification of Hazardous Waste" states that "Permeabilities measured in solidified waste typically range from around 10^{-4} to 10^{-8} cm/sec. Such low permeabilities indicate decreased mobility in the treated waste and a slower transfer of contaminants from the solid mass to leaching waters" (EPA 1990b). All of the treated samples had permeabilities that are typical

of solidified waste forms. Ninety-five percent of the samples had very low permeabilities. The dominant flow of water should be around the treated material instead of through the material since the treated waste had low permeabilities.

4.1.2.3 Stabilization - Solid Waste Landfill

The following sections discussion of Solid Waste Landfill results for UCS analysis of 2- and 3-dimensional graphical results, tabular results, bulking factor, long-term study, and the recommended envelope for study.

Unconfined Compressive Strength

The Solid Waste Landfill material was pretreated by using the ashing procedure as described in Section 3.1.3.1 before the addition of stabilization reagents. The sample weight loss during the ashing process ranged from 19 to 22 percent. This ashing procedure should have volatilized or decomposed by oxidation many of the organic compounds present in the waste. In addition, certain metal compounds or elements, e.g., zinc chloride if present, would have been partly or completely volatilized from the waste. The combination of loss of the organic and inorganic compounds could have removed some of the cement setting inhibitors if they were present in the waste. The results presented in this section are valid only for samples which have received heat pretreatment.

This section addresses the UCS results; see Table 4-5 for the UCS, bulking factor, and permeability results. These tables are arranged in order of increasing UCS values. The precision of the UCS measurement is about 50 psi. Therefore, differences of this magnitude are not significant. Samples which did not fracture at the maximum applied axial load during the UCS testing are listed in the tables as ">480." Bar graphs of the UCS and bulking factor values as a function of sample number are in Figures 4-1 and 4-2 as a visual aid to show the range of UCS and bulking factor values measured in the study.

Analysis of Graphical Results - 2-Dimensional

Analysis of the SPLOM plot using the Influence plot option in Figure 4-3 indicates that increasing the cement and sodium silicate loadings have a positive influence on the UCS results. However, three data points have large influence on the regression line and the confidence interval lines are wide for sodium silicate. Thus the conclusions about sodium silicate based on this analysis are questionable. The effects of attapulgite, clinoptilolite, flyash, and water loadings on UCS are ambiguous due to the wide 90 percent confidence intervals.

Analysis of Graphical Results - 3-Dimensional

Figure 4-4 is a 3-dimensional (3-D) plot of UCS as a function of normalized flyash and cement loadings. The data points are represented as circles attached to a line perpendicular to the X-Y plane. The data in the 3-D plot is smoothed by Inverse Squared Distance procedures. At a given cement to

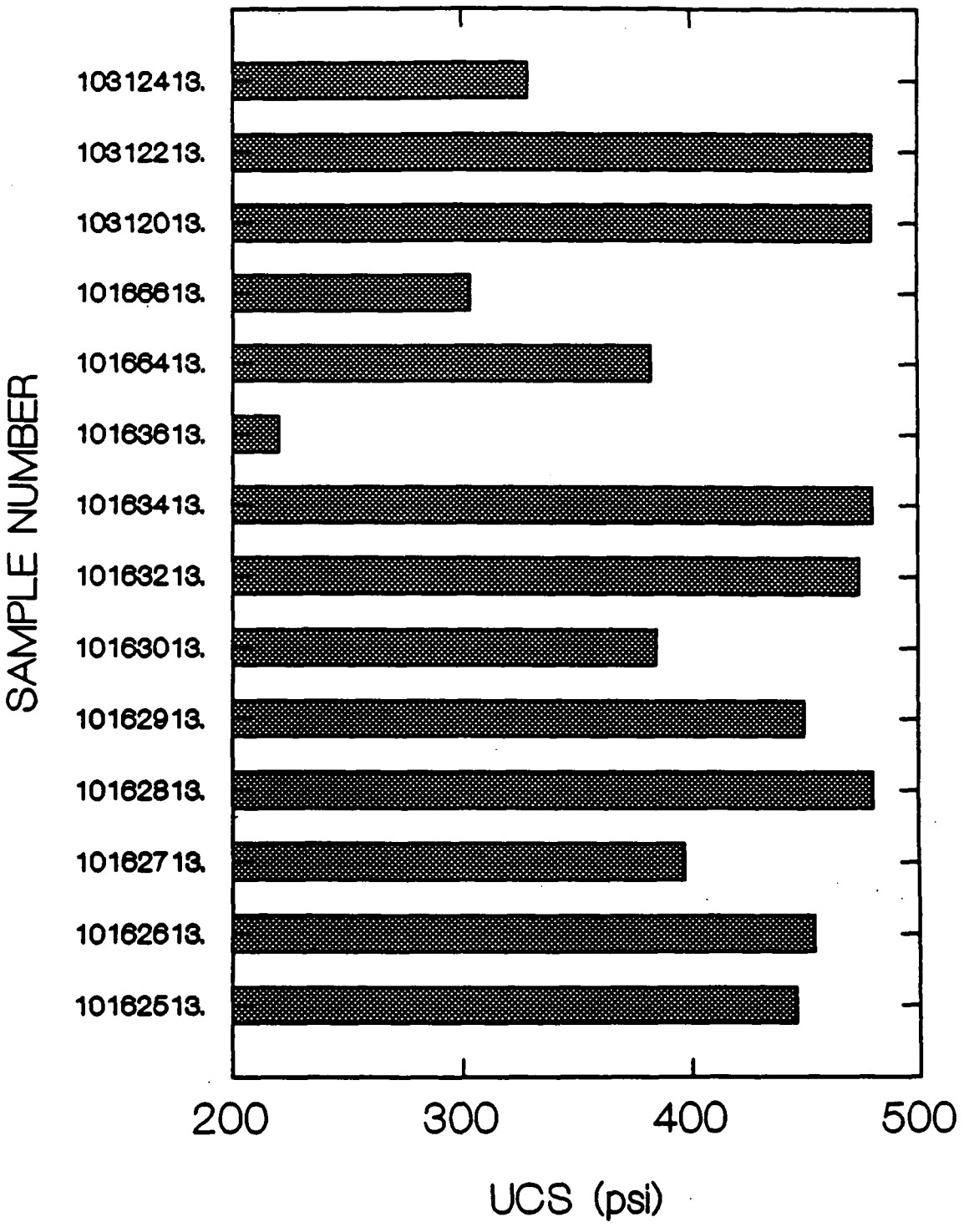


FIGURE 4- 1

BARGRAPH UCS VS TREATABILITY SAMPLE NUMBER FOR THE SOLID WASTE LANDFILL

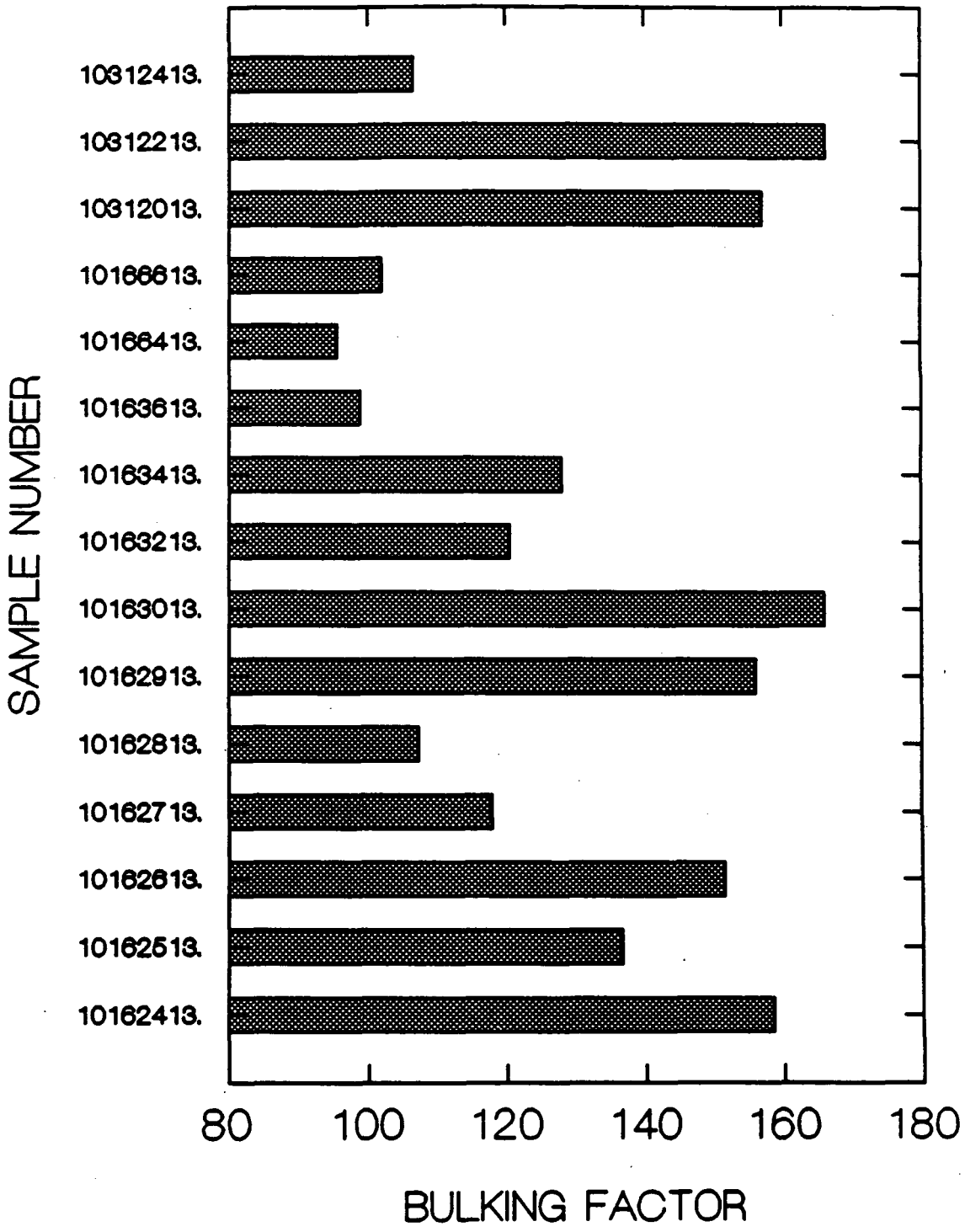


FIGURE 4-2

BARGRAPH BULKING FACTOR VS TREATABILITY SAMPLE NUMBER FOR THE SOLID WASTE LANDFILL

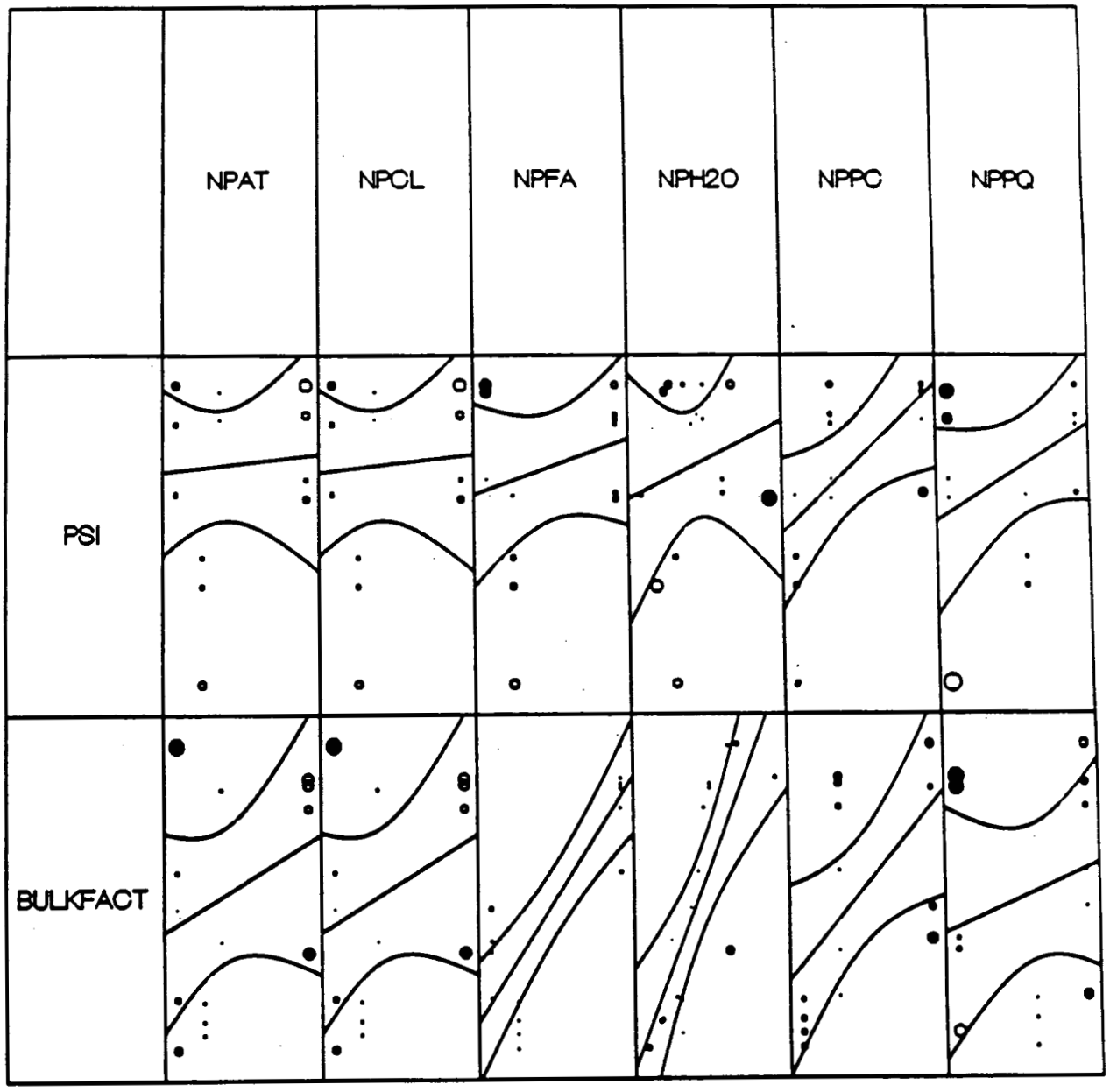


FIGURE 4-3

SPLOM PLOT FOR SOLID WASTE LANDFILL

129

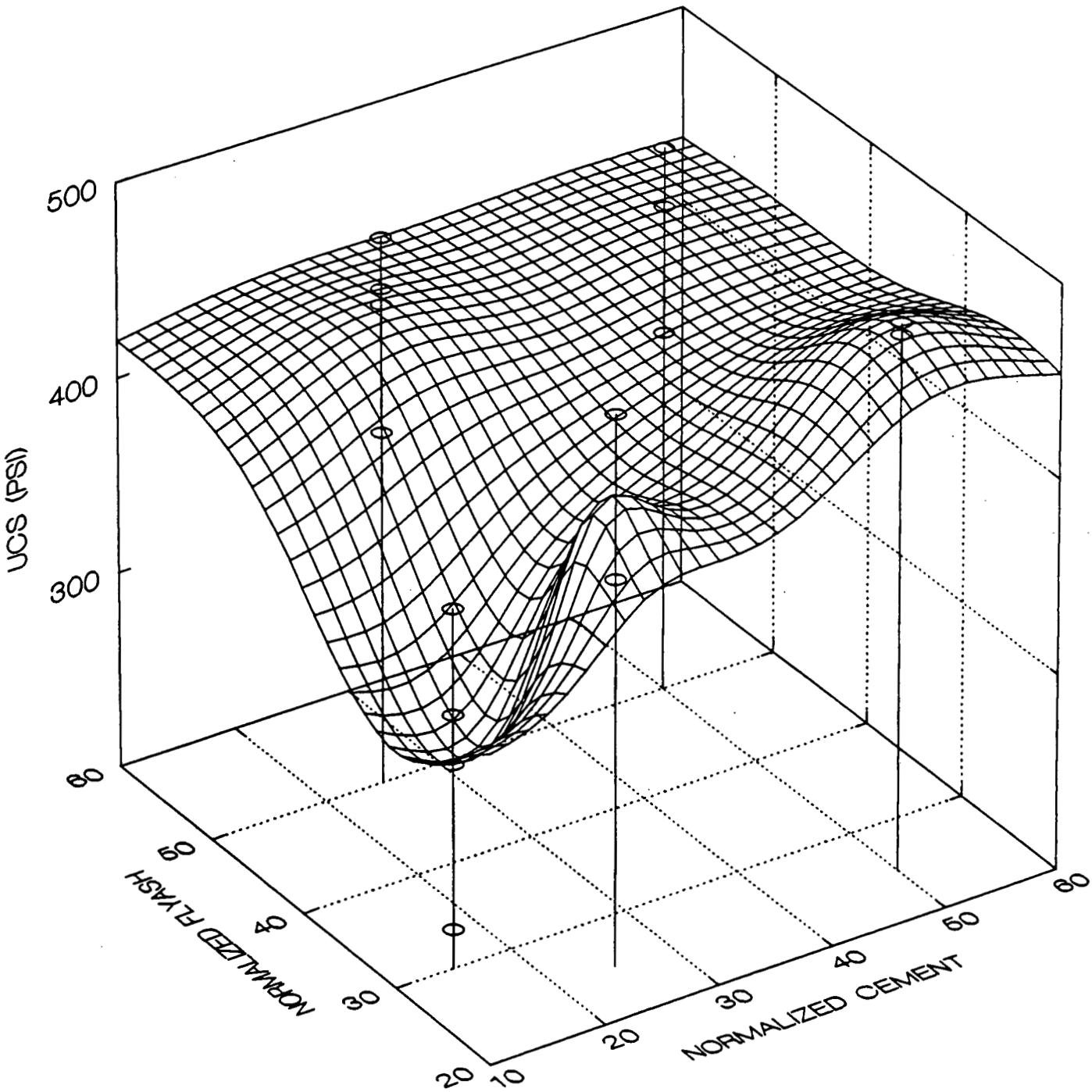


FIGURE 4-4

3-D PLOT OF UCS (psi) AS A FUNCTION OF NORMALIZED FLYASH AND CEMENT LOADINGS FOR THE SOLID WASTE LANDFILL

130

flyash ratio, the variations in UCS values are the result of changing the other reagent loadings, e.g., sodium silicate.

Figure 4-4 shows that at a normalized cement loadings of 50 and normalized flyash loadings from 25 to 50, UCS values from approximately 400 to 500 psi are obtained. Also there are UCS values between 400 and 500 psi at normalized flyash loadings of 25 and cement loadings ranging from 25 to 50. Analysis of the data in Figure 4-4 and Table 4-5 indicates that for a given cement to flyash ratio, the addition of sodium silicate improves the UCS value. A contour plot that represents the data could not be determined. Several smoothing routines were investigated, i.e., linear, DWLS, Inverse Squared Distance, and Negative Exponential.

Analysis of Tabular Results

Interpretation of the data in Table 4-5 indicates that at 15 percent cement, the UCS values range from 220 through 385 psi. The strength is increased by increasing the sodium silicate concentration. Higher attapulgite and clinoptilolite loadings decrease the UCS value; see Table 4-5, Runs 10, 12, and 11. At 25 percent cement loading, the UCS values range from 380 to >480 psi. The effects of the other reagents on the compressive strength are ambiguous. At 50 percent cement, the UCS value is greater than 450 psi irrespective of the other reagent loadings. Run 7 is an outlier to this trend.

Bulking Factor

Figure 4-5 and 4-6 are the 3-D and contour plots of bulking factor as a function of normalized cement and flyash loadings. The plateau in the 3-D plots at the highest cement loadings is an artifact of the plotting program. The smallest bulking factors are obtained at the lowest flyash and cement loadings. As flyash and cement loadings increase the bulking factor increases. In order to minimize bulking, the lowest flyash loading for a given cement loading should be used.

An empirical equation for bulking factor was determined:

$$BF = 5.6 * PFA + 3.0 * PPC,$$

where BF is the bulking factor, and PFA and PPC are the percentage of flyash and cement in the treated waste when mixed. A plot of the actual measured values versus the estimated values based on the mathematical model predictions is in Figure 4-7. The data is linear least square regressed with 90 percent confidence intervals. The equation has an R^2 value of 0.82. The equation indicates that the addition of flyash causes almost twice the volume increase as an equivalent addition of cement. This empirical equation should be used for qualitative prediction only.

It is often observed in stabilization of inorganic waste sludges that for equal additions of cement or flyash, the addition of flyash will result in a greater increase in bulking than addition of cement. The

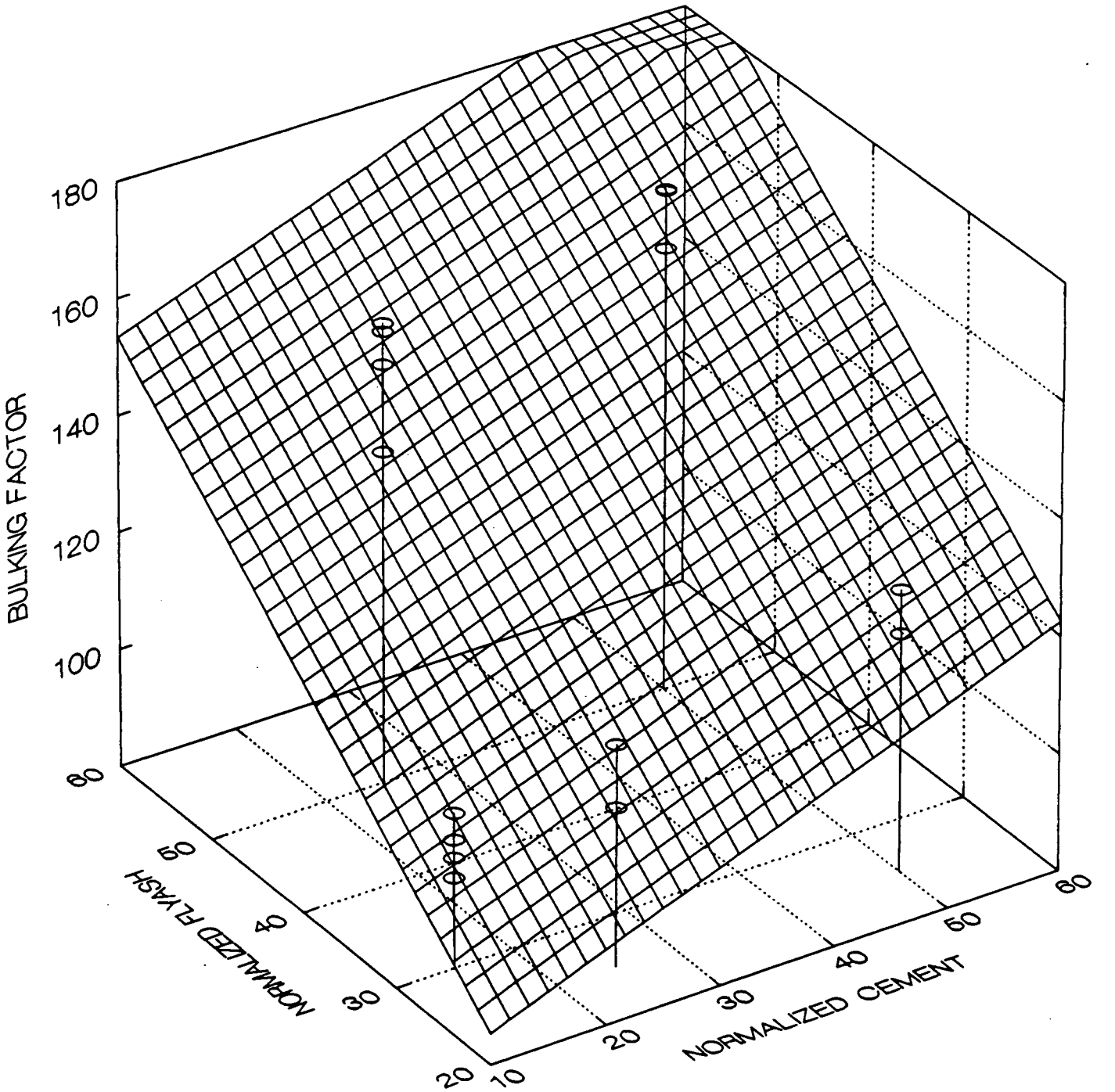


FIGURE 4-5

3-D PLOT OF LINEAR BULKING FACTOR AS A FUNCTION OF NORMALIZED CEMENT AND FLYASH LOADINGS FOR SOLID WASTE LANDFILL

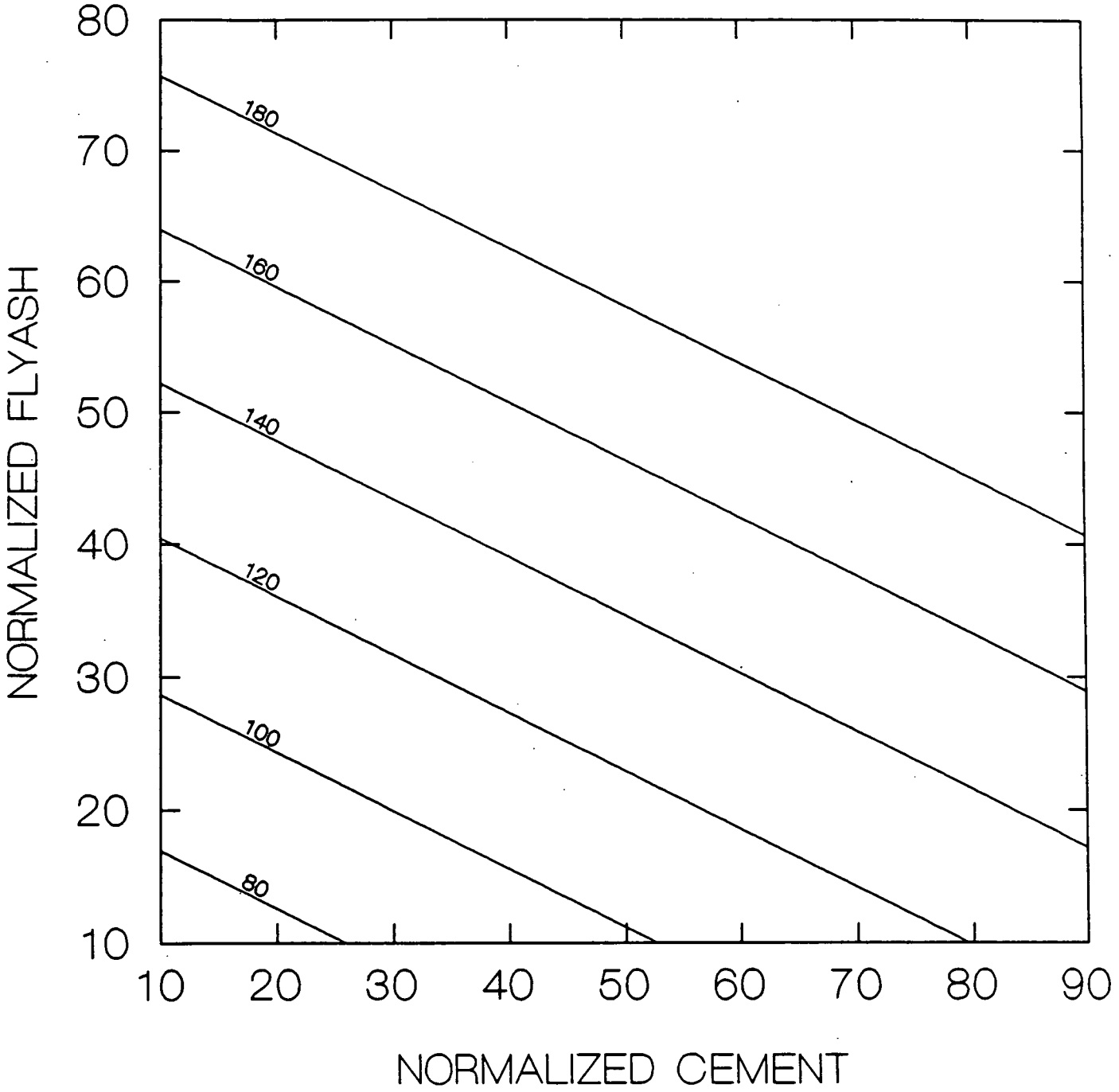


FIGURE 4-6

LINEAR CONTOUR PLOTS OF BULKING FACTOR AS A FUNCTION OF NORMALIZED CEMENT AND FLYASH LOADINGS FOR SOLID WASTE LANDFILL

3527

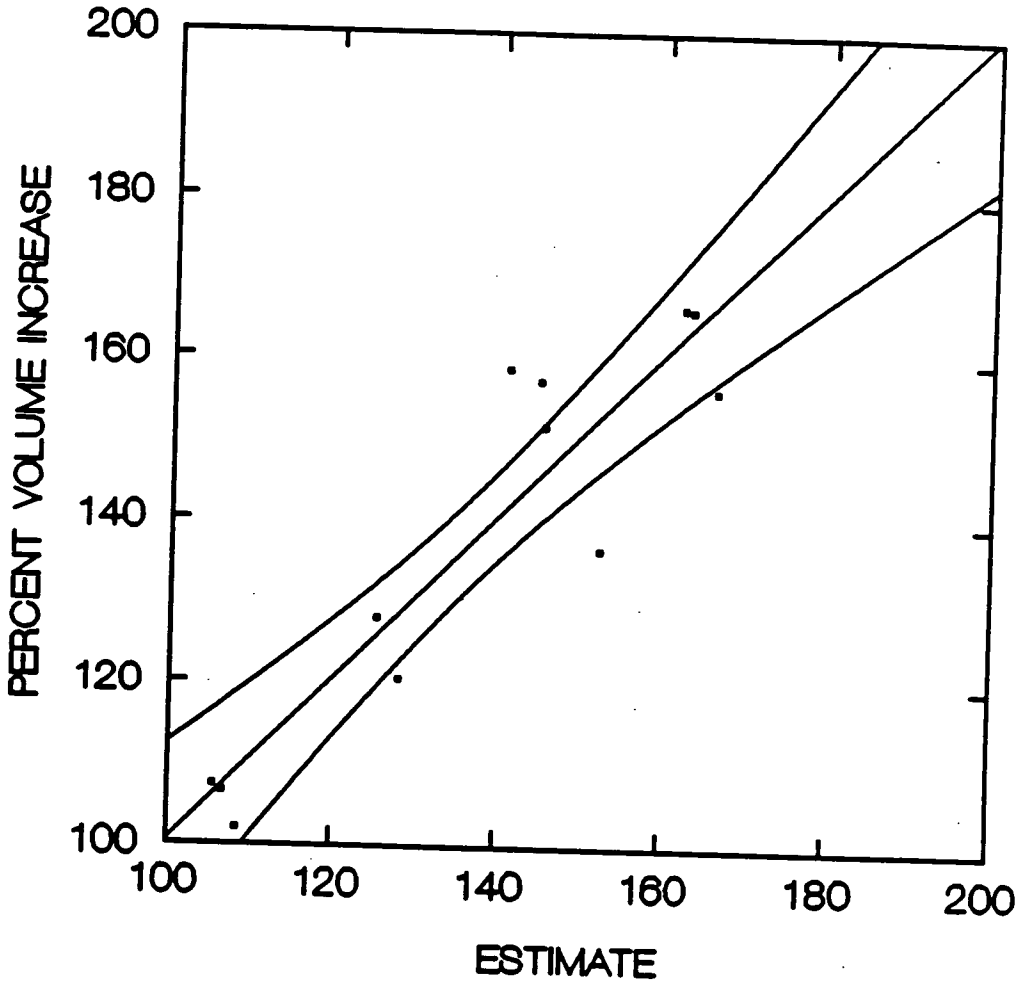


FIGURE 4-7

PLOT OF POST BULK FACTOR VS ESTIMATED BULKING FACTOR VALUES WITH A 90% CONFIDENCE LIMITS FOR THE SOLID WASTE LANDFILL

empirical mathematical models for the Solid Waste Landfill and Lime Sludge Ponds bulking factor supports this observation. A plausible explanation for this observation is that part of cement will rapidly dissolve and fill the voids between the particles in the mixture. Flyash is slow to react and therefore increases the bulking of the treated material more than cement does.

A qualitative relationship between UCS and bulking factor is shown in Figure 4-8. The data is smoothed using the DWLS procedure. Generally at bulking factors less than 140 percent, the UCS and bulking factor increase in unison. The negative curvature of the line in Figure 4-3 at greater than 140 percent bulking factor may be an artifact due to the scatter of the data. In particular, the two data points at approximately 160 percent bulking factor and 400 psi UCS values cause the best fit curve to have a more negative slope.

Recommended Formulations of Reagents

The formulations achieving greater than 450 psi are listed in Table 4-40. They are listed in order of ascending bulking factor. (See Figures 4-5 and 4-6 for a visual reference of the data point relations to each other.) The treated waste had low leachate concentrations when compared to the leachate action levels. The samples also had low permeability. Therefore, UCS and bulking factor are the parameters used to determine the recommended formulation. The recommended formulations that will achieve a UCS value greater than 450 psi and minimize bulking are given in Table 4-41. For a given cement loading the flyash loading should be minimized to control the bulking factor. These recommended formulations are valid only for heat pretreated material.

4.1.2.4 Stabilization - Lime Sludge Ponds

The following sections provide Lime Sludge Ponds discussion of results for unconfined compressive strength, analysis of 2- and 3-dimensional graphical results, tabular results, bulking factor, long-term study, and recommended envelope for study.

Unconfined Compressive Strength

This section addresses the UCS results. Tables 4-6 and 4-7 presents the UCS, bulking factor, and permeability results. These tables are arranged in order of increasing UCS values. The precision of the UCS measurement is about 50 psi. Therefore, differences of this magnitude are not significant. Samples which did not fracture at the maximum applied axial load during the UCS testing are listed in the tables as ">480." Values above 480 psi are indistinguishable due to the limits of instrument calibration. The range of UCS and bulking factor values can be seen in Figures 4-9 through 4-12. These figures are bar graphs of the magnitude of the UCS and bulking factor values as a function of sample number.

During Stage I, less than six formulations had UCS values greater than the approximately 500 psi performance objective. Three formulations had UCS values greater than 400 psi in Stage I. See Table

3527

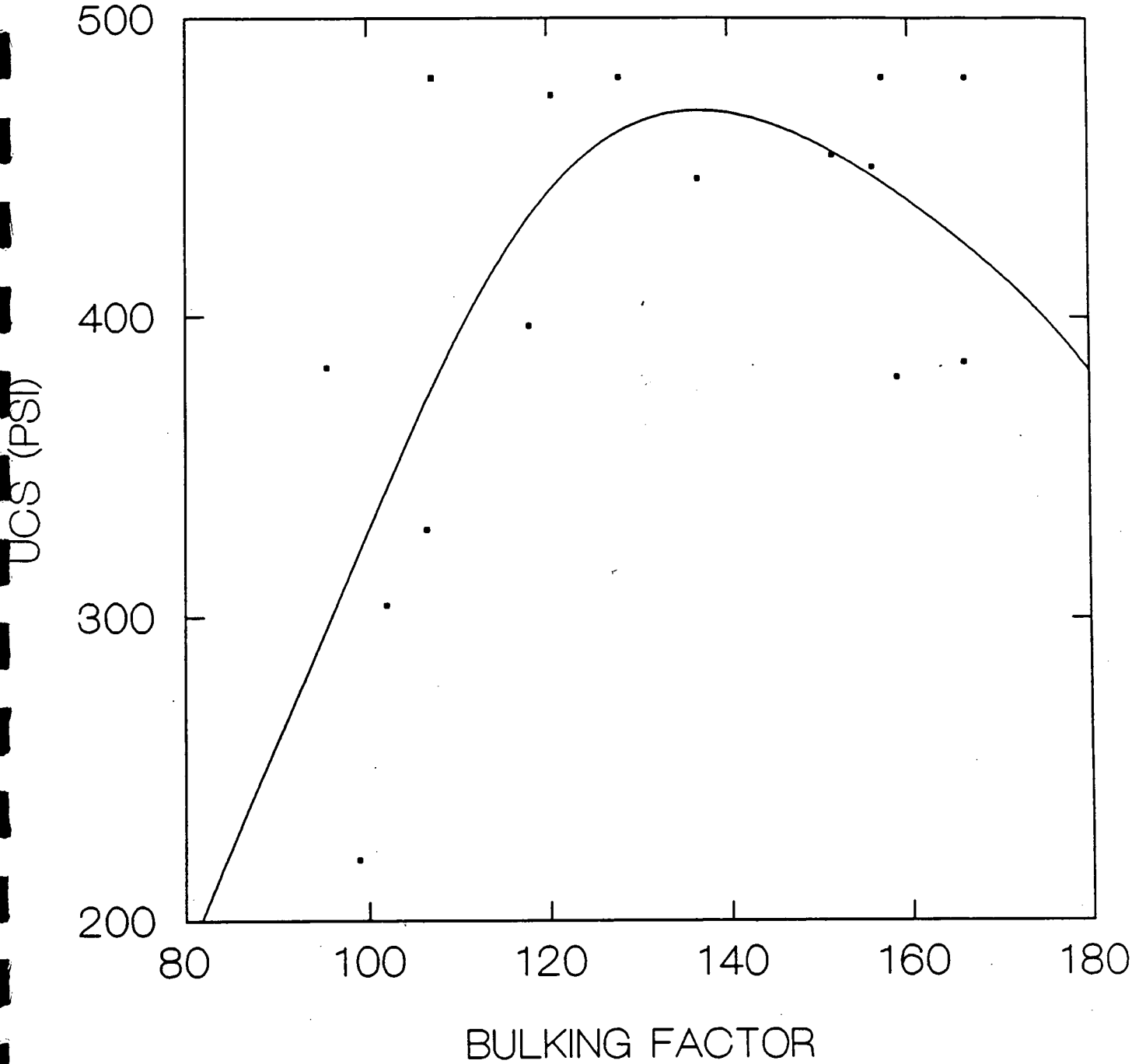


FIGURE 4-8

PROCEDURE FOR UCS VS BULKING FACTOR USING THE DWLS PROCEDURE FOR SOLID WASTE LANDFILL

136

TABLE 4-40

FORMULATIONS PASSING THE PERFORMANCE CRITERIA FOR THE SOLID WASTE LANDFILL*

Normalized Cement Loading	Normalized Flyash Loading	Normalized Sodium Silicate Loading	Normalized Attapulgite & Clinoptilolite Loadings	Bulking Factor
25	25	5	0	107
50	25	0-1.6	0-5	120-128
25	50	5	5	151-157
50	50	0	1.6	156
50	50	5	0	166

*Reagent loading per 100 pounds of wet weight of waste.

TABLE 4-41

RECOMMENDED FORMULATIONS TO MEET PERFORMANCE GOALS FOR THE SOLID WASTE LANDFILL*

Normalized Cement Loading	Normalized Flyash Loading	Normalized Sodium Silicate Loading	Normalized Attapulgite & Clinoptilolite Loadings
25	25	5	0
50	25	0-1.6	0-5

*Reagent loading per 100 pounds of wet weight of waste.

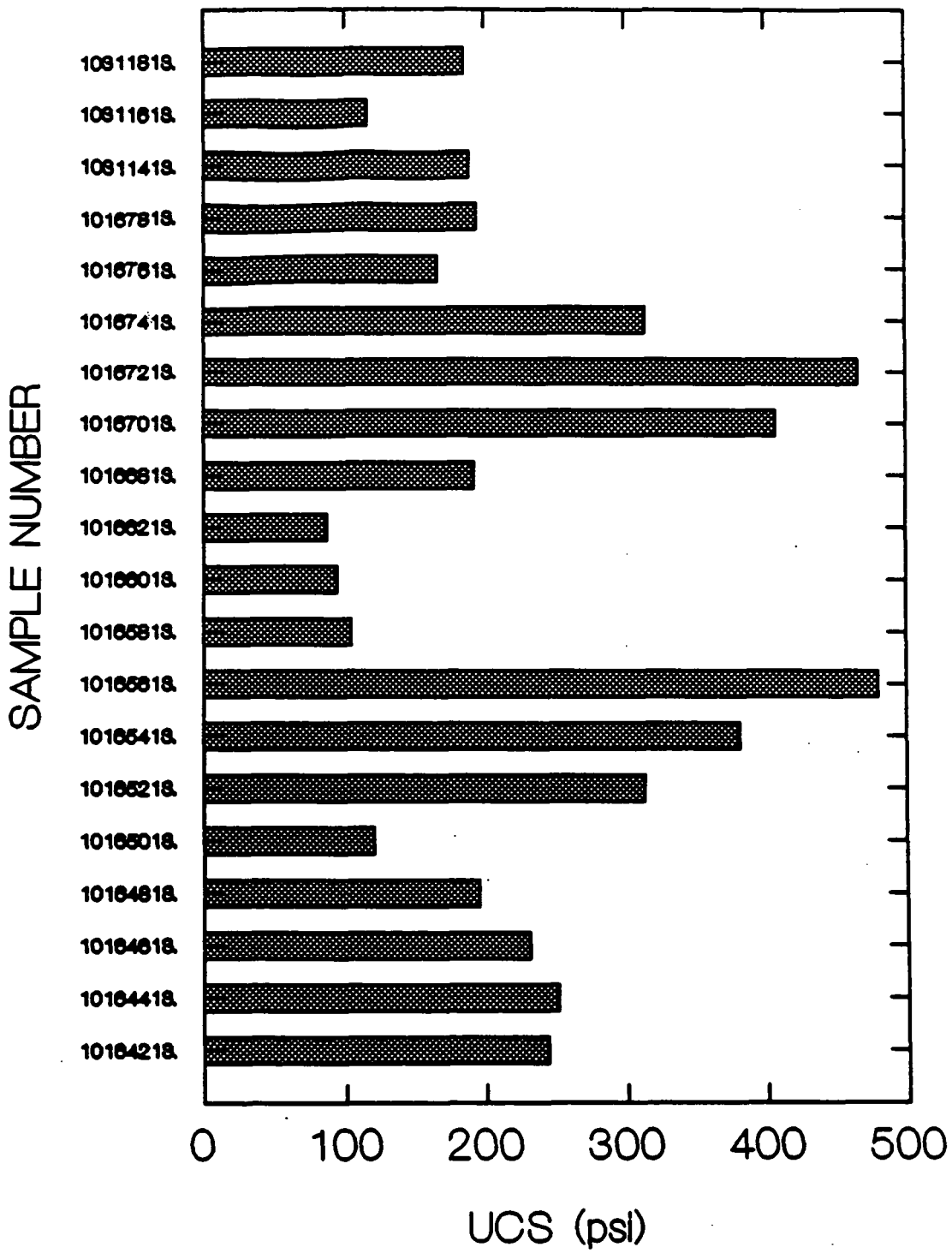


FIGURE 4-9

BARGRAPH OF UCS VS TREATABILITY SAMPLE NUMBER FOR LIME SLUDGE POND, STAGE 1

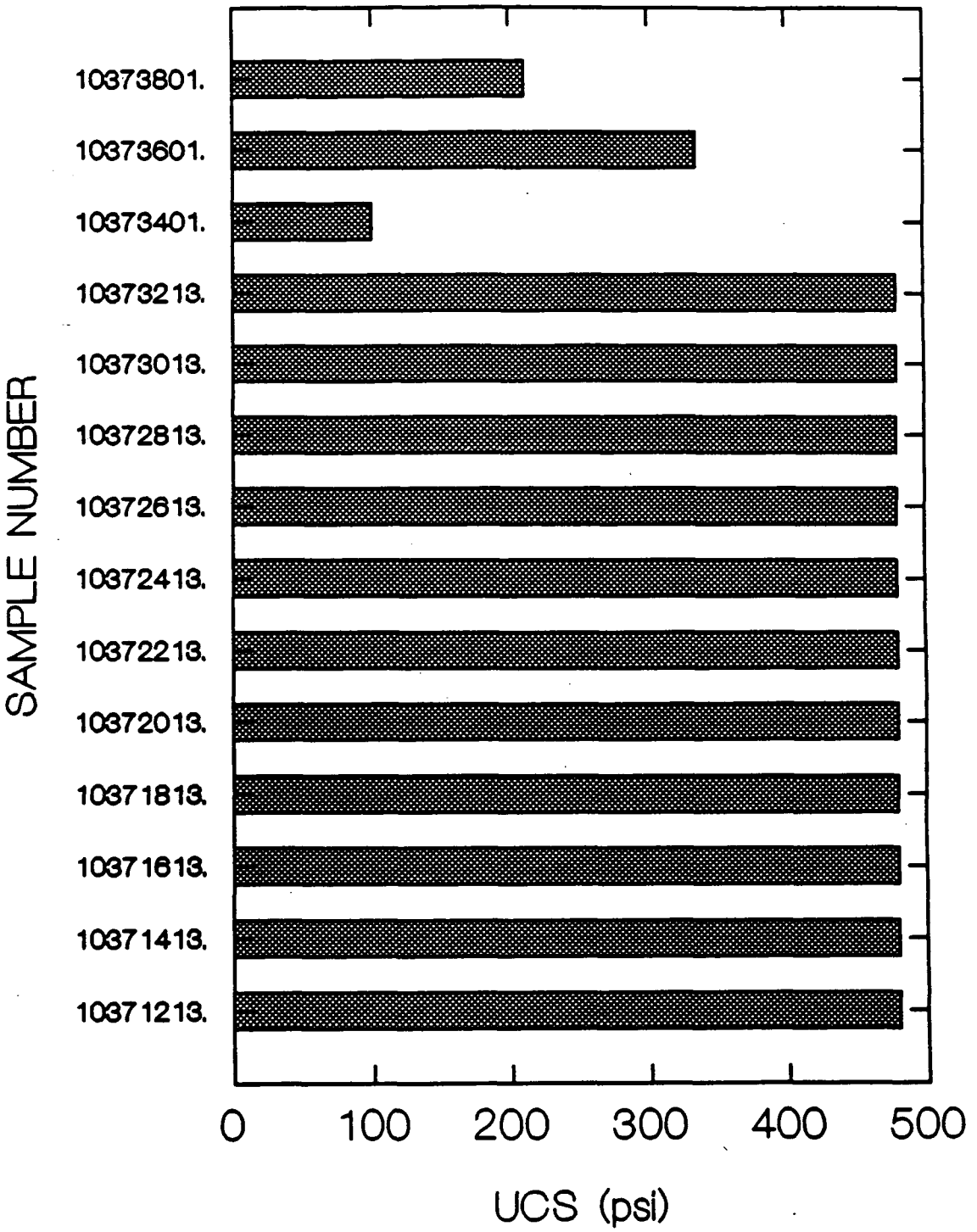


FIGURE 4-10

BARGRAPH OF UCS VS TREATABILITY SAMPLE NUMBER FOR LIME SLUDGE POND, STAGE 2

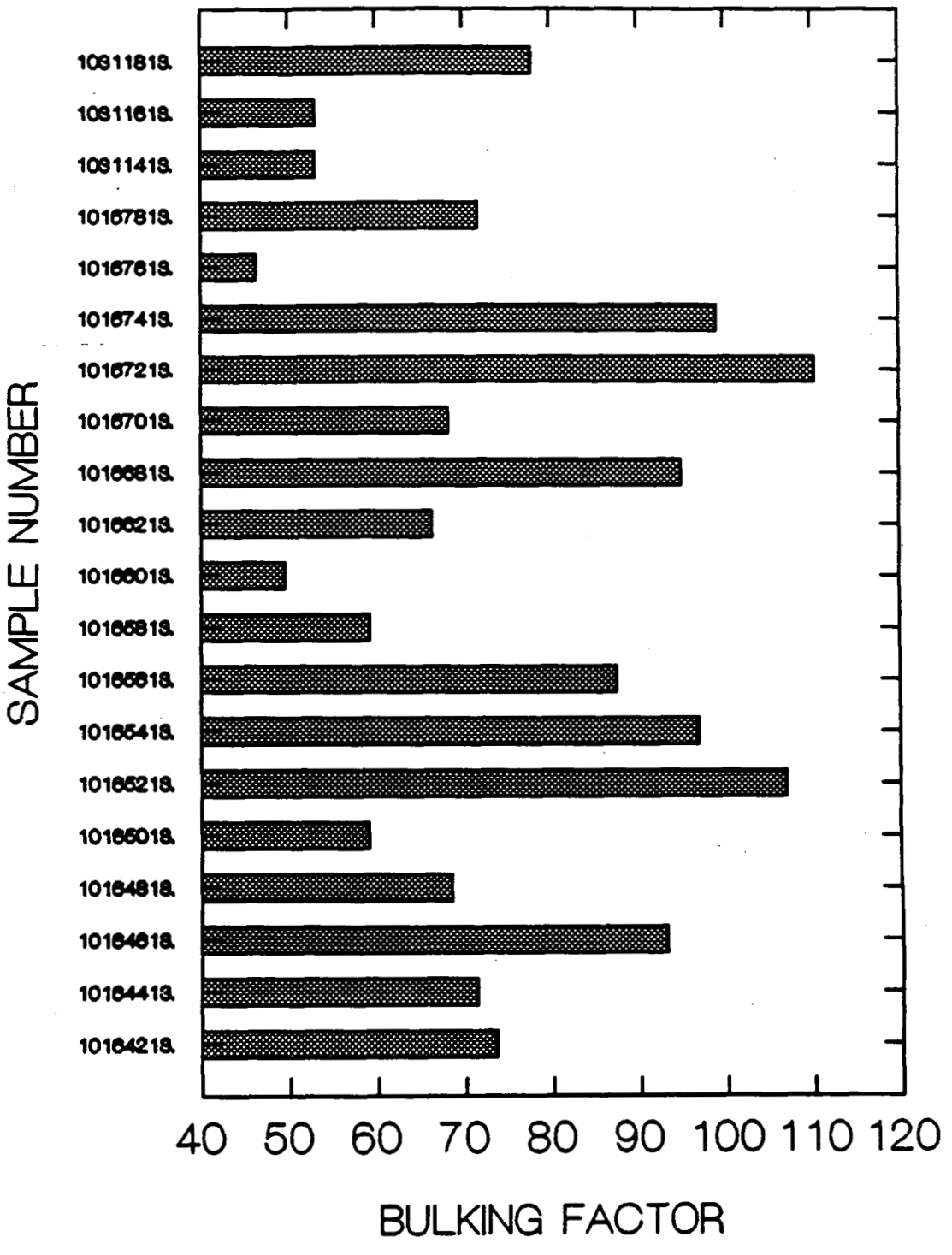


FIGURE 4-11

BARGRAPH OF BULKING FACTOR VS TREATABILITY SAMPLE NUMBER FOR LIME SLUDGE POND, STAGE 2

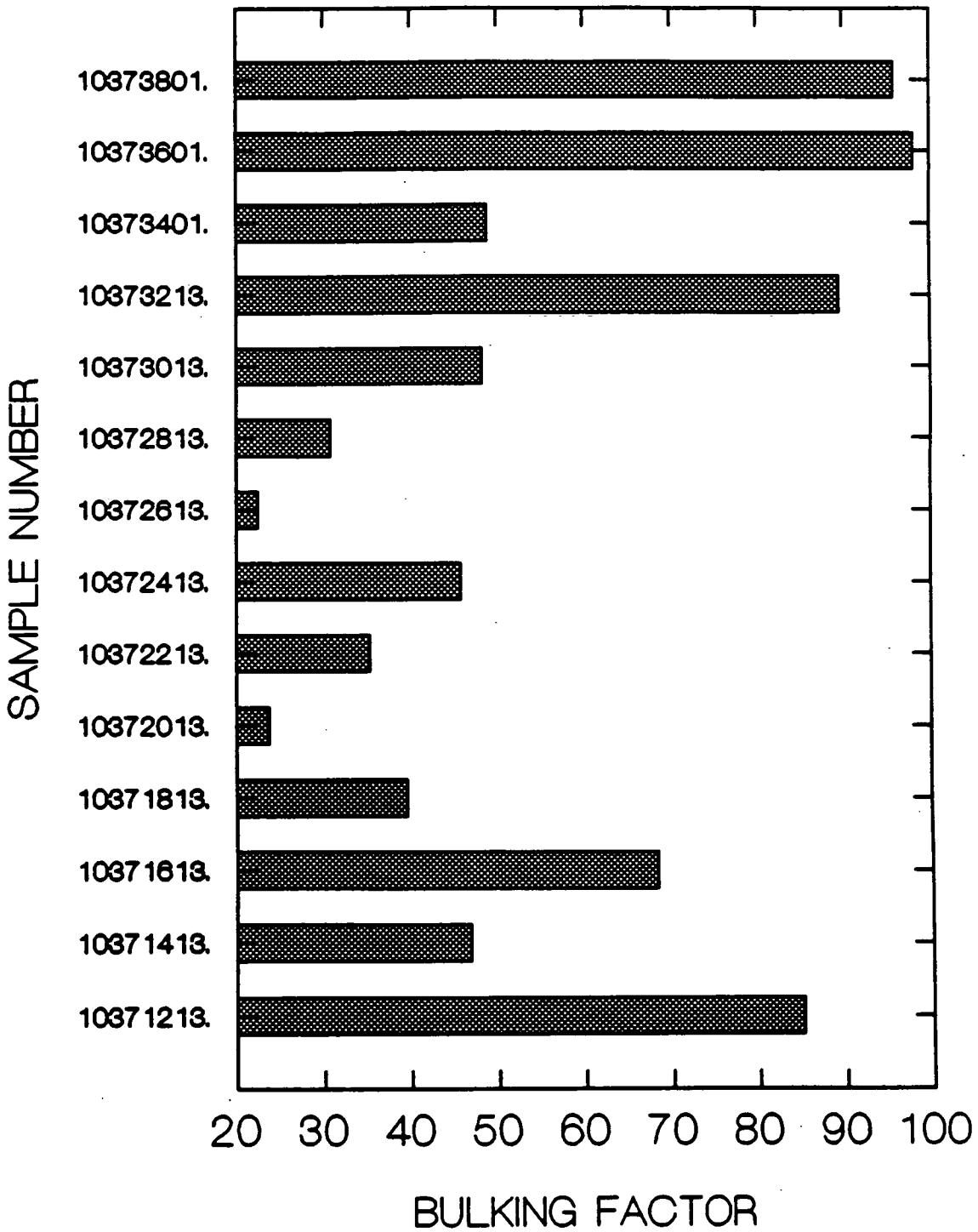


FIGURE 4-12

BARGRAPH OF BULKING FACTOR VS TREATABILITY SAMPLE NUMBER FOR LIME SLUDGE POND, STAGE 2

4-6 and Figure 4-9. Revised formulations were tested in Stage II based on the Stage I results. These formulations had cement loadings greater than or equal to 50 percent and contained no flyash. All of the Stage II formulations achieved UCS values greater than 480 psi.

Both Portland Type I and II cements were investigated due to the potential problem of high sulfate concentration in the waste. High sulfate concentration may cause a loss of compressive strength as the material sets and cures. Type II cement was investigated because it is less susceptible to moderate sulfate attack than Type I. Type I cement was tested because it is more readily available and less expensive.

The Lime Sludge Ponds contain waste from the FEMP water treatment plant, coal pile runoff (WEMCO, 1989) and the boiler plant blowdown. The low UCS values for any given formulation (as compared to the South Field and Solid Waste Landfill results) may be partly due to the amines added to the water in the boiler plant. Other unidentified inhibitors may also be present. J. R. Conner's book, "Chemical Fixation and Solidification of Hazardous Wastes", list amines (along with alcohols, amides, carbonyls and chlorinated hydrocarbons) as inhibitors of cement chemical reactions in Chapter 9 ("Chemical Factors Affecting Solidification", Table 9-1, p. 299).

Analysis of Graphical Results - 2-Dimensional

Figure 4-13 is a SPLOM plot using the Influence plot options. (See Section 4.1.1). Analysis of Figure 4-13, indicates that the UCS values are increased by increasing the cement loading. The effects of attapulgite, clinoptilolite, water and sodium silicate loadings on the UCS values are ambiguous due to the wide confidence intervals. The effect of flyash on UCS is also ambiguous. The slope of the linear regression line is negative indicating that increasing flyash loading decreases the UCS. However, over half of the data points are outside of the 90 percent confidence intervals. Therefore, the flyash results are ambiguous. Figure 4-14 is an alternative plot of UCS and flyash loadings. A best-fit line was drawn through the data points using the distance weighted least squares regression (DWLS) smoothing routine in SYGRAPH. Analysis of the figure indicates that as the flyash loading increases, the UCS values decrease until the percentage flyash in the reagent/waste mixture exceeds about 15 percent in the waste-reagent mixture. The UCS value then increases with subsequent higher loadings of flyash. The increasing UCS values after about 15 percent loading may be due to the adsorption of amines and other inhibitors by the site flyash. Amines are known to be inhibitors for cement chemical reactions (Conner, J. R., Chapter 9, Table 9-1, p. 299). If the inhibitors are adsorbed and separated from the cement, the cement setting and strength formation reactions can proceed without inhibition.

Analysis of Graphical Results - 3-Dimensional

Figures 4-15 and 4-16 are 3-dimensional (3-D) plots of UCS as a function of normalized flyash and cement loadings. The data points are represented as circles attached to a line perpendicular to the

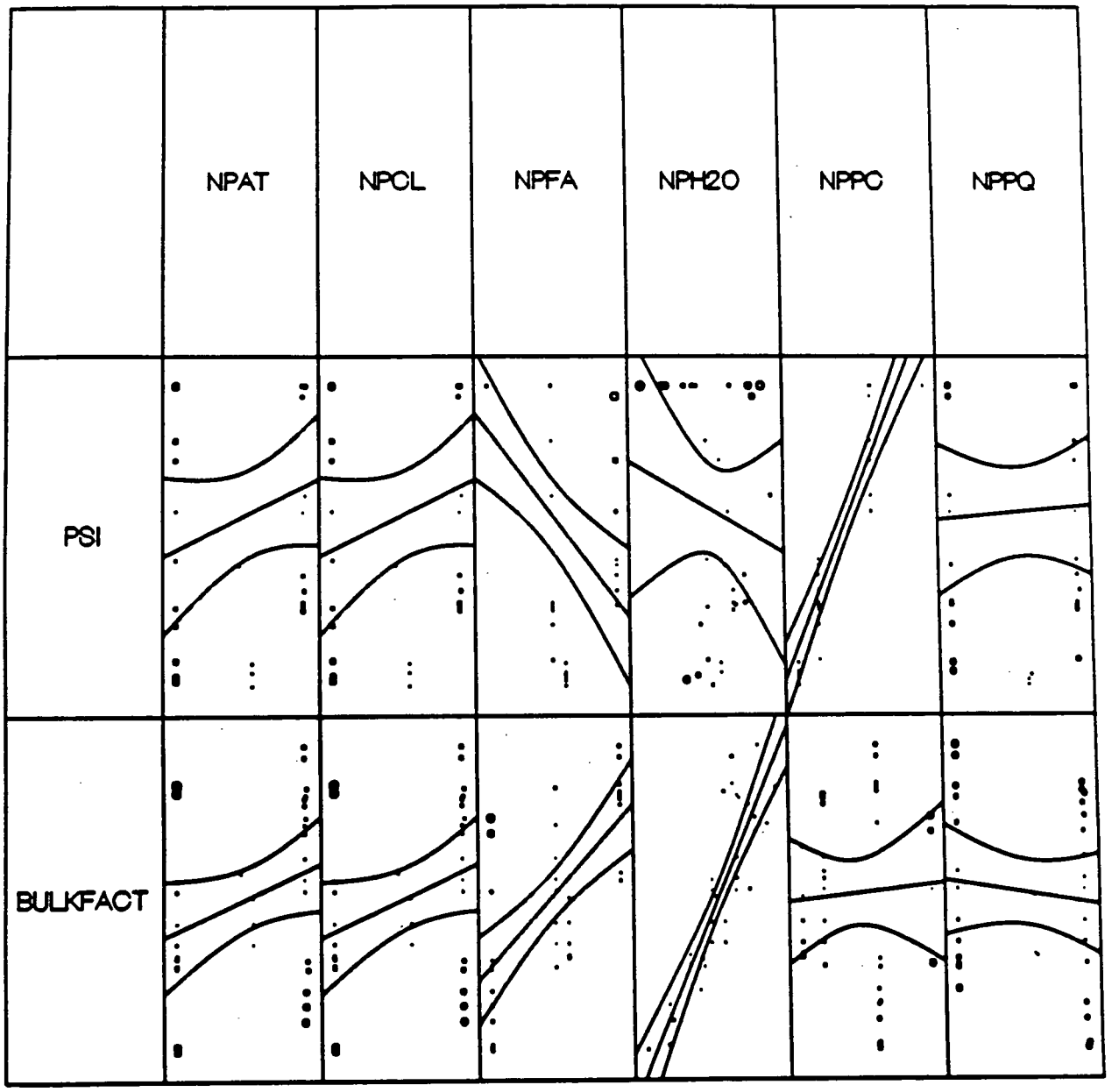


FIGURE 4-13

SPLOM PLOT FOR LIME SLUDGE POND

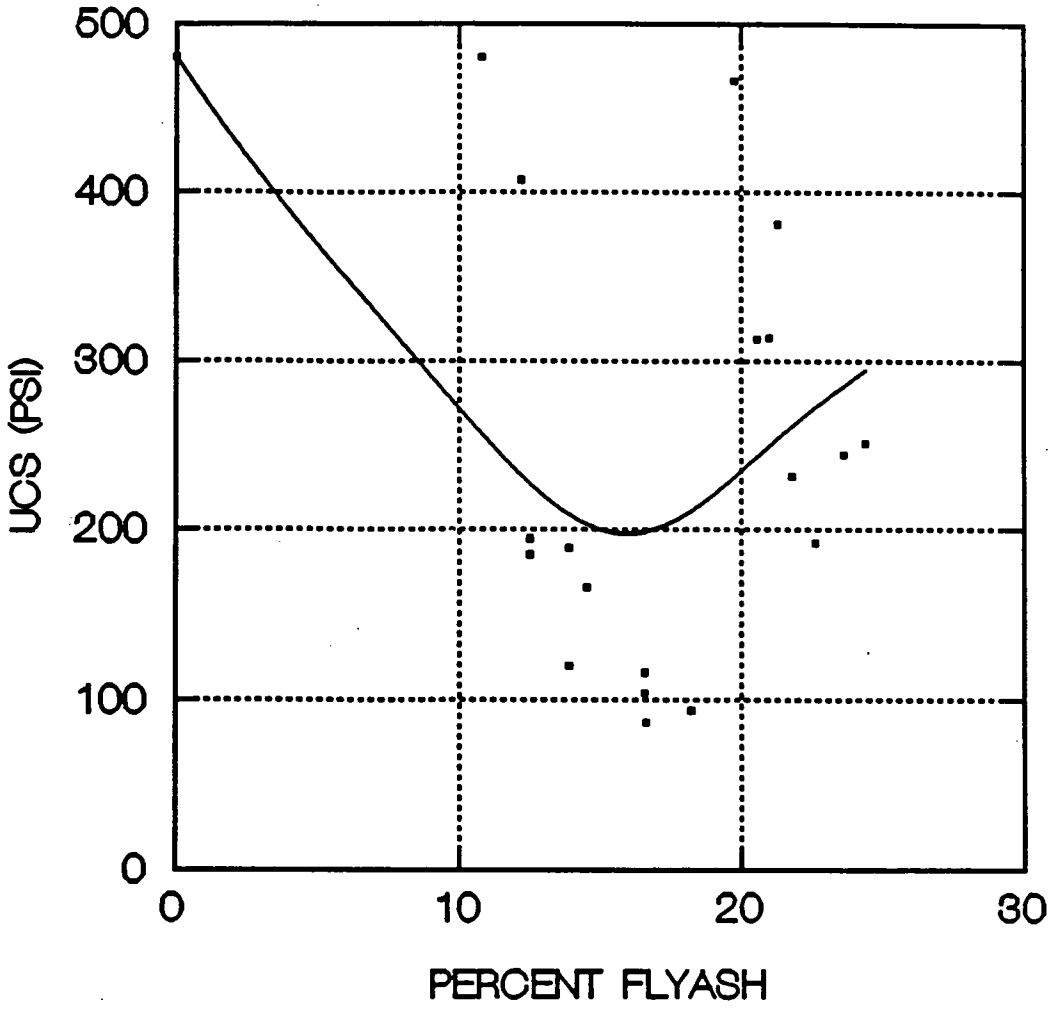


FIGURE 4-14

ALTERNATIVE PLOT OF UCS VS FLYASH LOADING FOR LIME SLUDGE POND

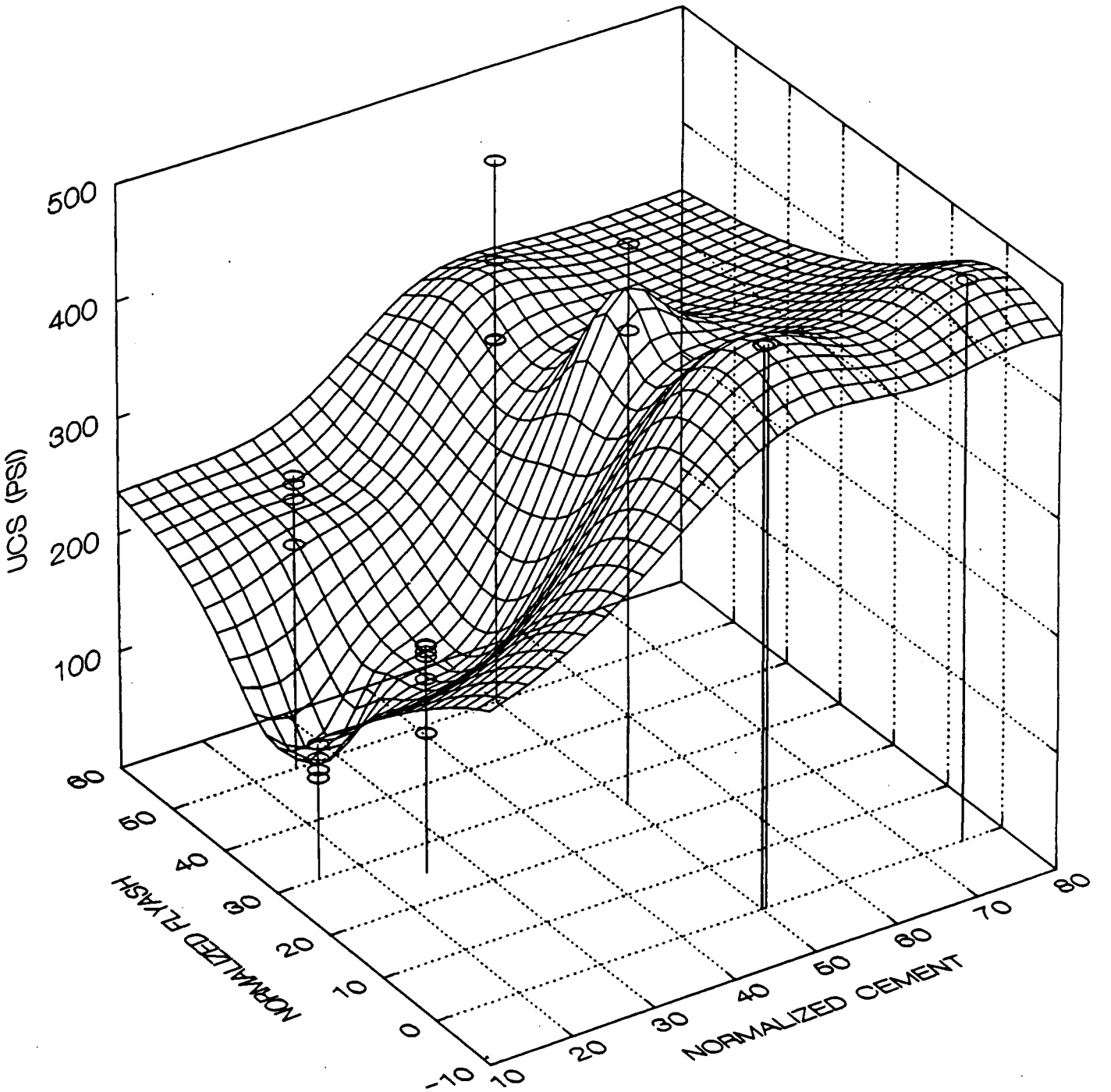


FIGURE 4-15

3-D PLOTS OF UCS AS A FUNCTION OF NORMALIZED FLYASH AND CEMENT LOADINGS FOR LIME SLUDGE POND

3527

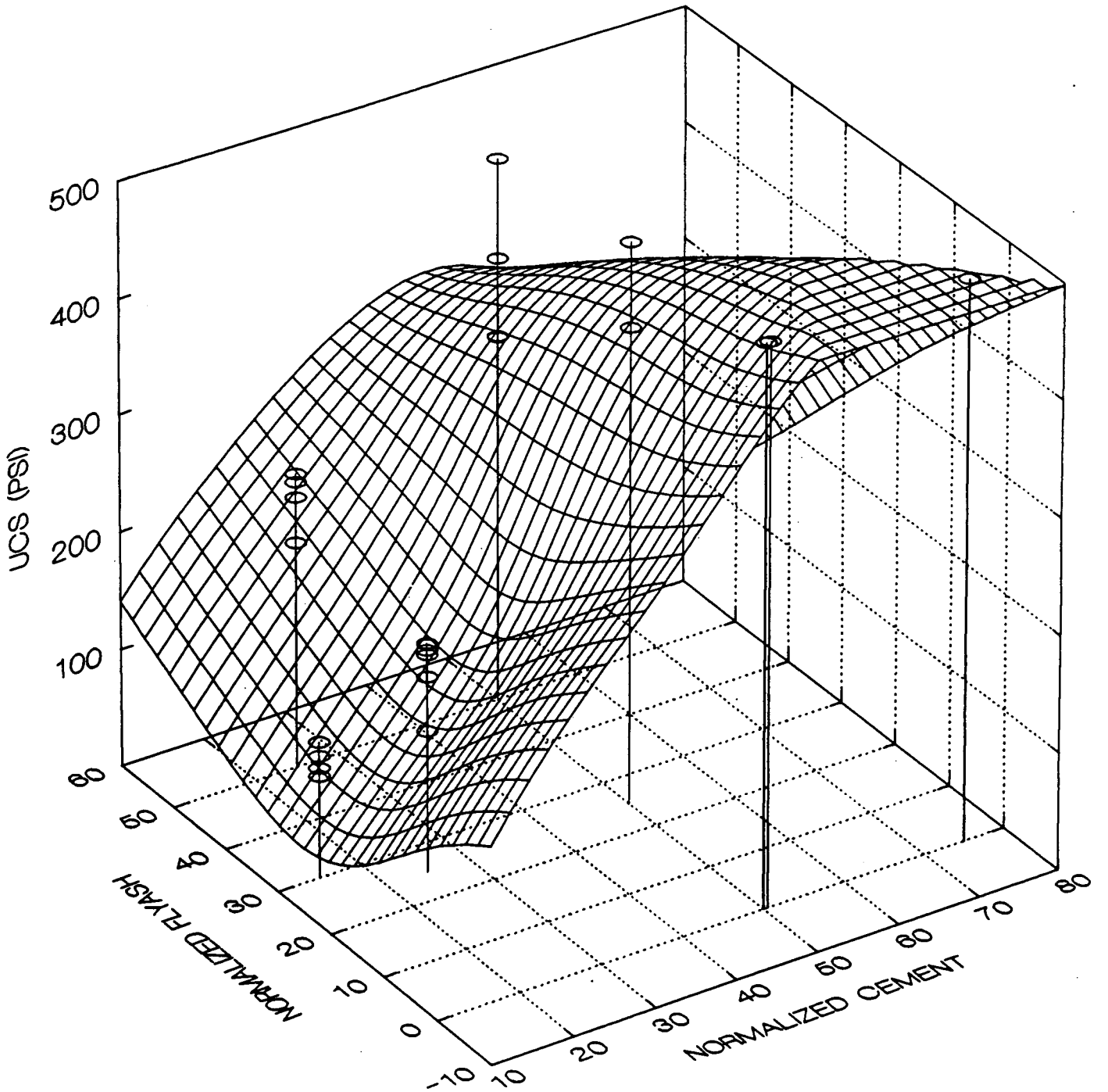


FIGURE 4-16

3-D PLOT OF DWLS-UCS AS A FUNCTION OF NORMALIZED FLYASH AND CEMENT LOADINGS FOR LIME SLUDGE POND

X-Y plane. The data in the 3-D plots are smoothed by Inverse Squared and DWLS procedures respectively. At a given cement to flyash ratio, the variations in UCS values are the result of changing the other reagent loadings, e.g., sodium silicate.

Figures 4-15 and 4-16 show that at a normalized cement loading of 50 and normalized flyash loadings from zero (0) to 50, UCS values from approximately 400 to 500 psi are obtained. At lower loadings of cement the UCS rapidly decreases. In Figure 4-16 one data point at a loading of 50 and 25 for cement and flyash, respectively, was removed from the plot for clarity. In this plot the values of UCS decrease at cement loadings greater than 50: This is an artifact of the smoothing routine. Figure 4-17 is a contour plot of the smoothed surface in Figure 4-16. Qualitative predictions of UCS values as a function of cement and flyash loadings may be derived from the contour plot.

Analysis of Tabular Results

Low cement loadings are ineffective at achieving the desired strength requirement; see Runs 10 through 12 in Table 4-6. Cement loadings of 15 percent (w/w of cement/waste) yield UCS values ranging from 87 to 116 psi. At 25 percent cement, irrespective of the type of cement, the UCS value varies between 120 and 251 psi. The actual value depends on the other reagent loadings. With this percentage of cement, the UCS is below 200 psi when the percentage of flyash is less than 50 percent. When the flyash loading is increased to 50 percent, the UCS increases to above 200 psi. The analysis of the data indicates that increasing the flyash loading increases the strength of the sample (see runs 1, 2, 3, 4, 5, 15, and 16). At 50 percent cement loadings, the UCS values are above 300 psi. The trend of increasing strength with greater flyash loadings (observed with 25 percent cement) is reversed. The UCS values are greater than 480 psi, between 400 and 480 psi, and between 300 and 400 psi for 0, 25, and 50 percent flyash loadings, respectively. (See Runs 6, 7, 9, 13, 14, and all of Stage II.) Comparisons of the Type I and Type II cement results indicate that within the precision of the test they yield the same results.

Bulking Factor

Analysis of Figure 4-13 indicates that the bulking factor is increased by increasing all of the reagent loadings, except sodium silicate. Sodium silicate has little effect on the bulking factor; i.e., increasing the sodium silicate loading does not cause the bulking factor to consistently increase or decrease. On the basis of these graphical results (see Figures 4-13), the most important variables are cement and flyash loadings.

Figure 4-18 and 4-19 are the 3-D and contour plots of bulking factor as a function of normalized cement and flyash loadings. The plateaus at the highest and lowest cement loadings are artifacts of the plotting program. The smallest bulking factors are obtained at zero (0) flyash loading. As flyash and cement loadings increase the bulking factor increases. A qualitative relationship between the UCS values and bulking factor for Stage I is shown in Figure 4-20. Generally, the UCS and bulking factor

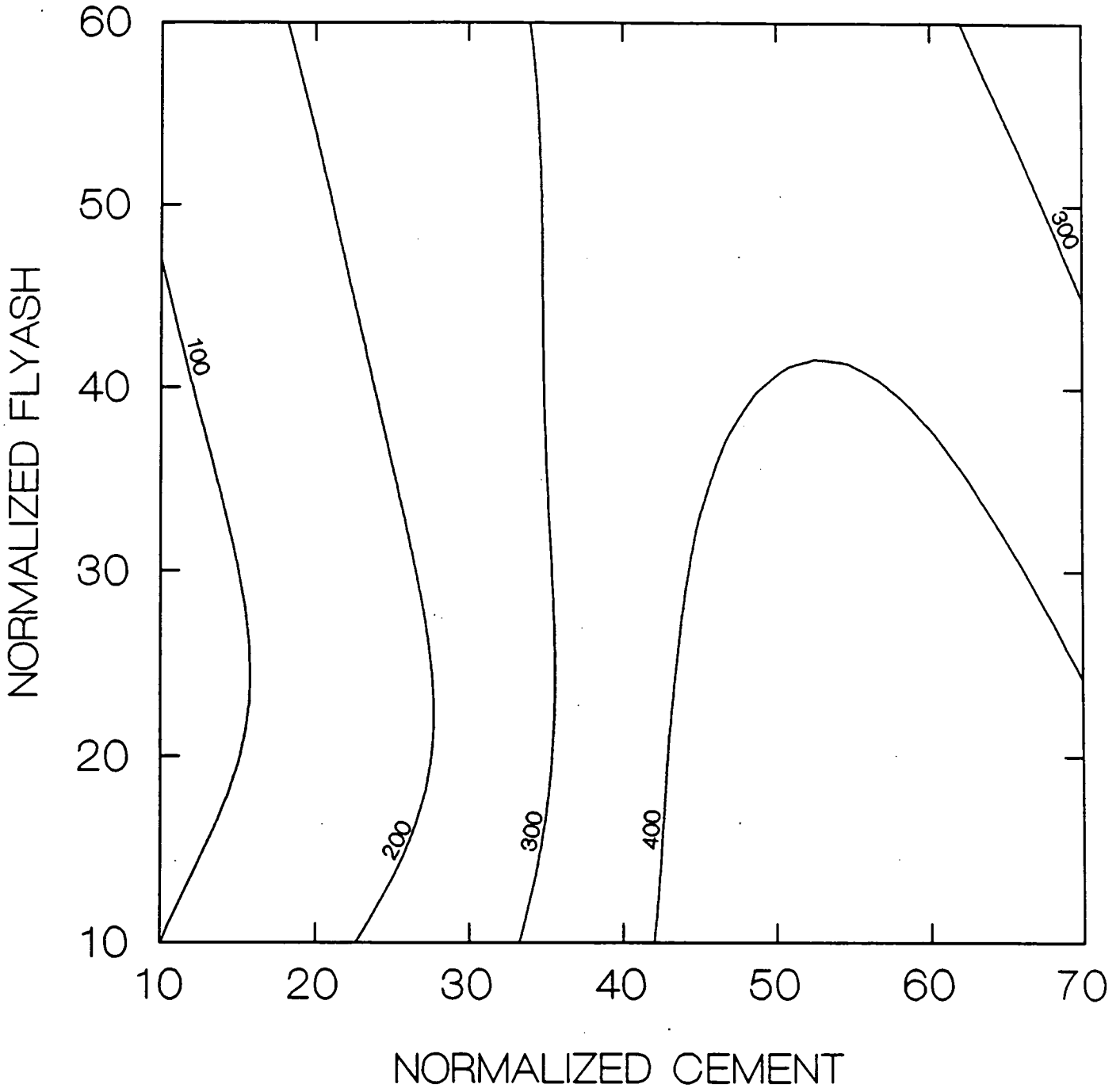


FIGURE 4-17

PLOT OF DWLS CONTOUR-UCS FOR LIME SLUDGE POND

3527

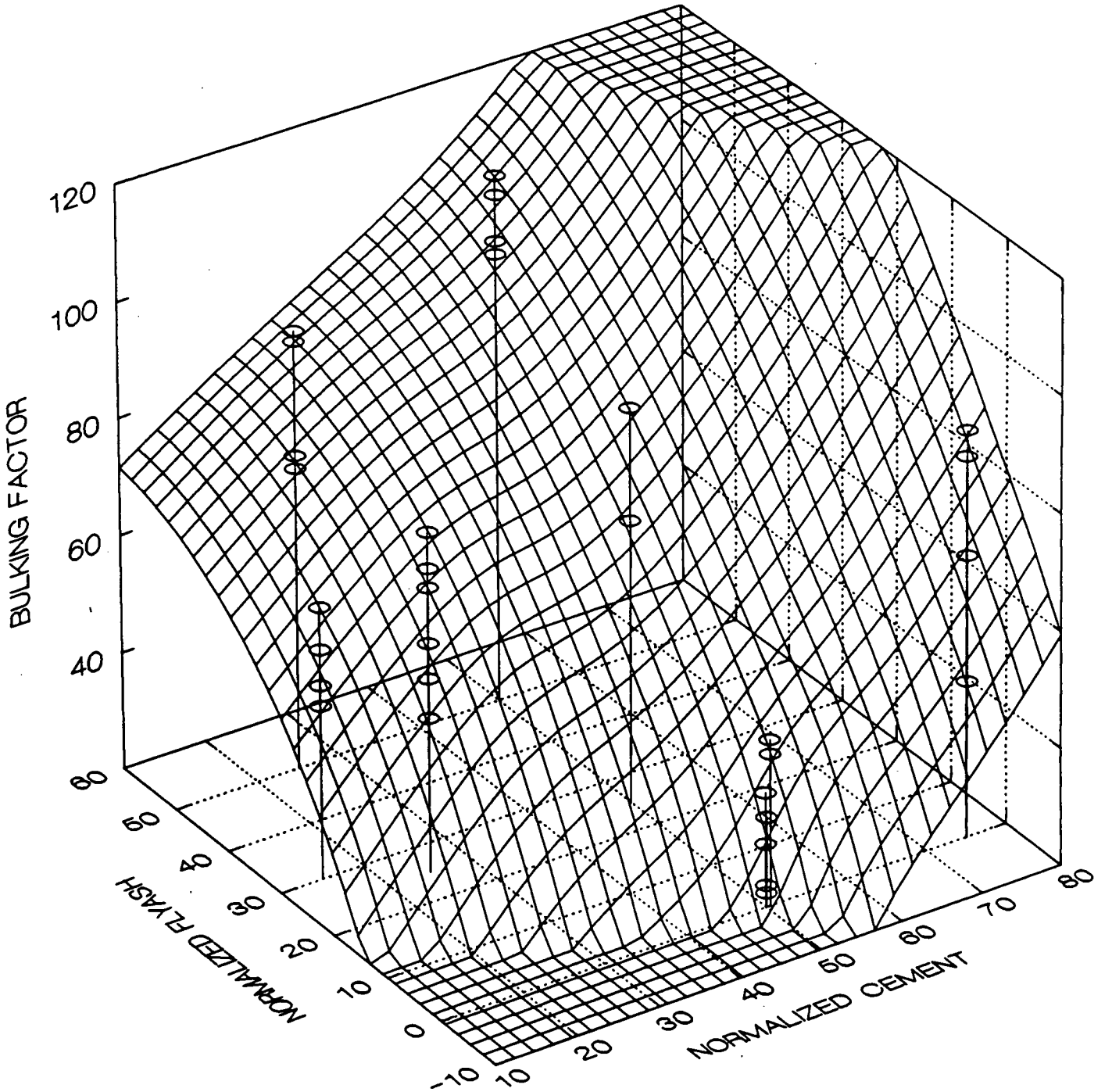


FIGURE 4-18

3-D PLOT OF DWLS-BULKING FACTOR AS A FUNCTION OF NORMALIZED CEMENT AND FLYASH LOADINGS FOR LIME SLUDGE POND

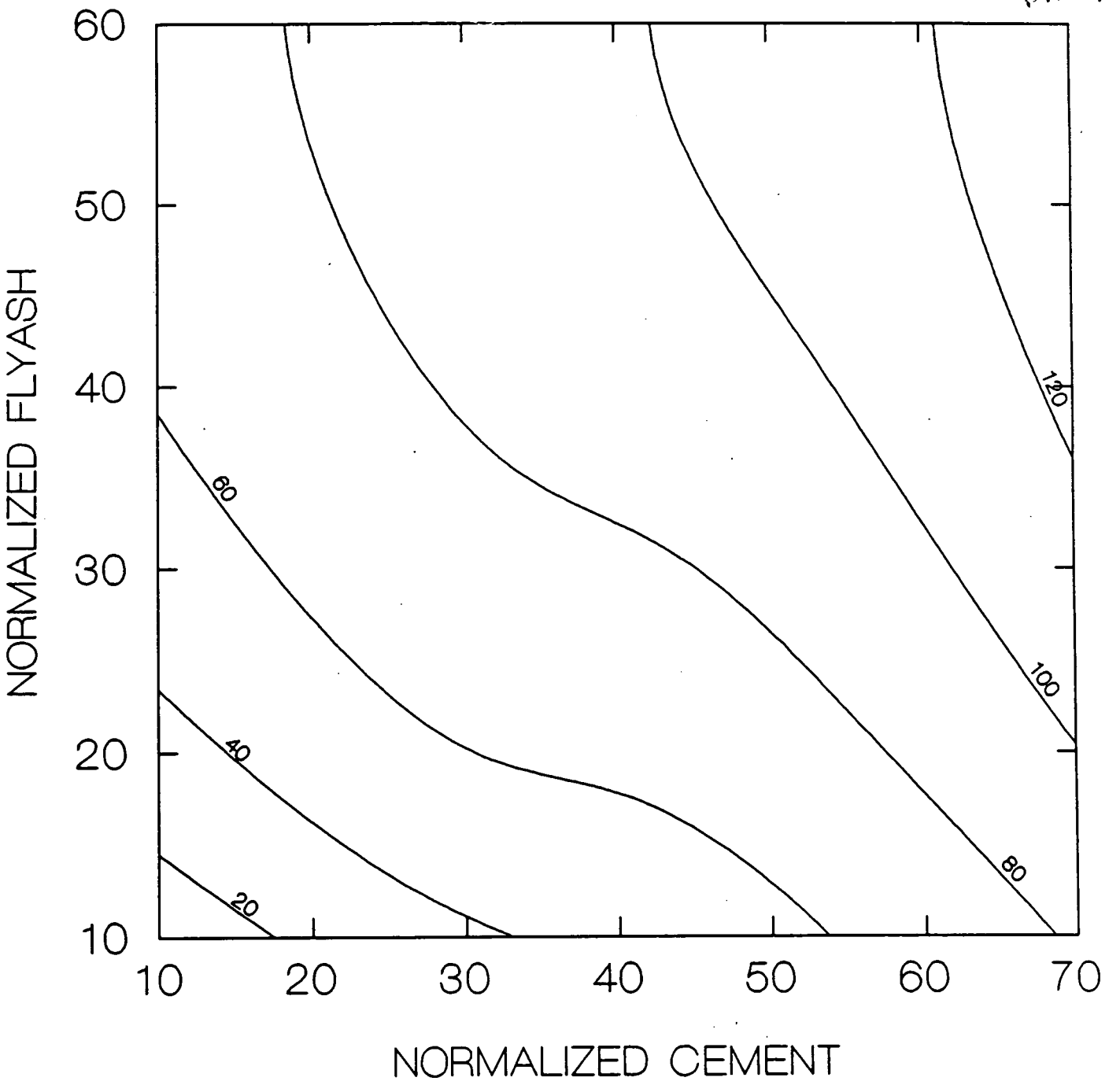


FIGURE 4-19

PLOT OF DWLS CONTOUR-BULKING FACTOR FOR LIME SLUDGE POND

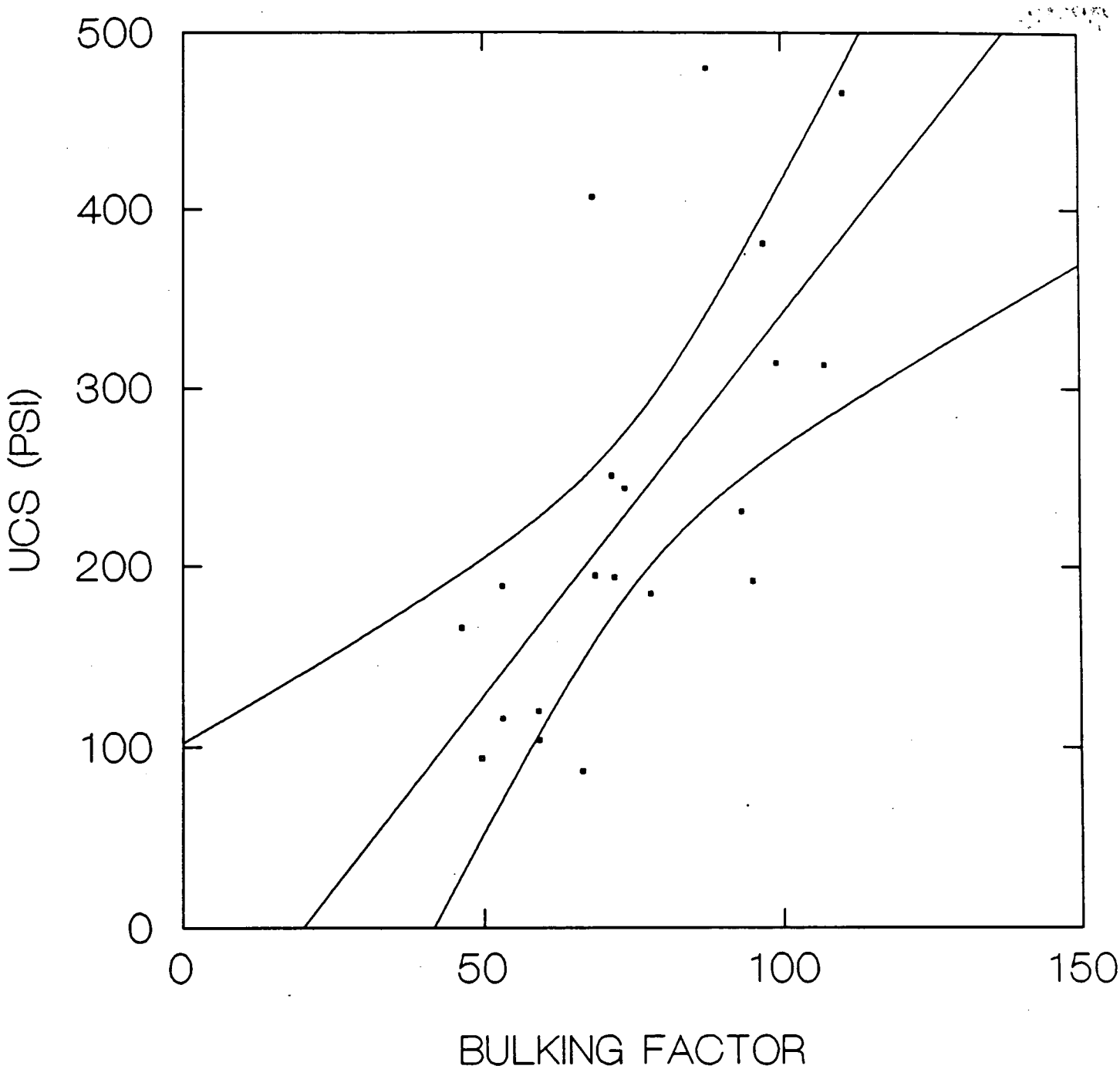


FIGURE 4-20

UCS VS BULKING FACTOR FOR LIME SLUDGE POND, STAGE 1

increase in unison. Since all UCS values are >480 psi in Stage II, no correlation between UCS and bulking factor could be determined for Stage II data.

An empirical equation for bulking factor was determined:

$$BF = 1.6 * PFA + 2.4 * PH_2O + 0.8 * PPC,$$

where BF is the bulking factor, and PFA, PH_2O, and PPC are the percentage of flyash, water, and cement in the treated waste when mixed. A plot of the actual measured values versus the mathematical predicted (estimated) values based on this equation is in Figure 4-21. The data is linear least square regressed with 90 percent confidence limits. The equation has an R^2 value of 0.755. The equation indicates that an addition of flyash causes almost twice the volume increase as an equivalent addition of cement. Due to the relatively low R^2 value and since almost half of the data is outside the 90 percent confidence intervals, the equation should be used only for qualitative prediction of the bulking factor.

Long-Term Study

Historical process knowledge indicates that high sulfate concentrations exist in the Lime Sludge Ponds waste. High sulfate concentration may cause a loss of compressive strength as the material sets and cures. Therefore, long-term (90 days) compressive strength studies were conducted to identify if the potentially high sulfate concentration in the waste would affect the compressive strength. Three formulations were selected that would have UCS values ranging from approximately 100 to 500 psi. Portland Type II cement was used in each test. Duplicate samples were set for each formulation and tested for UCS on Days 28 and 90. The 90-day samples had UCS values greater than the 28-day cured samples. This is the expected trend for cement curing without a sulfate problem. The analysis of these results indicates that when using Portland Type II cement, there is not a detrimental effect of sulfate on the UCS. The 90-day time period was selected because it was about three times the usual curing time, and also fell within the time interval during which the treatability study was conducted.

Recommended Formulations of Reagents

The formulations achieving greater than 450 psi and using the lowest loadings of cement are listed in Table 4-42. They are listed in order of ascending bulking factor. The first two rows are for Stage I results; the remainder of the table is for Stage II results. The treated waste had low leachate concentrations when compared to the leachate action level. The samples also had low permeability. Therefore, UCS and bulking factor are the parameters used to determine the recommended formulations. The recommended formulations that will achieve a UCS value greater than 450 psi and minimize the bulking factor are given in Table 4-43. If flyash is used, as in Stage I, the minimum flyash loading is recommended to minimize bulking.

3527

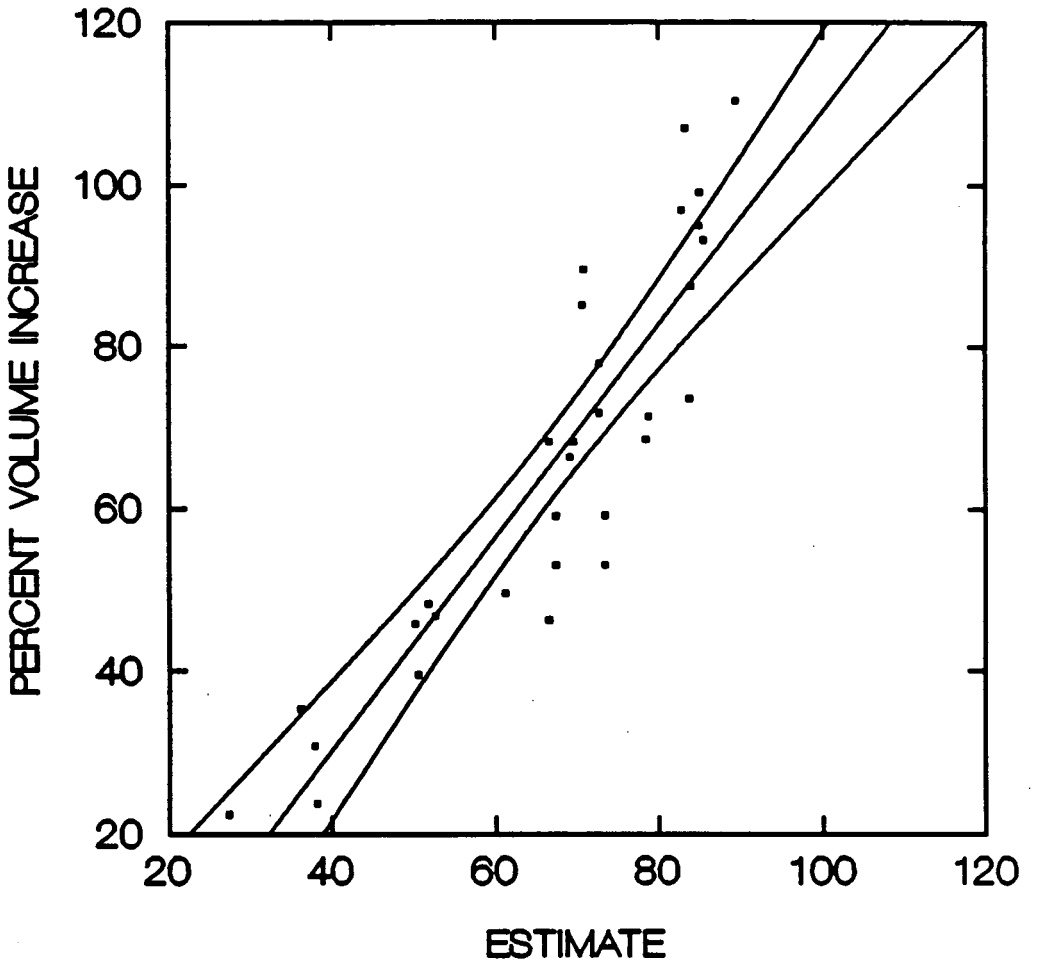


FIGURE 4-21

PLOT OF BULK FACTOR VALUES VS ESTIMATED BULKING FACTOR VALUES WITH A 90% CONFIDENCE LIMITS FOR THE LIME SLUDGE POND

TABLE 4-42

FORMULATIONS PASSING THE PERFORMANCE CRITERIA
FOR THE LIME SLUDGE Ponds AREA*

Normalized Cement Loading	Normalized Flyash Loading	Normalized Sodium Silicate Loading	Normalized Attapulgite & Clinoptilolite Loading	Bulking Factor
50	50	0	5	110
50	25	0	5	88
50	0	5	0	22-24
50	0	5	5	31-35
50	0	0	5	40-48

*Reagent loading per 100 pounds of wet weight of waste.

TABLE 4-43

RECOMMENDED FORMULATIONS TO MEET PERFORMANCE GOALS FOR THE LIME SLUDGE Ponds AREA*

Normalized Cement Loading	Normalized Flyash Loading	Normalized Sodium Silicate Loading	Normalized Attapulgite & Clinoptilolite Loadings
50	25	0	5
50	0	5	0

*Reagent loading per 100 pounds of wet weight of waste.

4.1.2.5 Stabilization - South Field

The following sections provide South Field discussion of results for unconfined compressive strength, analysis of 2- and 3-dimensional graphical results, tabular results, bulking factor, long-term study, and recommended envelope for study.

Unconfined Compressive Strength

This section addresses the UCS results; see Table 4-8 for the UCS, bulking factor, and permeability results. These tables are arranged in order of increasing UCS values. The precision of the UCS measurement is about 50 psi. Therefore, differences of this magnitude are not significant. Samples which did not fracture at the maximum applied load during the UCS testing are listed in the tables as ">480." Bar graphs of the UCS and bulking factor values as a function of sample number are in Figures 4-22 and 4-23 as a visual aid to show the range of UCS and bulking factor values measured in this study.

Analysis of Graphical Results - 2-Dimensional

Figure 4-24 is a SPLOM plot where the bulking factor (BULKFACT) and UCS values (PSI) are plotted versus the normalized reagent loadings. Analysis of the plots indicates that the compressive strength is increased by increasing the cement loading. The effects of attapulgite, clinoptilolite, flyash, water, and sodium silicate loadings on the UCS are ambiguous due to the wide 90 percent confidence interval. The slope of SPLOM plot for flyash indicates that flyash has a detrimental effect on the compressive strength. However, over half of the data are outside the confidence intervals, thus the result is ambiguous.

Analysis of Graphical Results - 3-Dimensional

Figure 4-25 is a 3-D plot of UCS as a function of normalized flyash and cement loadings. The data points are represented as circles attached to a line perpendicular to the X-Y plane. The data is smoothed by the Linear Least Squares procedure. At a given cement to flyash ratio, the variations in UCS values are the result of changing the other reagent loadings, e.g., sodium silicate. Figure 4-26 is a contour plot of the smoothed surface in Figure 4-25. Qualitative predictions of UCS values as a function of cement and flyash loadings may be derived from the contour plot. The smoothing routine predicts the measured results well at higher cement loadings. However, the quality of fit decreases at lower cement loadings. At a normalized cement loading of 50 and flyash ranging from 25 to 50, UCS values from 400 to 500 psi are obtained. Analysis of the plots and the data in Table 4-8 indicates that for a given cement to flyash ratio, additions of sodium silicate improves the UCS.

Analysis of Tabular Results

Analysis of the data in Table 4-8 reveals that a 25 percent cement loading (w/w of cement/waste) yields UCS results from 158 to 354 psi. Run 5 has a UCS value of 354 psi as compared to less than 296 psi for the other formulations with 25 percent cement loading. This higher UCS value may be

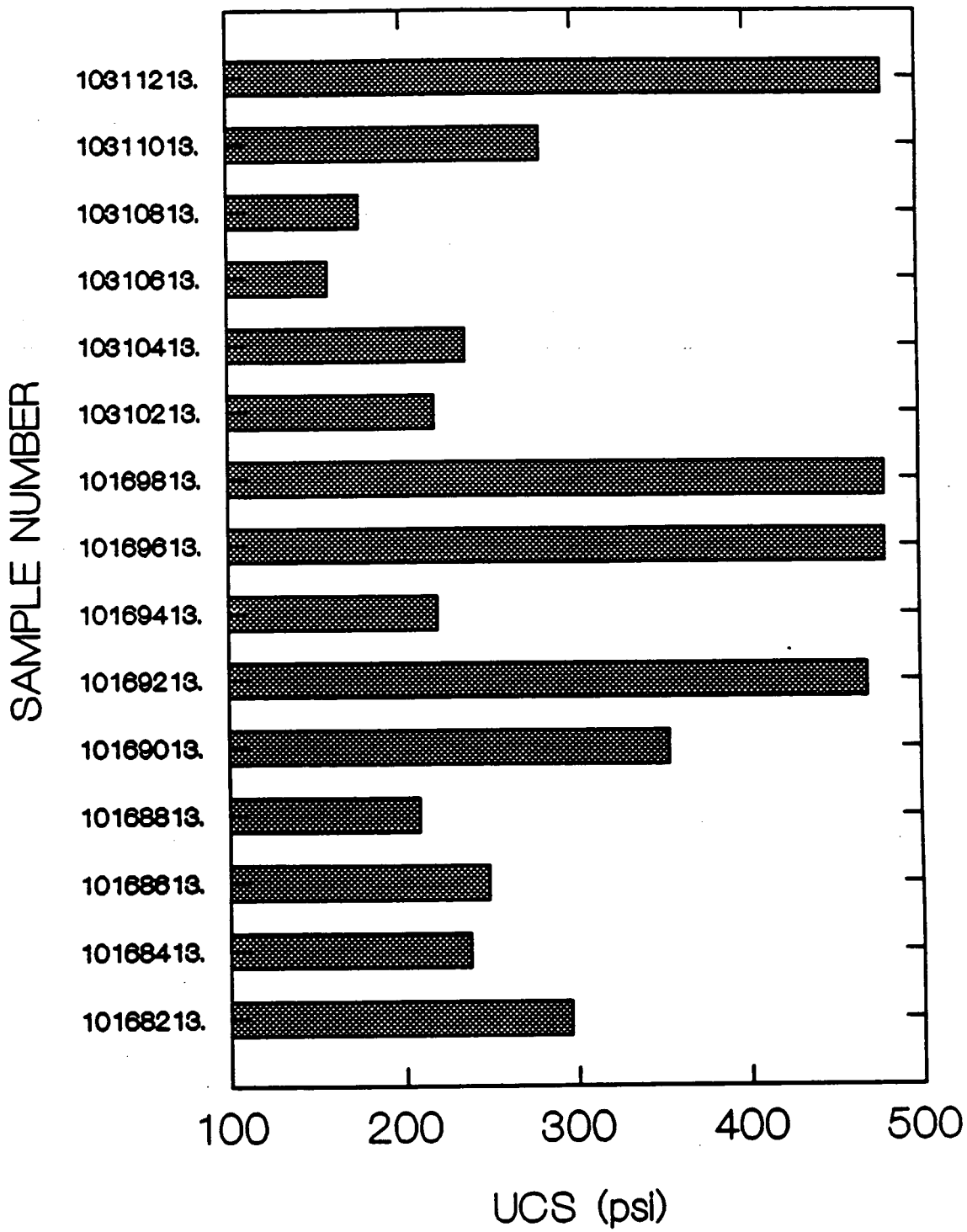


FIGURE 4-22

BARGRAPH OF UCS VS TREATABILITY SAMPLE NUMBER FOR SOUTH FIELD

3527

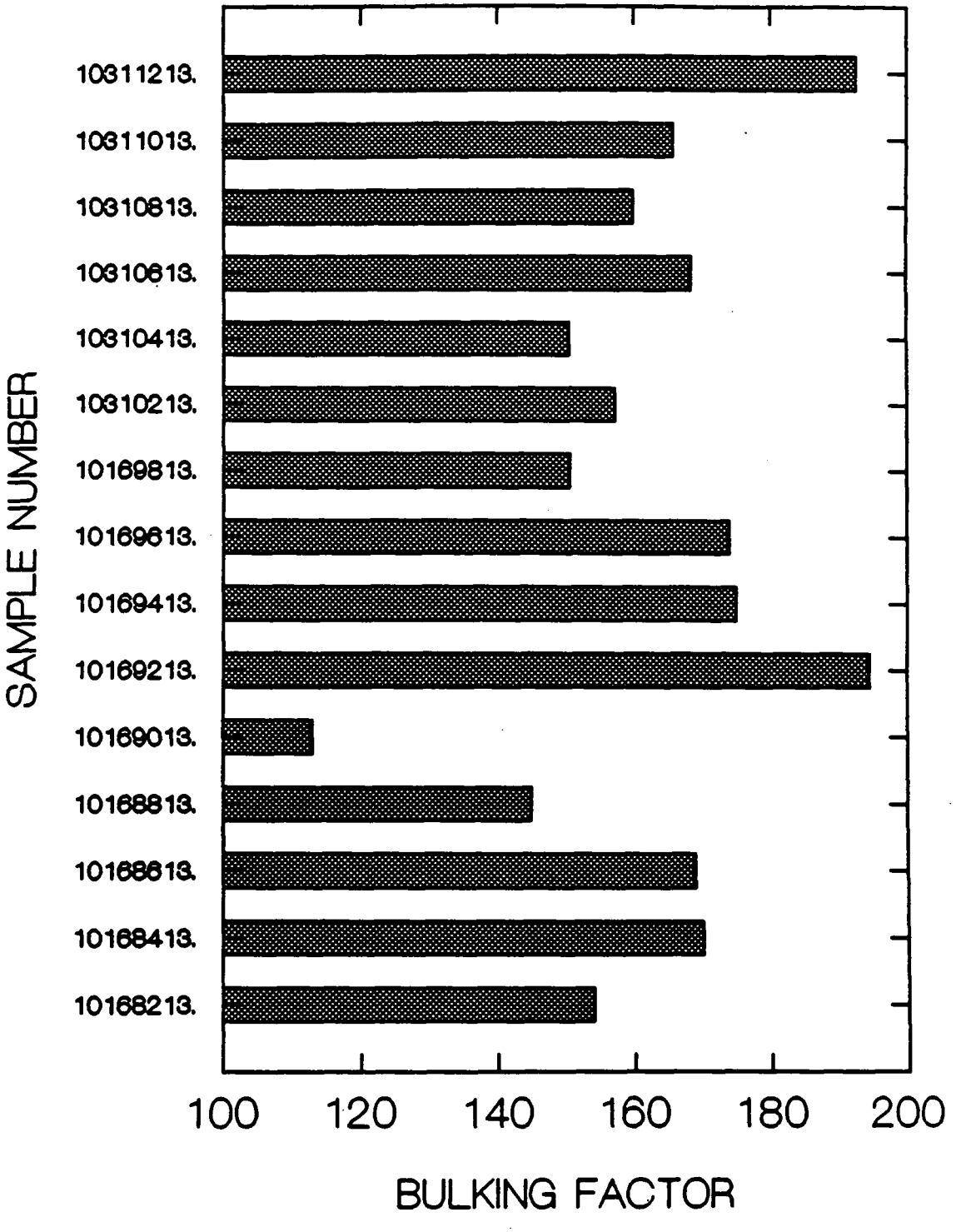


FIGURE 4-23

BARGRAPH OF BULKING FACTOR VS TREATABILITY SAMPLE NUMBERS FOR SOUTH FIELD

3527

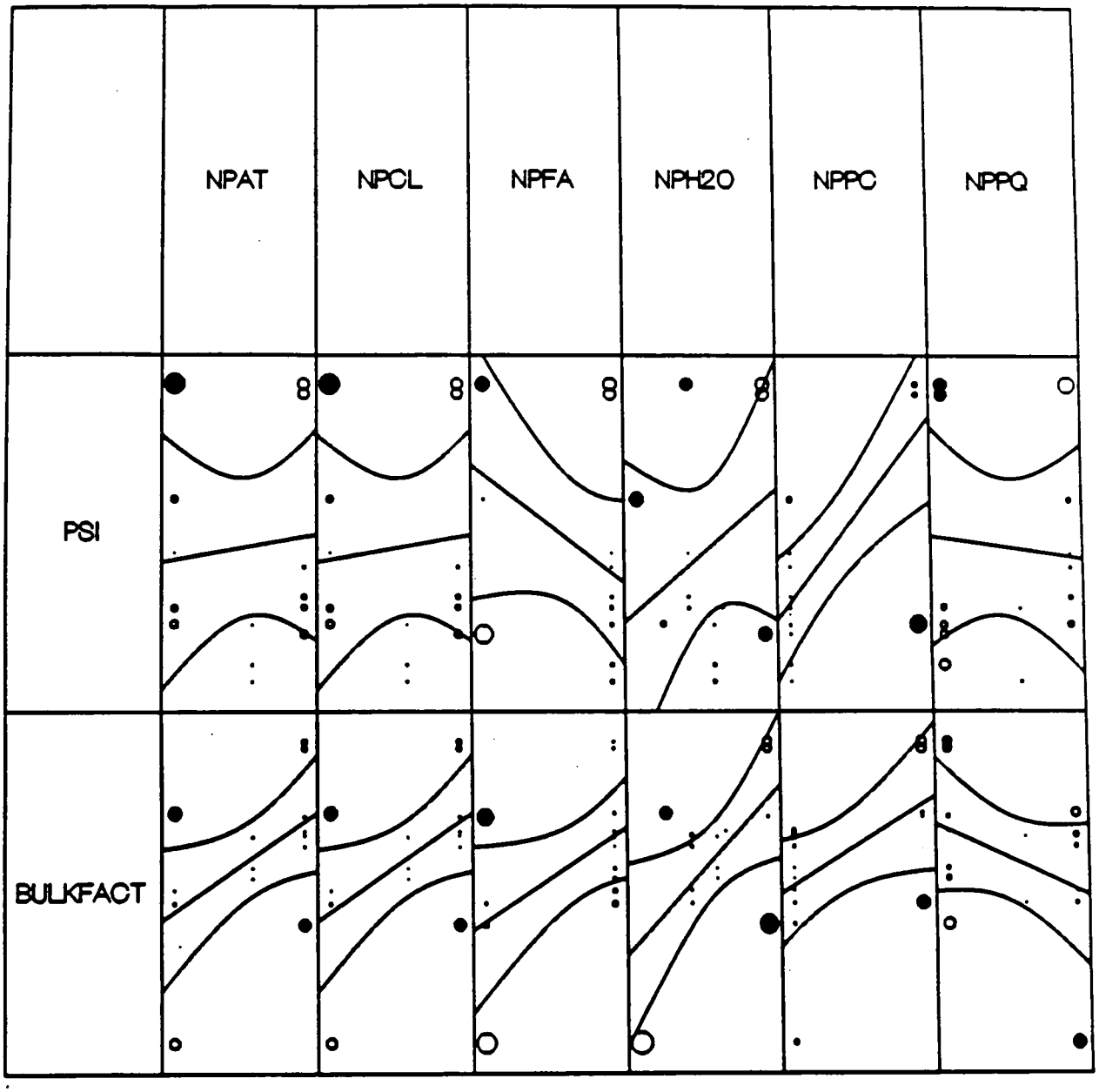


FIGURE 4-24

SPLOM PLOT FOR SOUTH FIELD

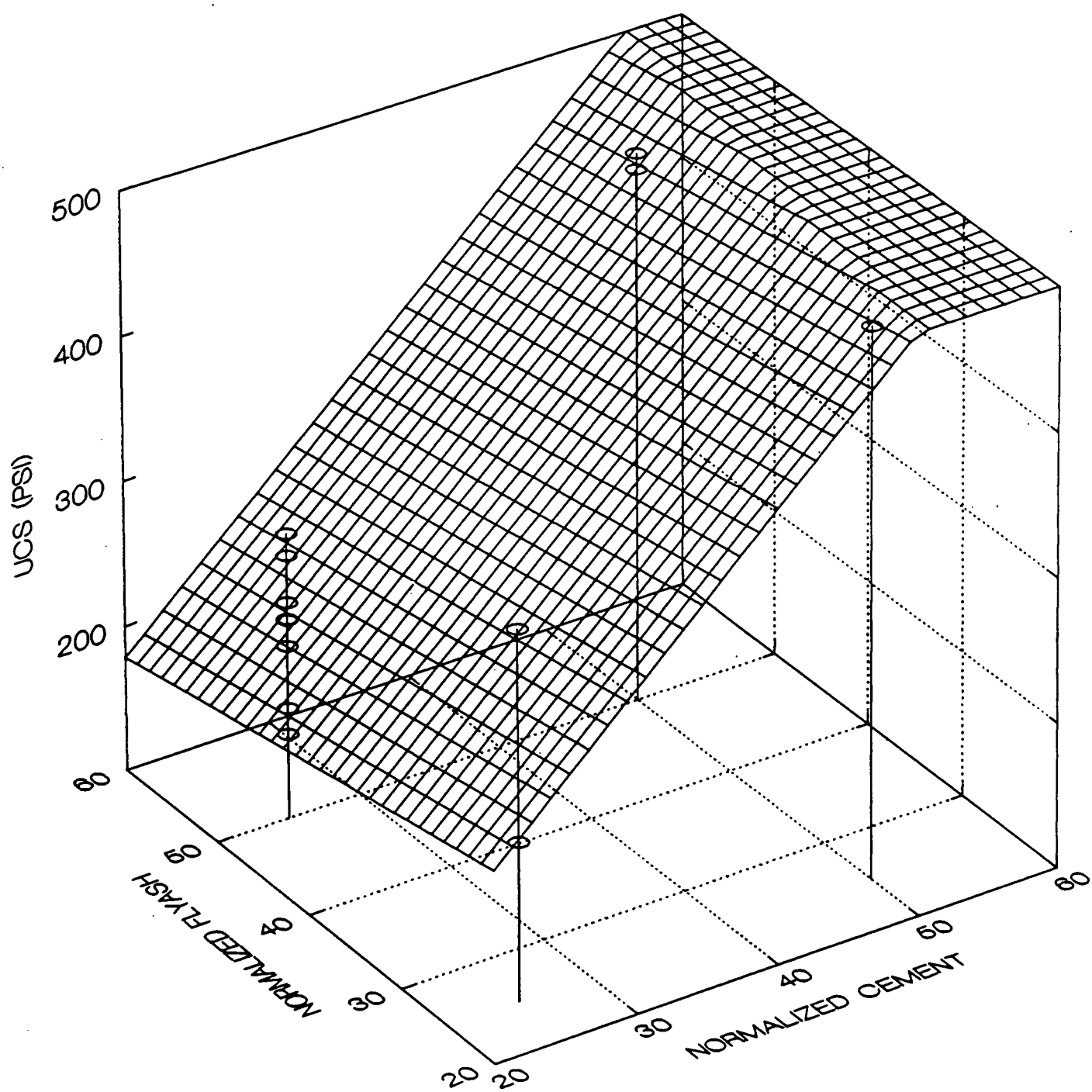


FIGURE 4-25

3-D PLOT OF LINEAR-UCS AS A FUNCTION OF NORMALIZED FLYASH AND CEMENT LOADINGS FOR SOUTH FIELD

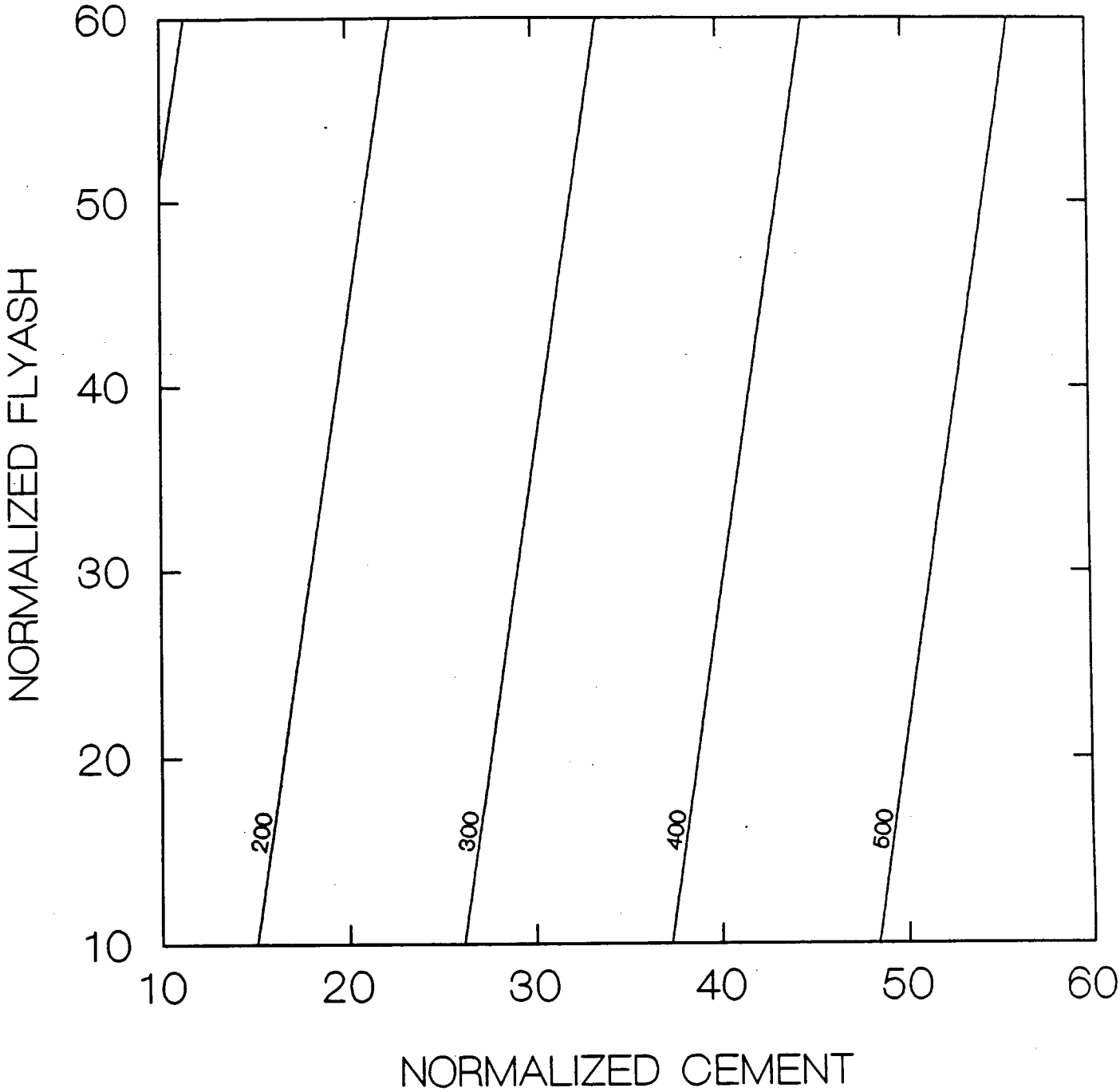


FIGURE 4-26

LINEAR CONTOUR PLOT OF UCS AS A FUNCTION OF NORMALIZED CEMENT AND FLYASH LOADING FOR SOUTH FIELD

due to the higher loading of sodium silicate combined with zero addition of attapulgite and clinoptilolite and low loading of flyash. The effects of reagents besides cement and sodium silicate are ambiguous at the 25 percent loading of cement. When the cement loading is increased to 50 percent, the UCS values are greater than 469 psi irrespective of the other reagents. This trend applies to all formulations except for Run 7. Within the precision of this test, using flyash from the active and inactive piles location yields the same results.

Bulking Factor

Analysis of Figure 4-24 indicates that the bulking factor is increased by addition of all reagents except sodium silicate. The wide confidence intervals in the sodium silicate and cement plots indicate that any conclusions related to sodium silicate and cement are questionable.

Figure 4-27 and 4-28 are the 3-D and contour plots of bulking factor as a function of normalized cement and flyash loadings. The plateau at the highest flyash and cement loadings is an artifact of the plotting program. The smallest bulking factors are obtained at the lowest flyash and cement loadings. As the flyash and cement loadings increase the bulking factors increase. Figure 4-29 plots UCS versus bulking factor. The results are ambiguous.

An empirical equation for bulking factor was determined:

$$BF = 4.9 * PFA + 4.6 * PPC + 28.8 * PAT - 0.79 * PAT * PFA,$$

where BF is the bulking factor, and PFA, PPC, PAT, PAT and PFA are the percentage of flyash, cement, and attapulgite or clinoptilolite in the treated waste when mixed. A plot of the actual measured valves versus the values estimated from the mathematical equation is in Figure 4-30. The data is linear least square regressed with 90 percent confidence limits. The equation has an R^2 value of 0.96. The equation indicates that the addition of attapulgite or clinoptilolite causes almost five times greater volume increase than an addition of an equivalent amount of flyash or cement. The effect of flyash and cement on the bulking factor are similar. This empirical equation should be used for qualitative predictions of bulking factor, not quantitative.

Recommended Formulations of Reagents

The formulations achieving greater than 350 psi are listed in Table 4-44. They are listed in ascending order of bulking factor. (See Figures 4-25 and 4-28 for a visual relationship of the data points.) The treated waste had low leachate concentrations when compared to the leachate action levels. The sample also had low permeabilities. Therefore, UCS and bulking factor are the parameters used to determine the recommended formulations. The recommended formulations that will achieve a UCS value greater than 350 psi and minimize the bulking factor are given in Table 4-45. To minimize the bulking factor, the flyash loading needs to be minimized for a given cement loading.

3527

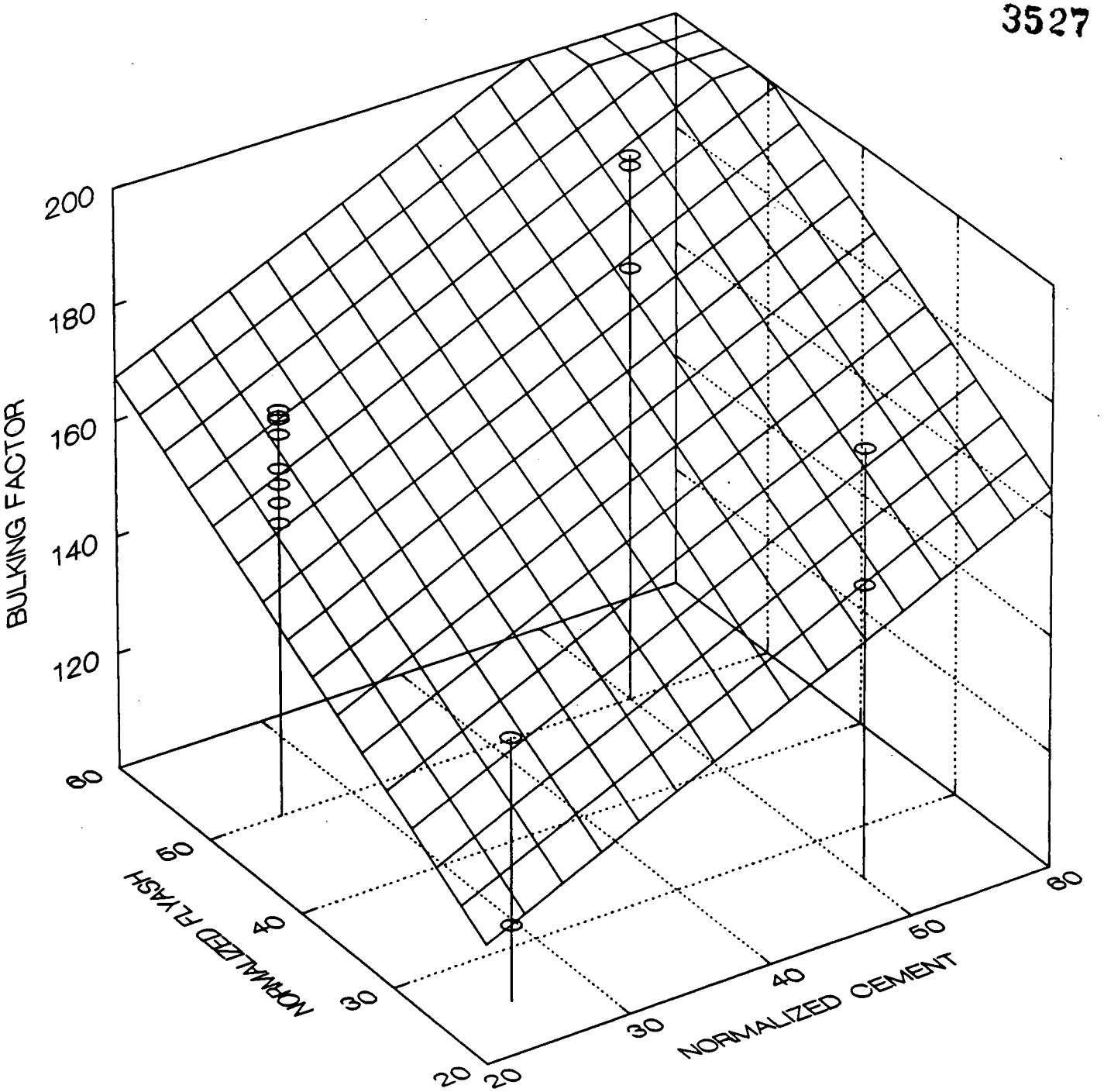


FIGURE 4-27

3-D PLOT OF LINEAR-BULKING FACTOR AS A FUNCTION OF NORMALIZED FLYASH AND CEMENT FOR SOUTH FIELD

3527

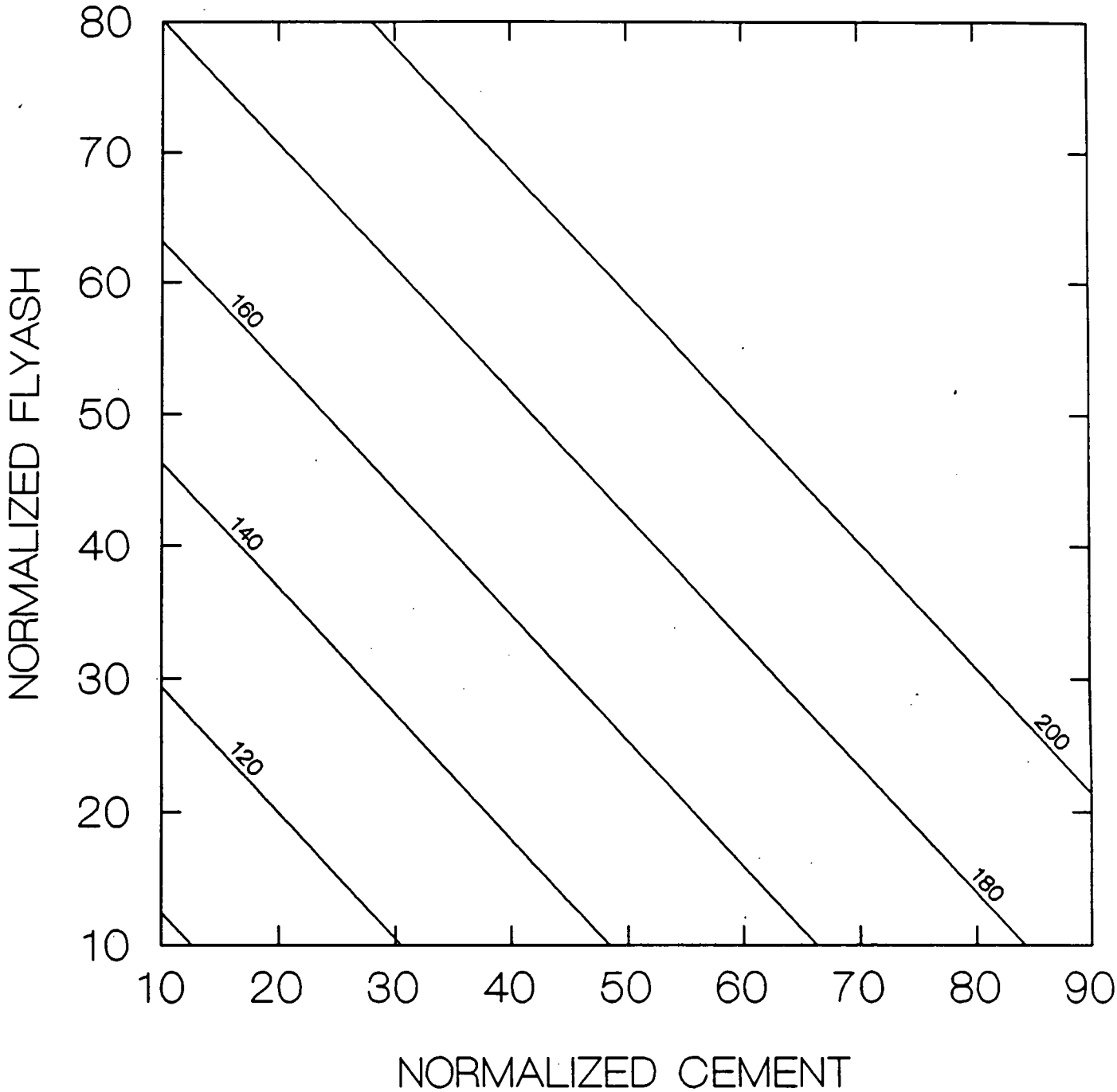


FIGURE 4-28

LINEAR CONTOUR PLOT OF BULKING FACTOR AS A FUNCTION OF NORMALIZED CEMENT AND FLYASH LOADINGS FOR SOUTH FIELD

3527

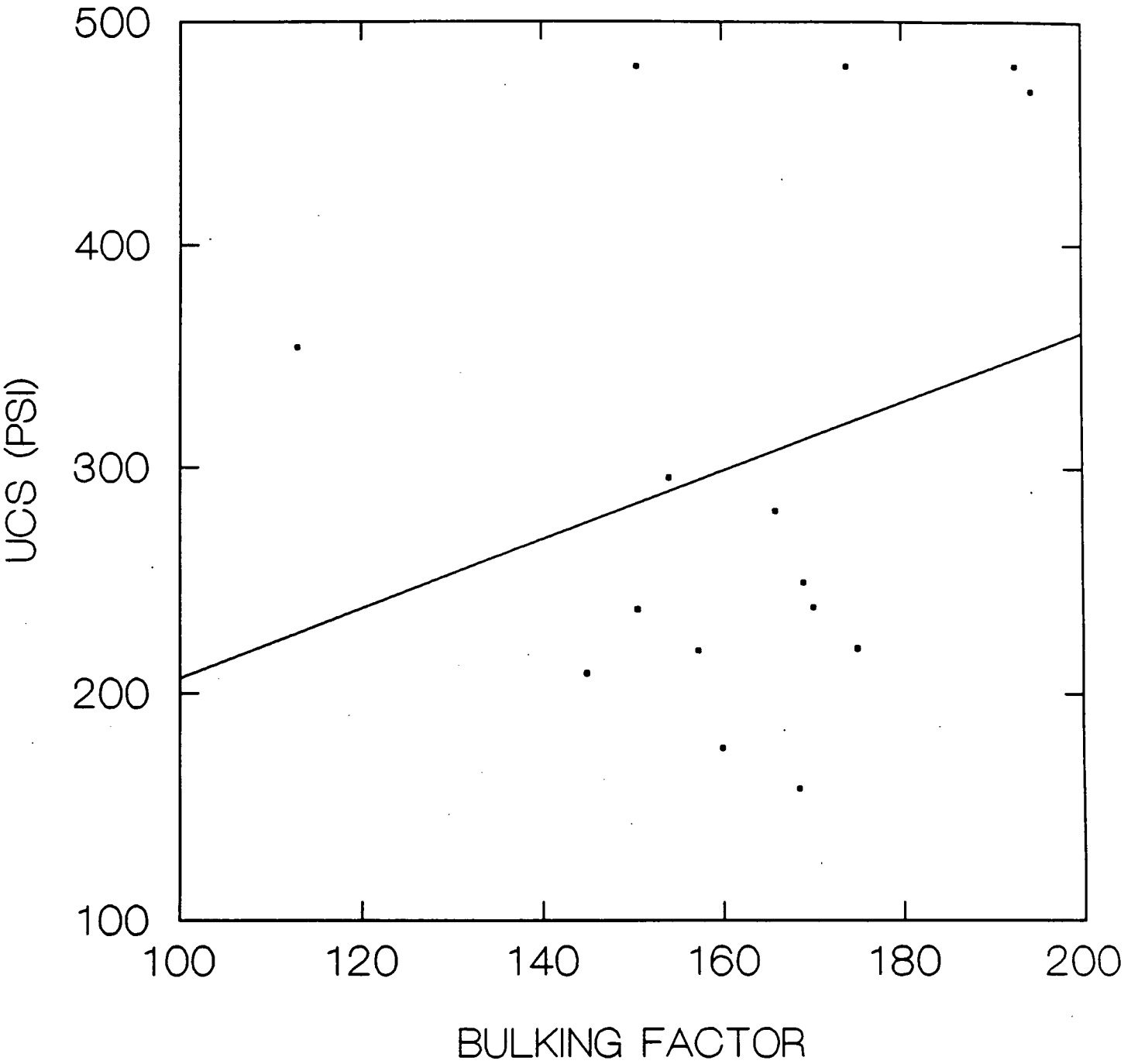


FIGURE 4-29

UCS VS BULKING FACTOR FOR SOUTH FIELD

3527

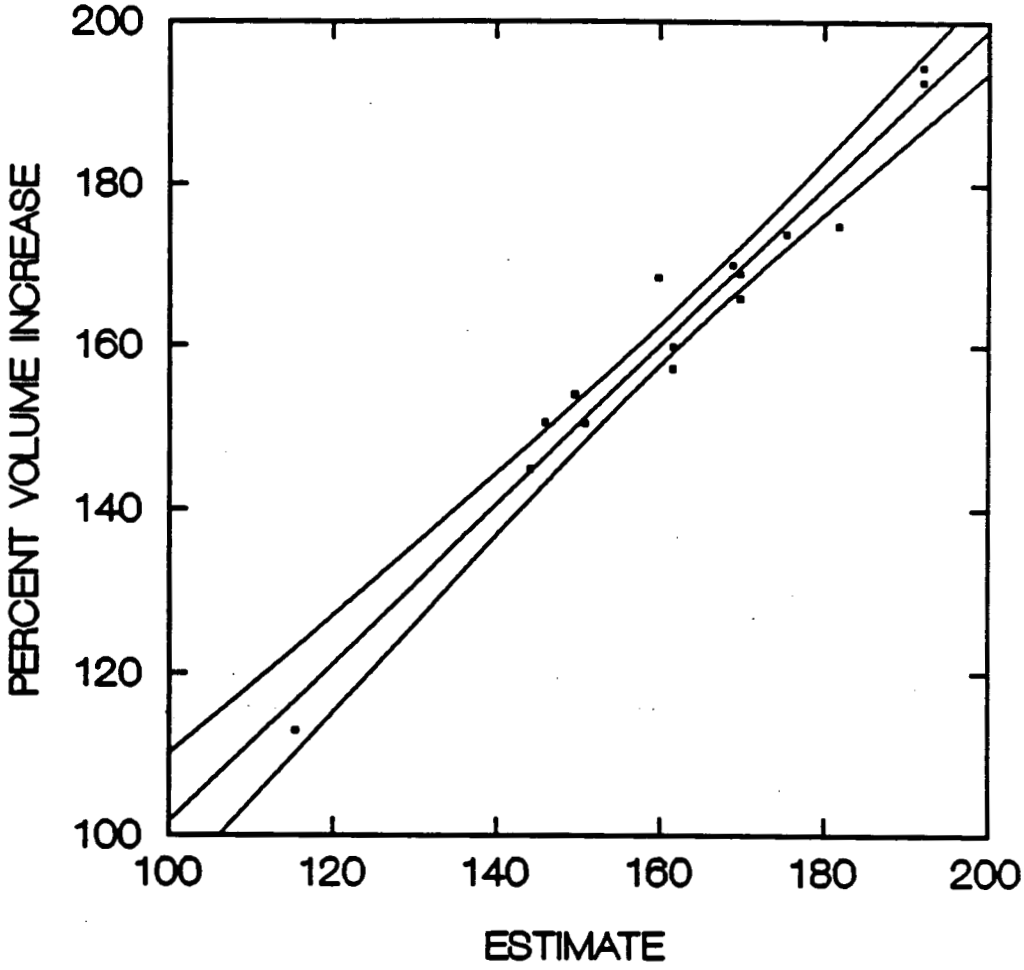


FIGURE 4-30

PLOT OF BULKING FACTOR VALUES VS ESTIMATED BULKING FACTOR VALUES WITH 90% CONFIDENCE LIMITS FOR SOUTH FIELD

TABLE 4-44

FORMULATIONS PASSING THE PERFORMANCE CRITERIA FOR THE SOUTH FIELD AREA*

Normalized Cement Loading	Normalized Flyash Loading	Normalized Sodium Silicate Loading	Normalized Attapulgite & Clinoptilolite Loadings	Bulking Factor
25	25	5	0	113
50	25	5	0	150
50	25	0	5	173
50	50	0	5	192-194

*Reagent loading per 100 pounds of wet weight of waste.

TABLE 4-45

RECOMMENDED FORMULATIONS TO MEET PERFORMANCE GOALS FOR THE SOUTH FIELD AREA*

Normalized Cement Loading	Normalized Flyash Loading	Normalized Sodium Silicate Loading	Normalized Attapulgite * Clinoptilolite Loadings
25	25	5	0
50	25	5	0
50	25	0	5

*Reagent loading per 100 pounds of wet weight of waste.

4.1.2.6 Radon Testing

In accordance with the Work Plan, if the combined Ra-226 and Ra-228 content in the treated waste exceeded 15 pCi/g, radon emanation (from the stabilized solids) and radon leaching (in deionized water) tests would be performed in the Advanced Phase -- optional work. The combined radium levels in the 1991 characterization samples were below 15 pCi/g. The radon emanation and leaching tests were therefore not conducted.

4.1.3 Comparison To Test Objectives

All of the performance objectives established in the Treatability Study Work Plan for this project were met. The performance objectives are listed along with a brief comment on how each objective was achieved. The objectives and accomplishments are as follows:

- To develop a database of stabilization reagents and corresponding hazardous and radioactive materials leachability for stabilized waste forms.

  Data on stabilization of the Operable Unit 2 wastes were obtained during this program. Relationships of the leachate concentrations to the leachate action levels are provided. The data is managed in a database program which was written using Clipper software. A copy of the Clipper printout is presented in Appendix B and a copy of the MTCLP and TCLP leachability data are in Appendix C. Comparisons to leachate action levels are in Appendix D. In addition, maximum and minimum leaching results for each waste unit and each compound are presented in Section 4.1.2.

- To develop a database of stabilization reagents and relative quantities required to minimize leachable concentrations of radionuclides and Hazardous Substances List (HSL) constituents from the final waste form.

  A copy of the MTCLP and TCLP leachability data are in Appendix C. Comparisons to leachate action levels are in Appendix D. See Section 4.1.2.1 for comparison to TC regulatory and leachate action level standards. Mathematical models to relate the effects of treated waste composition on the stabilized waste leachability would be unreliable due to the low concentration of the contaminants in the leachate solutions. See Section 4.1.2.

- To establish the proof of process and applicability of the selected stabilization technology.

  Reagent formulations were identified which met the performance objectives for UCS, permeability and leachability. See Section 4.1.2.

- To screen a large number of parameters and identify those that will be critical for future bench-scale studies.

  Various reagents were investigated at several distinct values. The effects of the reagents on the performance objectives were determined. It is recommended that tests be

conducted in future work to investigate the effects of water, clinoptilolite, and attapulgite addition in more detail.

- To determine an envelope of cement stabilization reagents and relative quantities required, so that the final waste form achieves a UCS of approximately 500 psi.

  The envelope of cement stabilization reagents was determined for each waste unit. See Section 4.1.2.

- To minimize the final volume of treated waste.

  Empirical equations were determined for relating bulking factor (percentage volume increase) to the reagent additions. Formulations that met the UCS requirements and minimized the percentage volume increase were determined and used in the permeability tests.

- To provide data which will be used in the FS to estimate the volumes of treated waste that will be generated by each process.

  Formulations that met the UCS requirements and minimized the percentage volume increase were determined and used in the permeability tests. Empirical equations were determined for relating bulking factor (percentage volume increase) to the reagent additions.

- To develop preliminary reagent mixtures for use in future treatability studies.

  Reagent mixtures were developed and recommendations were made for future treatability studies. See Section 4.1.2.

- To provide preliminary cost and design data for the FS.

  Ranges of reagent additions that would satisfy the performance criteria were determined. Also empirical bulking factor equations were derived which provide information on volume increase. This information will be used for the development of the required level of cost and design data to meet the FS study requirements.

- To provide leaching characteristics of stabilized and unstabilized waste for use in fate and transport modeling, using results obtained from the TCLP.

  The leaching results are described and summarized in Section 4.1.2. A copy of the MTCLP and TCLP leachability data are contained in Appendix C. Comparisons to leachate action levels are in Appendix D.

- To develop preliminary process parameters for use in future treatability studies: shear strength, waste form temperature rise, general description of waste before and after reagent addition, permeability of stabilized waste, percent of water in the waste, pH of the leachate solution, and information if there were significant amounts of gas given off during mixing or curing.

Preliminary process parameters for use in future treatability studies or in the remediation were collected. These parameters were designed to indicate if there may be gross processing problems while using the grout mixture. The parameters are shear strength, waste form temperature rise, penetration resistance, and if there was significant amounts of gas given off during mixing. The treated sample is considered processible if the mixture has low shear strength (<1 ton/ft^2), minimal temperature rise (<7 C), and no evidence of gas release soon after mixing. In addition to improved handling, the treated waste should set to achieve a penetration resistance of greater than 4.5 tons/ft^2 after a day of curing. Based on these parameters, all successful mixtures are processible.

- To provide the chemical and radiological data as shown in the Work Plan, Table 3-4.

  The leaching results are described and summarized in Section 4.1.2. A copy of the MTCLP and TCLP leachability data are in Appendix C. Comparisons to leachate action levels are in Appendix D.

The completed test program successfully determined ranges of formulations that would meet the performance objectives. The data can be used in the detailed analysis of alternatives during the FS process. Data was obtained which:

- Confirms that stabilization technology is applicable to Operable Unit 2
- Provides leachate and permeability results for input in the fate and transport modelling
- Provides reagent envelopes for the estimation of cost
- Provides information for further analysis in the Remedy Design Phase.

If cement stabilization is chosen, remedy design work using vendor-specific equipment needs to be conducted before implementation of this technology. Pilot plant studies to determine the effect of sample heterogeneity and vendor specific reagent characteristics need to be performed. It is also recommended that further tests be performed to determine the effects of water addition, on the strength and long-term stability of the treated waste. If attapulgite, and clinoptilolite are used in future studies, their affect on the treated waste stability also needs to be further investigated. In this study, enough water was added to make the waste and reagent mixture into a paste that could be easily mixed and fluid enough to add to mold for curing. The moisture content of the mixture ranged from approximately 22 to 45 percent. The optimum water addition was not determined to maximize the UCS. Additional tests with the desired formulation(s) may be investigated with several levels of water addition to determine the appropriate range of water additions to maximize the UCS.

Attapulgite and clinoptilolite were added to decrease the leachability of metals in the treated waste. Analysis of the treatability data indicates that the leachability is below the anticipated leachate action levels for the site. Therefore, addition of these reagents should not be necessary. Also, the addition of these reagents may have a detrimental effect on the unconfined compressive strength. It is therefore recommended that a larger scale test with no addition of attapulgite and clinoptilolite be investigated to prove that there is not a leachability problem.

Additional tests should also be conducted to test the long-term effect of stabilizing the Lime Sludge Ponds with Portland Type I cement.

4.2 QUALITY ASSURANCE/QUALITY CONTROL

The QAPP for the Fernald RI/FS is the governing document of QA covering the remedial investigation at the FEMP. The QAPP includes the quality objectives, the requirements for work performance to meet these objectives, and the means for verifying that the objectives have been met. To meet the analytical data quality objectives of the QAPP, strict documentation procedures are used in conjunction with reagent blanks, duplicate samples, and spiked samples to determine the precision, accuracy, and completeness of the data.

Project-specific notebooks signed out by the facility QCC to the individuals performing the experiments were used to record all daily laboratory activities. Non-project-specific logbooks were used to record the injection or introduction of samples into analytical instrumentation, as well as maintenance or problems with instruments. The notebooks and logbooks were returned to the facility QCC after completion of the project or when the books were filled. Standard QA/QC protocol followed guidelines specified in Section 7.0 of the Treatability Study Work Plan. This included numerical transcription verification and checking and recalculation of all calculations. Other analytical QC activities followed by the laboratories, including instrument calibrations, standards, blanks, duplicates, and QC samples, may be found in the lab-specific QAPPs. The results of some of these QA activities are contained in Appendices A and C of this report. The purpose and results of some of these QA/QC checks are explained in this section.

4.2.1 Run Blanks

For radionuclide, TCLP, and MTCLP analysis, run blanks consisting of the TCLP extraction fluid were analyzed to insure that any contamination in either the extraction fluid or the analytical process would be identified.

Instrument method blanks were performed by CLP protocol as were the TCLP extraction samples. All methods were within the CLP limits for each analysis.

TCLP extraction fluids were analyzed using the same method as the samples. The analyses were performed to determine if constituents of concern were being introduced into sample extracts from the extraction fluid. Silicon and zinc, constituents of concerned, appeared repeatedly in extract fluid 1 and extract fluid 2 at levels at or below contract detection limit for the CLP method of analyses. Acetone and methylene chloride were found in high levels in most of the extraction fluid analyses. These volatiles were labeled as rejected or undetected in the validation process because the TCLP extraction took place in the semivolatile extraction laboratory. All other organic analyses only detected constituents of concern at levels below the contract detection limits.

4.2.2 Reagent Blanks

To demonstrate that the reagents (Portland cement Types I and II, attapulgite, clinoptilolite, and sodium silicate) used for stabilizing samples did not contribute to the leachable metals, organics, or radionuclides in the treated mixtures, aliquots of each were submitted and analyzed for these contaminants. In addition, seven mixtures of various amounts of reagents were made (Table 3-10) and subjected to TCLP analyses. The results are in Appendix C. Many of the constituents of concern are found at low levels in the reagents. Some constituents such as barium, copper, manganese, boron, and silicon are found at levels above 1 ppm. Radionuclides are also in the reagents used in the solidification process. The clays showed a gross alpha of 77.3 pCi/L, with Ra-228 at 8.58 and total uranium at 4.32 g/L. The commercial flyash analyzed at 14.9 pCi/L for gross beta with total uranium at 8.04 g/L. The portland cements reported gross betas at 290 and 278 pCi/L and Ra-226 at levels of 4.48 and 7.77 pCi/L. These constituents are found at these levels in nature.

4.2.3 Spiked Samples

The spiked sample analysis is designed to measure the accuracy of the data and provide information about the effect of the sample matrix being analyzed on the digestion (if required) and measurement methodology. The spike was added to the leachate from the TCLP or MTCLP before the digestion. At least one spiked sample analysis was performed on each group of samples of a similar matrix type (ex: water, soil) and concentration (i.e., low, medium) for each set of leachate samples submitted for analysis or for each 20 samples analyzed.

For organic compounds, if spike recovery was not within the limits as specified by the CLP protocol, the data was flagged with an "*."

For metals, if the spike recovery was not within the limits for the analyte of concern, the data for all samples associated with the analysis of that spiked sample were flagged with the letter "N." An exception to this rule was granted in situations where the sample concentration exceeded the spike concentration by a factor of four or more. In such a case, the spike recovery was not considered and the data was reported unflagged even if the percent recovery did not fall within the control range. Individual spike recoveries were calculated using the following equation found in the EPA guidance document "Preparing Perfect Project Plans" (EPA 1989b):

$$\% \ Recovery = \frac{(S-U) * 100}{C_{SA}}$$

where

S = spiked sample result
U = unspiked sample result
C_{SA} = spike added

When the sample concentration was less than the instrument detection limit, S = 0 was used for the purpose of calculating the percent recovery.

For the volatile spiked compounds, 10 out of 80 spike recoveries fell outside the CLP protocol Q C limits. Only three of the spiked compounds of the five were outside of QC limits.

Semivolatile spiked compounds showed 50 out of 242 spike recoveries fell outside the CLP protocol QC limits. All but one of the 11 compounds, acenaphthene, showed recovery problems.

The pesticide spike recoveries faired much better with 3 of 120 spike recoveries outside the QC-required limits. Only 4,4-DDT had spike recoveries outside the QC limits.

The only metals with spike recoveries outside the CLP protocol QC limits are arsenic, lead, selenium, and thallium. The arsenic spike recoveries showed six out of 10 analyses outside the QC limits; the lead and thallium only had 1 of 10 analyses out; and the selenium had 4 out of outside QC limits. Of the 217 percent spike recoveries evaluations done for the metals, 202 were within the QC limits.

The spiked recovery results are included in Table 4-46.

4.2.4 Relative Percent Difference

The relative percent difference (RPD) is a comparison of the results of running duplicate samples through the same analytical procedures. Evaluating RPD results gives another indication of the validity of the data. The RPD for each analyte (or measured parameter) was calculated using the following equation:

$$RPD = \frac{(C1 - C2) * 100}{(C1 + C2)/2}$$

where

RPD = relative percent difference
C1 = larger of the two observed values
C2 = smaller of the two observed values

Of the 226 RPD evaluations done for the metals spike and spike duplicate samples, 221 were within the control range for the analytes of concern. Table 4-47 contain the results of the RPD analysis.

Table 4-46
PERCENT SPIKE RECOVERY OF TREATABILITY SAMPLES*

VOLATILES	QC Limits (%)	AVERAGE SPIKE RECOVERY (%)	# Outside QC Limits
1,1-Dichloroethene	61-145	88	6 of 16
Trichloroethene	71-120	99	3 of 16
Benzene	76-127	101	1 of 16
Toluene	76-125	96	0
Chlorobenzene	75-130	99	0
SEMIVOLATILES			
Phenol	12-86	76	6 of 22
2-Chlorophenol	27-123	103	4 of 22
1,4-Dichlorobenzene	36-97	58	1 of 22
N-Nitroso-di-n-propylam	41-116	52	6 of 22
1,2,4-Trichlorobenzene	39-98	68	1 of 22
4-Chloro-3-methylphenol	23-97	82	3 of 22
Acenaphthene	46-118	74	0
4-Nitrophenol	10-80	76	9 of 22
2,4-Dinitrotoluene	24-96	81	3 of 22
Pentachlorophenol	9-103	100	10 of 22
Pyrene	26-127	112	7 of 22
PESTICIDES			
gamma-BHC (Lindane)	56-123	78	0
Heptachlor	40-131	81	0
Aldrin	40-120	76	0
Dieldrin	52-126	88	0
Endrin	56-121	79	0
4,4'-DDT	39-127	111	3 of 20

Table 4-46
(Continued)

METALS	QC Limits (%)	AVERAGE SPIKE RECOVERY (%)	# Outside QC Limits
Aluminum	75-125	98	0 of 10
Antimony	75-125	106	0 of 10
Arsenic	75-125	75	6 of 10
Barium	75-125	100	0 of 10
Beryllium	75-125	97	0 of 10
Cadmium	75-125	88	0 of 10
Chromium	75-125	93	0 of 10
Cobalt	75-125	96	0 of 10
Copper	75-125	98	0 of 10
Iron	75-125	99	0 of 10
Lead	75-125	85	1 of 10
Manganese	75-125	97	0 of 10
Mercury	75-125	106	0 of 10
Nickel	75-125	99	0 of 10
Selenium	75-125	71	4 of 10
Silver	75-125	88	0 of 10
Thallium	75-125	101	1 of 10
Vanadium	75-125	99	0 of 10
Zinc	75-125	96	0 of 10
Cyanide	75-125	95	0 of 2
Molybdenum	75-125	100	0 of 10
Boron	75-125	98	0 of 5
Silicon	75-125	99	0 of 9

*TCLP extract is analyzed by CLP protocol

TABLE 4-47

RELATIVE PERCENT DIFFERENCE VOLATILES*

	Solid Waste Landfill			Lime Sludge Pond, S.I			Lime Sludge Pond, S.II		Southfield		
Compound Name	3, 3D (%)	7, 7D (%)	12, 12D (%)	5, 5D (%)	10, 10D (%)	16, 16D (%)	3, 3D (%)	7, 7D (%)	3, 3D (%)	6, 6D (%)	10, 10D (%)
Methylene Chloride	169	6	185	71	65	73	4	15	16	34	67
Acetone	126	160	113	30	6	35	127	99	114	157	78
4-Methyl-2-pentanone	N/A	N/A	N/A	N/A	N/A	N/A	25	0	N/A	N/A	N/A
2-Butanone	N/A	0	N/A	0	0	50	25	150	40	67	50

*Table represents % RPD where positive concentrations were detected for both the original and duplicate sample runs.
N/A - Concentration was not detected for one or both of the samples and an RPD could not be calculated.

TABLE 4-47 (Continued)

RELATIVE PERCENT DIFFERENCE PERMEABILITY*

	Solid Waste Landfill		Lime Sludge Pond, S.I	Southfield
Run No.	3, 3D RPD (%)	7, 7D RPD (%)	5, 5D RPD (%)	6, 6D RPD (%)
Permeability	47	200	117	179

*Table represents % RPD where positive concentrations were detected for both the original and duplicate sample runs.

TABLE 4-47 (Continued)

RELATIVE PERCENT DIFFERENCE FOR MODIFIED TCLP*

	Solid Waste Landfill			Lime Sludge Pond, Stage I			Lime Sludge Pond, Stage II		Southfield		
Run No.	3, 3D RPD (%)	7, 7D RPD (%)	12, 12D RPD (%)	5, 5D RPD (%)	10, 10D RPD (%)	16, 16D RPD (%)	3, 3D RPD (%)	7, 7D RPD (%)	3, 3D RPD (%)	6, 6D RPD (%)	10, 10D RPD (%)
Ba (g/L)	N/A	9	N/A	15	20	2	5	2	19	24	29
Cr (g/L)	7	46	21	18	87	20	3	10	36	42	68
Hg (g/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Table represents % RPD where positive concentrations were detected for both the original and duplicate sample runs.

TABLE 4-47 (Continued)

RELATIVE PERCENT (RPD) DIFFERENCE FOR TREATABILITY INORGANICS*

	Solid Waste Landfill			Lime Sludge Pond, Stage I			Lime Sludge Pond, Stage II		Southfield		
Run No.	3, 3D	7, 7D	12, 12D	5, 5D	10, 10D	16, 16D	3, 3D	7, 7D	3, 3D	6, 6D	10, 10D
Element	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Al	130	96	4	87	80	91	10	2	20	84	111
Sb	54	102	24	55	80	88	25	14	47	63	81
As	92	N/A	38	N/A	N/A	N/A	N/A	N/A	16	N/A	116
Ba	78	10	89	24	69	18	22	29	23	90	8
Be	N/A	42	13	21	29	N/A	3	7	N/A	34	N/A
Ca	57	79	4	71	76	78	11	5	8	78	73
Cr	16	13	1	49	10	5	1	10	17	46	29
Co	N/A	N/A	N/A	18	41	65	11	12	N/A	N/A	N/A
Cu	44	22	2	22	49	42	13	6	26	34	22
Fe	24	32	1	18	27	29	7	5	2	14	51
Mg	140	193	53	159	196	195	2	31	19	144	189
Mn	20	36	U	33	188	170	4	5	4	27	35
Ni	N/A	N/A	N/A	59	17	27	N/A	N/A	N/A	N/A	34
K	11	15	7	5	1	8	25	5	14	16	15
Ag	21	27	2	24	26	28	3	2	7	26	26
Na	N/A	N/A	N/A	166	176	N/A	1	19	N/A	N/A	196
V	60	84	5	50	30	40	7	7	16	65	56

TABLE 4-47

(Continued)

	Solid Waste Landfill			Lime Sludge Pond, Stage I			Lime Sludge Pond, Stage II		Southfield		
Run No.	3, 3D	7, 7D	12, 12D	5, 5D	10, 10D	16, 16D	3, 3D	7, 7D	3, 3D	6, 6D	10, 10D
Element	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Zn	150	27	139	35	155	85	64	N/A	85	N/A	21
CN	N/A	N/A	N/A	24	N/A	125	N/A	N/A	133	14	52
Mo	8	60	5	56	46	49	11	13	12	65	27
B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	85
Si	N/A	N/A	N/A	N/A	N/A	N/A	23	38	N/A	N/A	99

N/A - Concentration was not detected for one or both of the samples and an RPD could not be calculated.
*Table represents % RPD where positive concentrations were detected for both the original and duplicate sample runs.

TABLE 4-47 (Continued)

RELATIVE PERCENT DIFFERENCE RAD DATA*

		Solid Waste Landfill			Lime Sludge Pond, Stage I			Southfield		
Radionuclide	Sample ID/F units	3, 3D RPD (%)	7, 7D RPD (%)	12, 12D RPD (%)	5, 5D RPD (%)	10, 10D RPD (%)	16, 16D RPD (%)	3, 3D RPD (%)	6, 6D RPD (%)	10, 10D RPD (%)
Ra-226	(pCi/L)	N/A	N/A	N/A	15	N/A	70	N/A	N/A	33
Ra-228	(pCi/L)	97	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Gross beta	(pCi/L)	39	36	2	N/A	N/A	N/A	N/A	N/A	N/A

*Table represents % RPD where positive concentrations were detected for both the original and duplicate sample runs.

TABLE 4-47 (Continued)

RELATIVE PERCENT DIFFERENCE SEMIVOLATILES*

Run No.	3, 3D (%)	7, 7D (%)
Compound Name		
Benzoic acid	0	50

*Table represents % RPD where positive concentrations were detected for both the original and duplicate sample runs.

4.2.5 Duplicate Samples

At least 20 percent of all experimental tests were duplicated. Three duplicate treated mixtures were made for the Solid Waste Landfill (Runs 3, 7 and 12 of the 12 formulations, Table 3-7), the Lime Sludge Ponds Stage I (Runs 5, 10 and 16 of the 16 formulations, Table 3-9), and the South Field (Runs 3, 6 and 10 of the 12 formulations, Table 3-9). Two duplicate mixtures were made for the Lime Sludge Ponds Stage II (Runs 3 and 7 of the 9 formulations, Table 3-11). These results are included in Appendix C.

The percent RPD was calculated each constituent where positive concentrations were detected in both the original and the duplicate run samples. These values are in Table 4-47. Many concentrations were small reflecting large values for the percent RPD recoveries.

4.2.6 Completeness

Another calculation used to assess data quality is the level of completeness. The level of completeness is calculated using the following equation:

$$\%C = 100\% * (V/n)$$

where

- %C = percent completeness
- V = number of measurements judged valid
- n = total number of measurements necessary to achieve a specific statistical level of confidence in decision making

During the course of the study, 2822 chemical and radiological analyses were performed on advanced stage samples. The completed analyses totaled 2736 for a completeness rate of almost 97 percent.

4.3 SCHEDULE/COST FOR PERFORMING THE TREATABILITY STUDY

Preparation of the Operable Unit 2 Treatability Study Work Plan began in April 1991. A draft was prepared and underwent several iterations before it was submitted to EPA for review on August 24, 1991. EPA reviewed the document from August 23 to September 23, and in the process generated a list of comments. Responses to EPA comments, along with a revision of the Work Plan, were prepared between September 24 and October 21. The revised Work Plan and comment responses were submitted to EPA for review and approval on October 23.

Because of the tight schedule as shown in Figure 4-31, a decision was made to begin treatability testing before EPA approval. The first treatability sample was mixed on September 23, one month before the last Work Plan submittal to EPA.

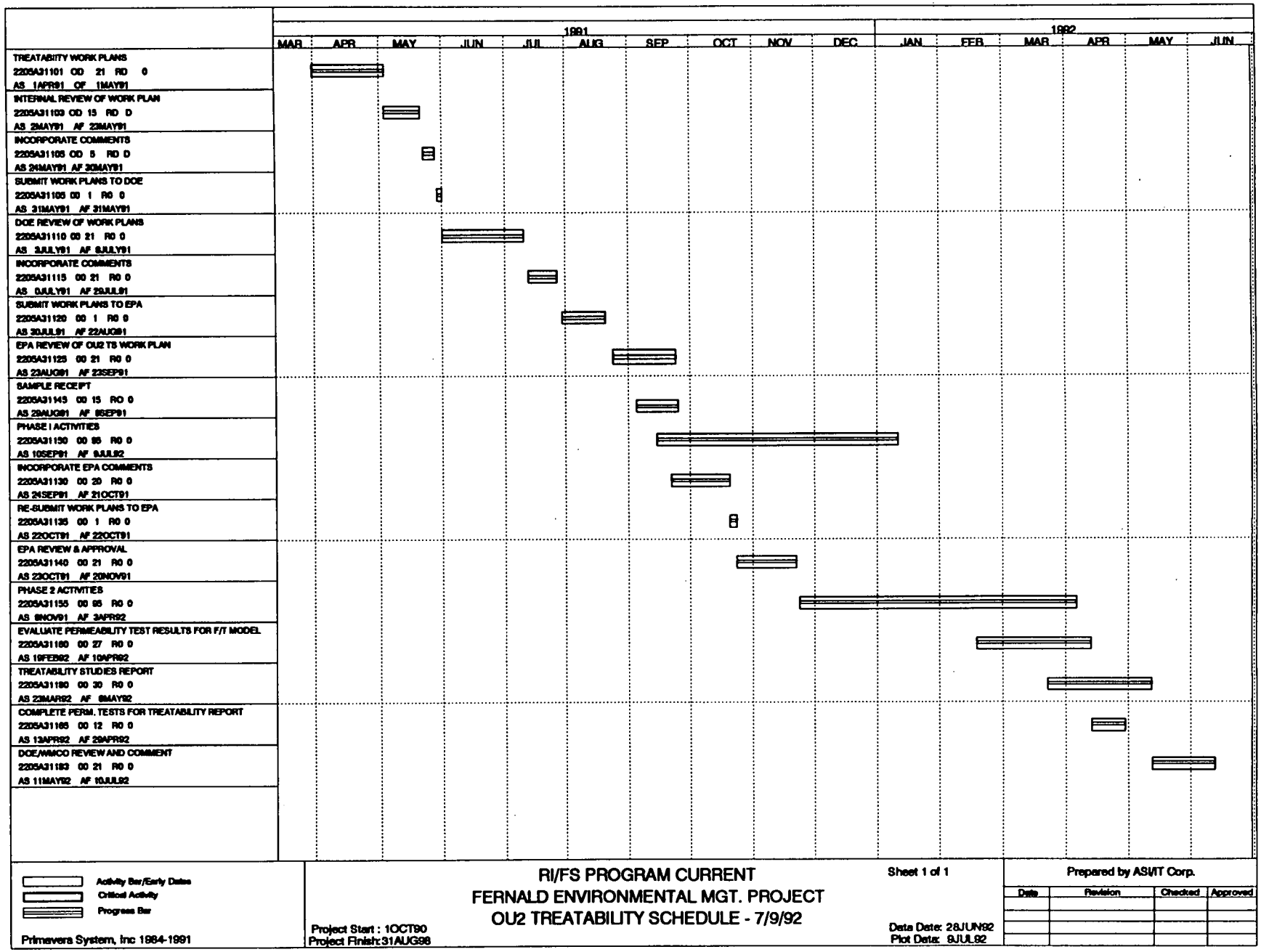


FIGURE 4-31. OU2 TREATABILITY STUDY SCHEDULE

The Stage 1 molds were mixed between September 23 and October 9. Based on the Stage 1 results, it was decided that a second stage would be performed on the Lime Sludge Ponds. These samples were taken between November 7 and November 14.

Because of the lack of time, it was not possible to sequence a preliminary phase with a subsequent advanced phase. Instead, a large number of samples were mixed, each was large enough to be used for both preliminary and advanced stage analysis. After each sample was UCS tested, MTCLP analyses was performed; however, holding time limits (two weeks) did not permit waiting for the results of MTCLP analysis before deciding which samples would go into advanced phase testing. Therefore, the decision to send a sample into the advanced phase analysis was based on the results of the UCS test. The MTCLP results were used to decide if another stage would be required based on leachability problems.

The full TCLP analysis of these samples did present problems. The cement in samples resulted in high concentrations of calcium in the TCLP leachates. This made some of the radiological analyses very difficult.

The high levels of calcium in the leachate resulted in what is called a difficult matrix. This result caused a doubling of the analytical tests. The levels of radioactivity in the samples also affected the cost. The single factor having the greatest impact was, however, the total number of samples receiving the advanced phase analysis. The large number of samples was required due to the inability (due to schedule) to identify a few promising formulations in a timely manner.

The overall cost of the Operable Unit 2 treatability program is approximately $1,200,000 with about two thirds of this amount for analyses.

4.4 KEY CONTACTS FOR OPERABLE UNIT 2 TREATABILITY STUDY

The project management organization for Operable Unit 2 treatability is shown in Figure 4-32. The principal parties include: DOE Fernald Field Office, WEMCO, ASI/IT, the IT Technology Development Laboratory, and Parsons.

Personnel involved in the management of the entire RI/FS include Jack R. Craig, DOE Project Director, who is responsible for the RI/FS; John D. Wood, ASI/IT's Project Director for the RI/FS contractor; and ASI/IT's John E. Razor, who serves as Deputy Project Director and is responsible for the technical content of all the RI/FS consultant's documents.

Additional personnel involved in the management of RI/FS treatability programs for all operable units include Dr. N. E. Hopson, ASI/IT's Technical Integration Manager, who is responsible for specific

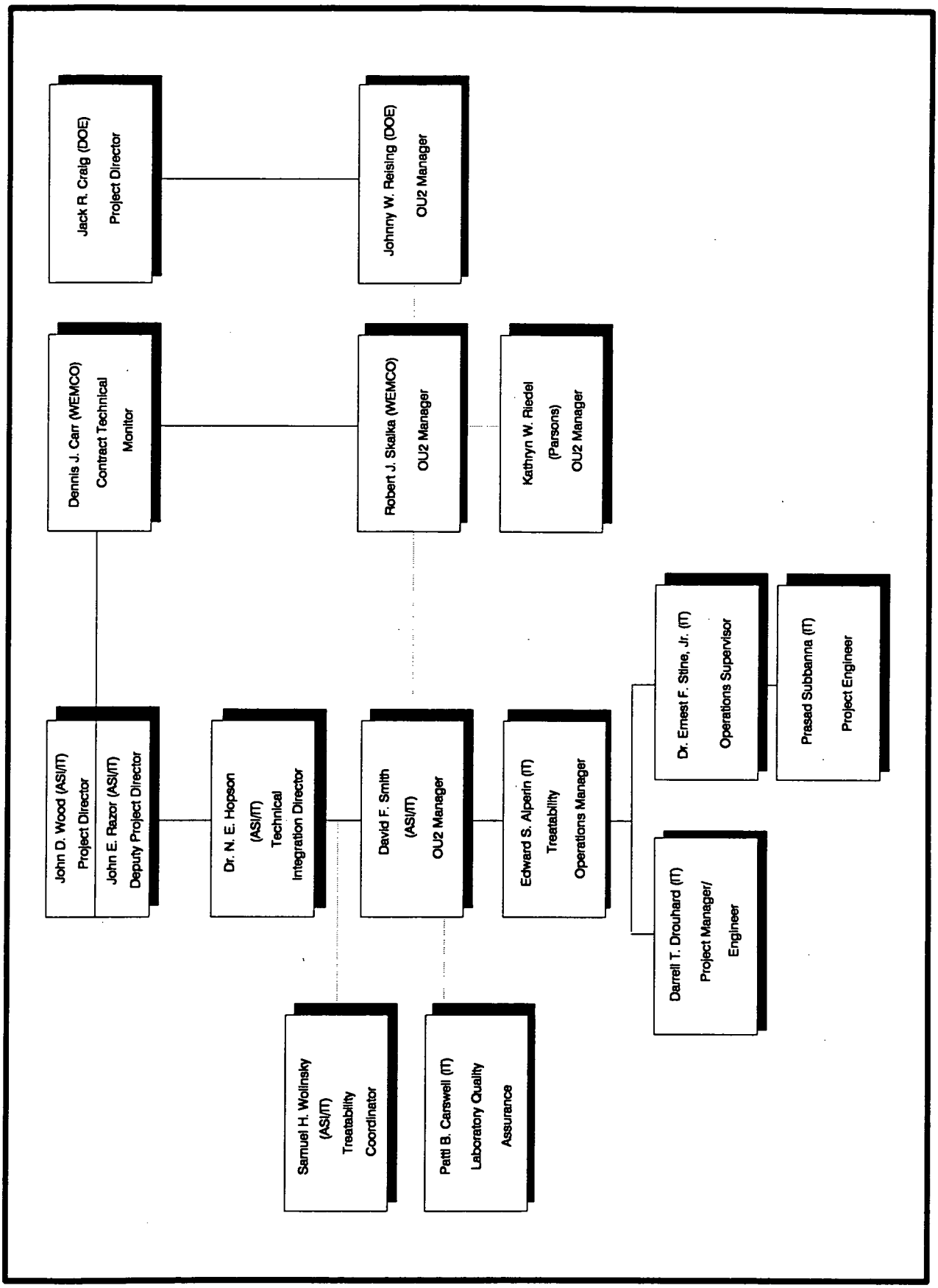


FIGURE 4-32. Treatability Study Management and Staffing

major work tasks as follows: RI, NEPA, and Treatability; and, Samuel H. Wolinsky, Treatability Coordinator for all operable unit treatability studies performed by the RI/FS consultant.

Personnel specifically involved in Operable Unit 2 include Johnny W. Reising, DOE Operable Unit Manager; Robert J. Skalka, WEMCO's Integration Contractor Operable Unit Manager; and Kathryn W. Riedel, Operable Unit Manager for Parsons, the remedial design contractor. David F. Smith serves as the RI/FS Operable Unit Manager.

The IT Technology Development Laboratory personnel performed the actual treatability testing. These individuals are Edward S. Alperin, Treatability Operations Manager, who is responsible for all treatability testing programs within the laboratory; Darrell T. Drouhard, Project Manager/Engineer, who coordinates all treatability laboratory work between the laboratories and the site; Dr. Ernest F. Stine, Jr., Operations Supervisor, who is responsible for the technical aspects of the treatability programs at the laboratory; Prasad Subbanna, Project Engineer, who performs most of the experiments; and Patti B. Carswell, Laboratory Quality Assurance Coordinator, who is responsible for all QA activities.

The following list provides the addresses and phone numbers of the key contacts associated with the Operable Unit 2 Treatability Study Report:

- Edward S. Alperin (IT)
  Treatability Operations Manager
  IT Corporation - Technology Development Laboratory
  304 Directors Drive
  Knoxville, TN 37923
  (615) 690-3211

- Dennis J. Carr (WEMCO)
  Contract Technical Monitor
  Westinghouse Environmental Management Co. of Ohio
  P.O. Box 398704
  Cincinnati, OH 45239
  (513) 738-6931

- Patti B. Carswell (IT)
  Laboratory Quality Assurance Coordinator
  IT Corporation - Technology Development Laboratory
  304 Directors Drive
  Knoxville, TN 37923
  (615) 690-3211

- Mr. Jack R. Craig (DOE)
  Project Director
  U. S. Department of Energy
  P.O. Box 398705

Cincinnati, OH 45239-8705
(513) 738-6159

- Darrell T. Drouhard (IT)
  Project Manager/Engineer
  IT Corporation - Technology Development Laboratory
  304 Directors Drive
  Knoxville, TN 37923
  (615) 690-3211

- Dr. N. E. Hopson (ASI/IT)
  Technical Integration Manager
  Advanced Sciences, Inc.
  P.O. Box 475
  Ross, OH 45061
  (513) 738-3100

- John Razor (ASI/IT)
  Deputy Project Director
  Advanced Sciences, Inc.
  P.O. Box 475
  Ross, OH 45061
  (513) 738-3100

- Johnny W. Reising (DOE)
  Operable Unit 2 Manager
  U.S. Department of Energy
  P.O. Box 398705
  Cincinnati, OH 45239-8705
  (513) 738-9083

- Kathryn W. Riedel (Parsons)
  Operable Unit 2 Manager
  Parsons
  6120 South Gilmore Road
  Fairfield Executive Center
  Fairfield, OH 45014
  (513) 870-8114

- Robert J. Skalka (WEMCO)
  Integration Contract Operable Unit Manager
  Westinghouse Environmental Management Co. of Ohio
  P.O. Box 398704
  Cincinnati, OH 45239
  (513) 738-6760

- David F. Smith (ASI-IT)
  Operable Unit 2 Manager
  Advanced Sciences, Inc.
  6739 Academy Rd., N.E.
  Albuquerque, NM 87109-3345
  (505) 828-0959 (ex 368)

- Dr. Ernest F. Stine, Jr. (IT)
  Operations Supervisor
  IT Corporation - Technology Development Laboratory
  304 Directors Drive
  Knoxville, TN 37923
  (615) 690-3211

- Prasad Subbanna (IT)
  Project Engineer
  IT Corporation - Technology Development Laboratory
  304 Directors Drive
  Knoxville, TN 37923
  (615) 690-3211

- Samuel H. Wolinsky (ASI/IT)
  Treatability Coordinator
  Advanced Sciences, Inc.
  P.O. Box 475
  Ross, OH 45061
  (513) 738-0430

- John Wood (ASI/IT)
  Project Director
  Advanced Sciences, Inc.
  P.O. Box 475
  Ross, OH 45061
  (513) 738-3100

1917

REFERENCES

Battelle Laboratories, Inc., 1981, "Environmental Report of the Feed Materials Production Center," Final Report to NLO, Battelle Laboratories, Columbus, OH.

Battelle Laboratories, Inc., National Lead Co. of Ohio, and the U.S. Dept. of Energy, 1977, "Environmental Impact Assessment - Feed Materials Production Center, Fernald, Ohio," DOE, Oak Ridge Operations Office, Oak Ridge, TN.

Brockman, C. S., 1986, "Glacial Geologic Mapping in Hamilton County, Ohio," Ohio Dept. of Natural Resources, Div. of Geological Survey, Columbus, OH.

Conner, J. R., 1990, Chemical Fixation and Stabilization of Hazardous Wastes, Van Nostrand Reinhold, New York, NY.

dePercin, P.E., E. Bates and D. Smith, 1991, "Designing Treatability Studies for CERCLA Sites: Three Critical Issues," Journal of the Air and Waste Management Assn., Vol. 41, No. 45.

Durrell, R. H., 1961, "The Pleistocene Geology of the Cincinnati Area," Field Trip 3 in Geological Soc. of America Guidebook for Field Trips, Cincinnati Meeting, Geological Soc. of America, New York, NY, pp. 47-57.

Fenneman, N. M., 1916, "The Geology of Cincinnati and Vicinity," Geological Survey of Ohio, Bulletin 19, Div. of Geological Survey, Columbus, OH.

Fleming, D. A. and K. N. Ross, 1984, "FMPC Environmental Monitoring Annual Report for 1983," NLCO-2018, National Lead Co. of Ohio, Cincinnati, OH, prepared for U.S. Dept. of Energy, Oak Ridge Operations Office, Oak Ridge, TN.

Ford, J. P., 1974, "Bedrock Geology of the Cincinnati West Quadrangle and part of the Covington Quadrangle, Hamilton County, Ohio," Report of Investigations No. 93, Ohio Dept. of Natural Resources, Div. of Geological Survey, Columbus, OH.

International Technology Corp., 1986, "Final Interim Report - Air, Soil, Water, and Health Risk Assessment in the Vicinity of the FMPC, Fernald, Ohio," report and data package prepared for the U.S. Dept. of Energy in support of the Fernald litigation, Oak Ridge Operations Office, Oak Ridge, TN.

Leow, J. A., 1985, "Top of Rock Map of Butler County, Ohio," Open File Map 224, Ohio Dept. of Natural Resources, Div. of Geological Survey, Columbus, OH.

Looney, S.W. and Gulledge, T.R., 1985, "Use of the Correlation Coefficient with Normal Probability Plots," American Statistician, Vol. 36(2), pp. 75-79.

Miami Conservancy District, 1985, "Hydrologic Data for the Hamilton-New Baltimore Area 1984," The Water Conservation Subdistrict of the Miami Conservancy District, Dayton, OH.

REFERENCES (continued)

Nuclear Regulatory Commission, 1991, "Technical Position on Waste Form (Rev. 1)," prepared by Low-Level Waste Management Branch, Division of Low-Level Waste Management and Decommissioning, for the NRC Office of Nuclear Material Safety and Safeguards, Washington, DC.

Oak Ridge Associated Universities, 1985, "Environmental Program Review of the Feed Materials Production Center, Fernald, Ohio," prepared for U.S. Dept. of Energy, Oak Ridge Operations Office, Oak Ridge, TN.

Swinford, M. (in preparation), "Bedrock Geology of Hamilton County, Ohio," Ohio Dept. of Natural Resources, Div. of Geological Survey, Columbus, OH.

Troxell, G. E., H. E. Davis and J. W. Kelley, 1968, Composition and Properties of Concrete, 2nd Ed., McGraw Hill Book Co., New York, NY.

U.S. Dept. of Agriculture, Soil Conservation Service, Ohio Dept. of Natural Resources, Division of Lands and Soil, and Ohio Agricultural Research and Development Center, 1980, "Soil Survey of Butler County, Ohio," USDA, ODNR, and Ohio Agricultural Research and Development Center, n.p.

U.S. Dept. of Agriculture, Soil Conservation Service, Ohio Dept. of Natural Resources, Division of Lands and Soil, and Ohio Agricultural Research and Development Center, 1982, "Soil Survey of Hamilton County, Ohio," USDA, ODNR and Ohio Agricultural Research and Development Center, n.p.

U.S. Dept. of Energy, 1985, "Report of Historic Uranium Releases from Current DOE Oak Ridge Operations Office Facilities," DOE, Oak Ridge Operations Office, Oak Ridge, TN.

U.S. Dept. of Energy, 1987, "Remedial Investigation and Feasibility Study, Feed Materials Production Center, Fernald, Ohio, Task 1 Report: Description of Current Situation," DOE, Oak Ridge Operations Office, Oak Ridge, TN.

U.S. Dept. of Energy, 1988, "FMPC Sampling and Analysis Report," Draft, Vols. 1 and 2, DOE, Oak Ridge Operations Office, Oak Ridge, TN.

U.S. Dept. of Energy, 1991, "Initial Screening of Alternatives for Operable Unit 2," Feed Materials Production Center, Fernald, Ohio, Remedial Investigation and Feasibility Study, DOE, Oak Ridge Operations Office, Oak Ridge, TN.

U.S. Dept. of Energy, 1992, "Risk Assessment Work Plan Addendum," Final Draft, DOE, Fernald Office, Cincinnati, OH.

U.S. Environmental Protection Agency, Oct. 1985, "Handbook, Remedial Action at Waste Disposal Sites (Revised)," EPA/625/6-85/006, EPA, Cincinnati, OH and Washington, DC.

U.S. Environmental Protection Agency, 1986, "Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Toxicity Characteristics Revision; Final Rule," 40CFR 261, Federal Register Vol. 55, No. 61, available from the U.S. Government Printing Office, Washington, DC.

REFERENCES (continued)

U.S. Environmental Protection Agency, 1988, "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA," EPA/540/G-89/004, EPA, Office of Emergency and Remedial Response, Washington, DC.

U.S. Environmental Protection Agency, 1989a, "Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part A, Interim Final," EPA/540/1-89/002, EPA, Office of Emergency and Remedial Response, Washington, DC.

U.S. Environmental Protection Agency, 1989b, "Environmental Protection Agency National Primary Drinking Water Regulations," 40CFR 141, as amended by 54FR27526, 27562, June 29, 1989 and 54FR30001, July 17, 1989, the Bureau of National Affairs, Inc., Washington, DC.

U.S. Environmental Protection Agency, 1989c, "Determining Soil Response Action Levels Based on Potential Contaminant Migration to Groundwater," EPA/540/2-89/057, EPA, Washington, DC.

U.S. Environmental Protection Agency, 1989d, "Guide for Conducting Treatability Studies under CERCLA," EPA/540/2-89-058, EPA, Office of Emergency and Remedial Response, Washington, DC.

U.S. Environmental Protection Agency, 1990a, "National Oil and Hazardous Substances Pollution Contingency Plan," Final Rule, Federal Register Vol. 55, No. 46, March 8, 1990, available from U.S. Government Printing Office, Washington, DC.

U.S. Environmental Protection Agency, 1990b, "Superfund Treatability Study Protocol: Solidification/Stabilization of Soils Containing Metals, Phase II," EPA/540/2-86/001, EPA, Washington, DC.

U.S. Environmental Protection Agency, 1991, "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part B, Development of Risk-Based Preliminary Remediation Goals," Interim, Publication 9285.7-01B, EPA, Office of Emergency and Remedial Response, Washington, DC.

Vormelker, J., 1985, "Top of Rock Map of Hamilton County, Ohio," Open File Map 229, Ohio Dept. of Natural Resources, Div. of Geological Survey, Columbus, OH.

Watkins, J. S. and A. M. Spieker, 1971, "Seismic Reduction Survey of Pleistocene Drainage Channels in the Lower Great Miami River Valley, Ohio," Professional Paper 605-B, U.S. Geological Survey, Columbus, OH.

Westinghouse Materials Company of Ohio, 1986, "Feed Materials Production Center Environmental Monitoring Annual Report for 1985," FMPC-2047, WMCO, Cincinnati, OH, prepared for U.S. Dept. of Energy, Oak Ridge Operations Office, Oak Ridge, TN.

Westinghouse Materials Company of Ohio, 1987, "Feed Materials Production Center Environmental Monitoring Annual Report for 1986," FMPC-2076, WMCO, Cincinnati, OH, prepared for U.S. Dept. of Energy, Oak Ridge Operations Office, Oak Ridge, TN.

REFERENCES (continued)

Westinghouse Materials Company of Ohio, 1988, "Feed Materials Production Center Environmental Monitoring Annual Report for 1987," FMPC-2135, WMCO, Cincinnati, OH, prepared for U.S. Dept. of Energy, Oak Ridge Operations Office, Oak Ridge, TN.

Westinghouse Materials Company of Ohio, 1989, "Feed Materials Production Center Environmental Monitoring Annual Report for 1988," FMPC-2173, WMCO, Cincinnati, OH, prepared for U.S. Dept. of Energy, Oak Ridge Operations Office, Oak Ridge, TN.

Weston, Inc., Roy F., 1986, "Department of Energy Feed Materials Production Center, Fernald, Ohio - Site Characterization of the Waste Storage Areas, Part 1: Evaluation of Current Situation," Weston, Inc., West Chester, PA, prepared for Westinghouse Materials Company of Ohio, Cincinnati, OH.

Weston, Inc., Roy F., 1987, "Characterization Investigation Study, Volume 2: Chemical and Radiological Analysis of the Waste Pits," U.S. Dept. of Energy Feed Mateials Production Center, Fernald, OH, prepared for Westinghouse Materials of Ohio, Cincinnati, OH.

Weston, Inc., Roy F., 1988, "Geotechnical Evaluation of Material Properties of Waste Pit Materials at the Feed Materials Production Center, Fernald, Ohio," prepared for Westinghouse Materials Co. of Ohio, Fernald, OH.

Wilkinson, L., 1988, SYSTAT: The System for Statistics, SYSTAT, Inc., Evanston, IL.

APPENDIX A

KSA

APPENDIX A

UNTREATED WASTE ANALYTICAL RESULTS

APPENDIX A - TABLE OF CONTENTS

Table A-1	TCLP Radiological Characterization Data
Table A-2	Inorganic Characterization Data (R&SC)
Table A-3	Radiological Characterization Data
Table A-4	Volatile Organic Characterization Data
Table A-5	Semivolatile Organic Characterization Data
Table A-6	Pesticide/PCB Characterization Data
Table A-7	Chemistry Characterization Data
Table A-8	Validation Qualifier Codes Used with Characterization Data
Table A-9	Summary Statistical Analysis-Solid Waste Landfill-Chemical Constituents-Characterization Data
Table A-10	Summary Statistical Analysis-Lime Sludge Ponds-Chemical Constituents-Characterization Data
Table A-11	Summary Statistical Analysis-South Field-Chemical Constituents-Characterization Data
Table A-12	Summary Statistical Analysis-Solid Waste Landfill-Radiological Constituents-Characterization Data
Table A-13	Summary Statistical Analysis-Lime Sludge Pond-Radiological Constituents-Characterization Data
Table A-14	Summary Statistical Analysis-South Field-Radiological Constituents-Characterization Data

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualfiers Lab	Q3	Q4	Q5
067245	Solid Waste Landfill		7440382	Arsenic	150	µg/L	U	–	–	–
067245	Solid Waste Landfill		7440393	Barium	913	µg/L		–	–	–
067245	Solid Waste Landfill		7440439	Cadmium	6	µg/L	U	–	–	–
067245	Solid Waste Landfill		7440473	Chromium	81	µg/L		–	–	–
067245	Solid Waste Landfill		7439921	Lead	40	µg/L	U	–	–	–
067245	Solid Waste Landfill		7439976	Mercury	0.2	µg/L	U	–	–	–
067245	Solid Waste Landfill		7782492	Selenium	80	µg/L	U	–	–	–
067245	Solid Waste Landfill		7440224	Silver	76.8	µg/L		–	–	–
067247	Solid Waste Landfill		7440382	Arsenic	150	µg/L	U	–	–	–
067247	Solid Waste Landfill		7440393	Barium	867	µg/L		–	–	–
067247	Solid Waste Landfill		7440439	Cadmium	6.3	µg/L	B	–	–	–
067247	Solid Waste Landfill		7440473	Chromium	79.9	µg/L		–	–	–
067247	Solid Waste Landfill		7439921	Lead	40	µg/L	U	–	–	–
067247	Solid Waste Landfill		7439976	Mercury	0.2	µg/L	U	–	–	–
067247	Solid Waste Landfill		7782492	Selenium	80	µg/L	U	–	–	–
067247	Solid Waste Landfill		7440224	Silver	75.3	µg/L		–	–	–
067261	Solid Waste Landfill		7440382	Arsenic	150	µg/L	U	JB	–	–
067261	Solid Waste Landfill		7440393	Barium	1140	µg/L		JB	–	–
067261	Solid Waste Landfill		7440439	Cadmium	13.5	µg/L	BN	R	–	–
067261	Solid Waste Landfill		7440473	Chromium	731	µg/L	N	R	–	–
067261	Solid Waste Landfill		7439921	Lead	427	µg/L	N	R	–	–
067261	Solid Waste Landfill		7439976	Mercury	0.2	µg/L	U	JB	–	–
067261	Solid Waste Landfill		7782492	Selenium	377	µg/L		JB	–	–
067261	Solid Waste Landfill		7440224	Silver	364	µg/L		R	–	–
067264	Solid Waste Landfill		7429905	Aluminum	801	µg/L		J	–	–
067264	Solid Waste Landfill		7440382	Arsenic	150	µg/L	U	JB	–	–
067264	Solid Waste Landfill		7440393	Barium	1260	µg/L		JB	–	–
067264	Solid Waste Landfill		7440439	Cadmium	6	µg/L	UN	R	–	–
067264	Solid Waste Landfill		7440473	Chromium	149	µg/L	N	R	–	–
067264	Solid Waste Landfill		7439921	Lead	41.3	µg/L	N	R	–	–
067264	Solid Waste Landfill		7439976	Mercury	0.2	µg/L	U	–	–	–
067264	Solid Waste Landfill		7782492	Selenium	110	µg/L		JB	–	–
067264	Solid Waste Landfill		7440224	Silver	104	µg/L		R	–	–
067301	Solid Waste Landfill		7440382	Arsenic	100	µg/L	U	J	–	–
067301	Solid Waste Landfill		7440393	Barium	974	µg/L		–	–	–
067301	Solid Waste Landfill		7440439	Cadmium	6.4	µg/L	B	–	–	–
067301	Solid Waste Landfill		7440473	Chromium	82.1	µg/L		–	–	–
067301	Solid Waste Landfill		7439921	Lead	69.5	µg/L		R	–	–
067301	Solid Waste Landfill		7439976	Mercury	0.2	µg/L	U	–	–	–
067301	Solid Waste Landfill		7782492	Selenium	149	µg/L		J	–	–
067301	Solid Waste Landfill		7440224	Silver	72.6	µg/L		–	–	–
067303	Solid Waste Landfill		7440382	Arsenic	100	µg/L	U	J	–	–
067303	Solid Waste Landfill		7440393	Barium	1080	µg/L		–	–	–
067303	Solid Waste Landfill		7440439	Cadmium	5.3	µg/L	B	–	–	–
067303	Solid Waste Landfill		7440473	Chromium	87.7	µg/L		–	–	–
067303	Solid Waste Landfill		7439921	Lead	66.8	µg/L		R	–	–
067303	Solid Waste Landfill		7439976	Mercury	0.2	µg/L	U	–	–	–
067303	Solid Waste Landfill		7782492	Selenium	128	µg/L		J	–	–
067303	Solid Waste Landfill		7440224	Silver	74.5	µg/L		–	–	–
067318	Solid Waste Landfill		7440382	Arsenic	250	µg/L	U	–	–	–
067318	Solid Waste Landfill		7440393	Barium	1070	µg/L		–	–	–
067318	Solid Waste Landfill		7440439	Cadmium	10.6	µg/L	B	–	–	–
067318	Solid Waste Landfill		7440473	Chromium	92.9	µg/L		–	–	–
067318	Solid Waste Landfill		7439921	Lead	89.5	µg/L		–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualfiers Lab	Q3	Q4	Q5
067318	Solid Waste Landfill		7439976	Mercury	0.2	µg/L	U	–	–	–
067318	Solid Waste Landfill		7782492	Selenium	137	µg/L		–	–	–
067318	Solid Waste Landfill		7440224	Silver	81.4	µg/L		–	–	–
067319	Solid Waste Landfill		7440382	Arsenic	250	µg/L	U	–	–	–
067319	Solid Waste Landfill		7440393	Barium	1140	µg/L		–	–	–
067319	Solid Waste Landfill		7440439	Cadmium	10	µg/L	U	–	–	–
067319	Solid Waste Landfill		7440473	Chromium	83.9	µg/L		–	–	–
067319	Solid Waste Landfill		7439921	Lead	77.8	µg/L		–	–	–
067319	Solid Waste Landfill		7439976	Mercury	0.2	µg/L	U	–	–	–
067319	Solid Waste Landfill		7782492	Selenium	143	µg/L		–	–	–
067319	Solid Waste Landfill		7440224	Silver	73.4	µg/L		–	–	–
067397	Solid Waste Landfill	–9D	7429905	Aluminum	942	µg/L		R	–	–
067397	Solid Waste Landfill	–6D	7429905	Aluminum	552.8	µg/L		R	–	–
067397	Solid Waste Landfill	–9	7429905	Aluminum	1090	µg/L		–	–	–
067397	Solid Waste Landfill	–6	7429905	Aluminum	631	µg/L		–	–	–
067397	Solid Waste Landfill	–9D	7440360	Antimony	30	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9	7440360	Antimony	30	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6	7440360	Antimony	30	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6D	7440360	Antimony	30	µg/L	U	R	–	–
067397	Solid Waste Landfill	–6	7440382	Arsenic	50	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9	7440382	Arsenic	2	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6D	7440382	Arsenic	50	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9D	7440382	Arsenic	2	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9D	7440393	Barium	76.34	µg/L	B	R	–	–
067397	Solid Waste Landfill	–9	7440393	Barium	84.5	µg/L	B	–	–	–
067397	Solid Waste Landfill	–6D	7440393	Barium	62.5	µg/L	B	R	–	–
067397	Solid Waste Landfill	–6	7440393	Barium	63.7	µg/L	B	–	–	–
067397	Solid Waste Landfill	–9	7440417	Beryllium	2	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6	7440417	Beryllium	2	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6D	7440417	Beryllium	2	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9D	7440417	Beryllium	2	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9D	7440439	Cadmium	2	µg/L	U	R	–	–
067397	Solid Waste Landfill	–6D	7440439	Cadmium	2	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9	7440439	Cadmium	2	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6	7440439	Cadmium	2	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6	7440702	Calcium	19000	µg/L		–	–	–
067397	Solid Waste Landfill	–9D	7440702	Calcium	18400	µg/L		R	–	–
067397	Solid Waste Landfill	–9	7440702	Calcium	20100	µg/L		–	–	–
067397	Solid Waste Landfill	–6D	7440702	Calcium	18504	µg/L		R	–	–
067397	Solid Waste Landfill	–9D	7440473	Chromium	11.33	µg/L		R	–	–
067397	Solid Waste Landfill	–6	7440473	Chromium	10	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9	7440473	Chromium	10	µg/L	U*	–	–	–
067397	Solid Waste Landfill	–6D	7440473	Chromium	10	µg/L	U	R	–	–
067397	Solid Waste Landfill	–6D	7440484	Cobalt	10	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9	7440484	Cobalt	10	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9D	7440484	Cobalt	10	µg/L	U	R	–	–
067397	Solid Waste Landfill	–6	7440484	Cobalt	10	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6	7440508	Copper	10	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9D	7440508	Copper	15.51	µg/L	B	R	–	–
067397	Solid Waste Landfill	–6D	7440508	Copper	10	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9	7440508	Copper	12.8	µg/L	B	–	–	–
067397	Solid Waste Landfill	–9	7439896	Iron	1020	µg/L		–	–	–
067397	Solid Waste Landfill	–6	7439896	Iron	472	µg/L		–	–	–
067397	Solid Waste Landfill	–9D	7439896	Iron	937	µg/L		R	–	–

Table A–2. Fernald Environmental Management Project Inorganic Characterization TCLP Data

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualfiers			
							Lab	Q3	Q4	Q5
067397	Solid Waste Landfill	–6D	7439896	Iron	463.5	µg/L		R	–	–
067397	Solid Waste Landfill	–9	7439921	Lead	2.9	µg/L	B	–	–	–
067397	Solid Waste Landfill	–6	7439921	Lead	40	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9D	7439921	Lead	2.96	µg/L	B	R	–	–
067397	Solid Waste Landfill	–6D	7439921	Lead	40	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9D	7439954	Magnesium	4343	µg/L	B	R	–	–
067397	Solid Waste Landfill	–6D	7439954	Magnesium	4322	µg/L	B	R	–	–
067397	Solid Waste Landfill	–6	7439954	Magnesium	4460	µg/L	B	–	–	–
067397	Solid Waste Landfill	–9	7439954	Magnesium	4760	µg/L	B	–	–	–
067397	Solid Waste Landfill	–6D	7439965	Manganese	3.504	µg/L	B	R	–	–
067397	Solid Waste Landfill	–9D	7439965	Manganese	8.933	µg/L	B	R	–	–
067397	Solid Waste Landfill	–9	7439965	Manganese	9.6	µg/L	B	–	–	–
067397	Solid Waste Landfill	–6	7439965	Manganese	3.5	µg/L	B	–	–	–
067397	Solid Waste Landfill	–9	7439976	Mercury	0.2	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9D	7439976	Mercury	0.2	µg/L	U	R	–	–
067397	Solid Waste Landfill	–6D	7439987	Molybdenum	10	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9D	7439987	Molybdenum	10	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9	7439987	Molybdenum	10	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6	7439987	Molybdenum	10	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6	7440020	Nickel	20	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9D	7440020	Nickel	20	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9	7440020	Nickel	20	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6D	7440020	Nickel	20	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9	7440097	Potassium	272	µg/L	B	–	–	–
067397	Solid Waste Landfill	–9D	7440097	Potassium	205	µg/L	B	R	–	–
067397	Solid Waste Landfill	–6D	7782492	Selenium	80	µg/L	U	R	–	–
067397	Solid Waste Landfill	–6	7782492	Selenium	80	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9D	7782492	Selenium	2	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9	7782492	Selenium	2	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9	7440213	Silicon	3680	µg/L	N	–	–	–
067397	Solid Waste Landfill	–6	7440213	Silicon	2980	µg/L	N	–	–	–
067397	Solid Waste Landfill	–6D	7440213	Silicon	2937	µg/L		–	–	–
067397	Solid Waste Landfill	–9D	7440213	Silicon	3197	µg/L		R	–	–
067397	Solid Waste Landfill	–6D	7440224	Silver	10	µg/L	U	R	–	–
067397	Solid Waste Landfill	–6	7440224	Silver	10	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9	7440224	Silver	10	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9D	7440224	Silver	10	µg/L	U	R	–	–
067397	Solid Waste Landfill	–6	7440235	Sodium	971	µg/L	B	–	–	–
067397	Solid Waste Landfill	–9	7440235	Sodium	1650	µg/L	B	–	–	–
067397	Solid Waste Landfill	–6D	7440235	Sodium	915.7	µg/L	B	R	–	–
067397	Solid Waste Landfill	–9D	7440235	Sodium	1499	µg/L	B	R	–	–
067397	Solid Waste Landfill	–6D	7440280	Thallium	150	µg/L	U	R	–	–
067397	Solid Waste Landfill	–6	7440280	Thallium	150	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9	7440280	Thallium	2	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9D	7440280	Thallium	2	µg/L	U	R	–	–
067397	Solid Waste Landfill	–9	7440622	Vanadium	10	µg/L	U	–	–	–
067397	Solid Waste Landfill	–6D	7440622	Vanadium	10	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9D	7440622	Vanadium	10	µg/L	U	R	–	–
067397	Solid Waste Landfill	–6	7440622	Vanadium	10	µg/L	U	–	–	–
067397	Solid Waste Landfill	–9	7440666	Zinc	78.1	µg/L		R	–	–
067397	Solid Waste Landfill	–6	7440666	Zinc	68.1	µg/L		–	–	–
067397	Solid Waste Landfill	–9D	7440666	Zinc	78.93	µg/L		R	–	–
067397	Solid Waste Landfill	–6D	7440666	Zinc	70.69	µg/L		–	–	–
067402	Solid Waste Landfill	–9	7429905	Aluminum	1260	µg/L		–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualfiers Lab	Q3	Q4	Q5
067402	Solid Waste Landfill	–6	7429905	Aluminum	967	µg/L		–	–	–
067402	Solid Waste Landfill	–9	7440360	Antimony	30	µg/L	U	–	–	–
067402	Solid Waste Landfill	–6	7440360	Antimony	30	µg/L	U	–	–	–
067402	Solid Waste Landfill	–6	7440382	Arsenic	50	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440382	Arsenic	2.1	µg/L	B	–	–	–
067402	Solid Waste Landfill	–6	7440393	Barium	161	µg/L	B	–	–	–
067402	Solid Waste Landfill	–9	7440393	Barium	311	µg/L		–	–	–
067402	Solid Waste Landfill	–6	7440417	Beryllium	2	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440417	Beryllium	2	µg/L	U	–	–	–
067402	Solid Waste Landfill	–6	7440439	Cadmium	2	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440439	Cadmium	2	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440702	Calcium	19600	µg/L		–	–	–
067402	Solid Waste Landfill	–6	7440702	Calcium	17300	µg/L		–	–	–
067402	Solid Waste Landfill	–6	7440473	Chromium	10	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440473	Chromium	10	µg/L	U*	–	–	–
067402	Solid Waste Landfill	–9	7440484	Cobalt	10	µg/L	U	–	–	–
067402	Solid Waste Landfill	–6	7440484	Cobalt	10	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440508	Copper	10	µg/L	U	–	–	–
067402	Solid Waste Landfill	–6	7440508	Copper	10	µg/L	U	–	–	–
067402	Solid Waste Landfill	–6	7439896	Iron	824	µg/L		–	–	–
067402	Solid Waste Landfill	–9	7439896	Iron	906	µg/L		–	–	–
067402	Solid Waste Landfill	–6	7439921	Lead	40	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7439921	Lead	2.3	µg/L	B	–	–	–
067402	Solid Waste Landfill	–6	7439954	Magnesium	4170	µg/L	B	–	–	–
067402	Solid Waste Landfill	–9	7439954	Magnesium	4590	µg/L	B	–	–	–
067402	Solid Waste Landfill	–9	7439965	Manganese	8.2	µg/L	B	–	–	–
067402	Solid Waste Landfill	–6	7439965	Manganese	7.8	µg/L	B	–	–	–
067402	Solid Waste Landfill	–9	7439976	Mercury	0.2	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7439987	Molybdenum	10	µg/L	U	–	–	–
067402	Solid Waste Landfill	–6	7439987	Molybdenum	10	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440020	Nickel	20	µg/L	U	–	–	–
067402	Solid Waste Landfill	–6	7440020	Nickel	20	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440097	Potassium	489	µg/L	B	–	–	–
067402	Solid Waste Landfill	–6	7782492	Selenium	80	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7782492	Selenium	2	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440213	Silicon	4340	µg/L	N	–	–	–
067402	Solid Waste Landfill	–6	7440213	Silicon	3460	µg/L	N	–	–	–
067402	Solid Waste Landfill	–9	7440224	Silver	10	µg/L	U	–	–	–
067402	Solid Waste Landfill	–6	7440224	Silver	10	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440235	Sodium	2280	µg/L	B	–	–	–
067402	Solid Waste Landfill	–6	7440235	Sodium	1280	µg/L	B	–	–	–
067402	Solid Waste Landfill	–6	7440280	Thallium	150	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440280	Thallium	2	µg/L	U	–	–	–
067402	Solid Waste Landfill	–6	7440622	Vanadium	10	µg/L	U	–	–	–
067402	Solid Waste Landfill	–9	7440622	Vanadium	10	µg/L	U	–	–	–
067402	Solid Waste Landfill	–6	7440666	Zinc	176	µg/L		–	–	–
067402	Solid Waste Landfill	–9	7440666	Zinc	263	µg/L		–	–	–
067003	Lime Sludge Pond		7440382	Arsenic	380	µg/L		–	–	–
067003	Lime Sludge Pond		7440393	Barium	639	µg/L		–	–	–
067003	Lime Sludge Pond		7440439	Cadmium	34.6	µg/L		–	–	–
067003	Lime Sludge Pond		7440473	Chromium	91.8	µg/L		–	–	–
067003	Lime Sludge Pond		7439921	Lead	204	µg/L		–	–	–
067003	Lime Sludge Pond		7439976	Mercury	0.2	µg/L	U	–	–	–
067003	Lime Sludge Pond		7782492	Selenium	400	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualfiers			
							Lab	Q3	Q4	Q5
067003	Lime Sludge Pond		7440224	Silver	145	µg/L		–	–	–
067007	Lime Sludge Pond		7440382	Arsenic	499	µg/L		–	–	–
067007	Lime Sludge Pond		7440393	Barium	513	µg/L		–	–	–
067007	Lime Sludge Pond		7440439	Cadmium	43.8	µg/L		–	–	–
067007	Lime Sludge Pond		7440473	Chromium	111	µg/L		–	–	–
067007	Lime Sludge Pond		7439921	Lead	276	µg/L		–	–	–
067007	Lime Sludge Pond		7439976	Mercury	0.2	µg/L	U	–	–	–
067007	Lime Sludge Pond		7782492	Selenium	475	µg/L		–	–	–
067007	Lime Sludge Pond		7440224	Silver	154	µg/L		–	–	–
067150	Active Flyash		7440382	Arsenic	50	µg/L	U	–	–	–
067150	Active Flyash		7440393	Barium	320	µg/L		–	–	–
067150	Active Flyash		7440439	Cadmium	7.5	µg/L		–	–	–
067150	Active Flyash		7440473	Chromium	44.8	µg/L		–	–	–
067150	Active Flyash		7439921	Lead	40	µg/L	U	–	–	–
067150	Active Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067150	Active Flyash		7782492	Selenium	83.2	µg/L		–	–	–
067150	Active Flyash		7440224	Silver	40.8	µg/L		–	–	–
067157	Active Flyash		7440382	Arsenic	70.4	µg/L		–	–	–
067157	Active Flyash		7440393	Barium	547	µg/L		–	–	–
067157	Active Flyash		7440439	Cadmium	12.4	µg/L		–	–	–
067157	Active Flyash		7440473	Chromium	54.2	µg/L		–	–	–
067157	Active Flyash		7439921	Lead	74.5	µg/L		–	–	–
067157	Active Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067157	Active Flyash		7782492	Selenium	111	µg/L		–	–	–
067157	Active Flyash		7440224	Silver	48.9	µg/L		–	–	–
067162	Active Flyash		7440382	Arsenic	119	µg/L		–	–	–
067162	Active Flyash		7440393	Barium	393	µg/L		–	–	–
067162	Active Flyash		7440439	Cadmium	4.5	µg/L	B	–	–	–
067162	Active Flyash		7440473	Chromium	29.1	µg/L		–	–	–
067162	Active Flyash		7439921	Lead	40	µg/L	U	–	–	–
067162	Active Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067162	Active Flyash		7782492	Selenium	115	µg/L		–	–	–
067162	Active Flyash		7440224	Silver	26.9	µg/L		–	–	–
067170	Active Flyash		7440382	Arsenic	250	µg/L	U	–	–	–
067170	Active Flyash		7440393	Barium	674	µg/L		–	–	–
067170	Active Flyash		7440439	Cadmium	26.2	µg/L		–	–	–
067170	Active Flyash		7440473	Chromium	218	µg/L		–	–	–
067170	Active Flyash		7439921	Lead	200	µg/L	U	–	–	–
067170	Active Flyash		7782492	Selenium	400	µg/L	U	–	–	–
067170	Active Flyash		7440224	Silver	205	µg/L		J	–	–
067186	Active Flyash		7440382	Arsenic	250	µg/L	U	JB	–	–
067186	Active Flyash		7440393	Barium	539	µg/L		–	–	–
067186	Active Flyash		7440439	Cadmium	10	µg/L	U	–	–	–
067186	Active Flyash		7440473	Chromium	189	µg/L		–	–	–
067186	Active Flyash		7439921	Lead	200	µg/L	U	–	–	–
067186	Active Flyash		7782492	Selenium	400	µg/L	U	JB	–	–
067186	Active Flyash		7440224	Silver	181	µg/L		–	–	–
067189	Active Flyash		7440382	Arsenic	92.6	µg/L		–	–	–
067189	Active Flyash		7440393	Barium	432	µg/L		–	–	–
067189	Active Flyash		7440439	Cadmium	7.6	µg/L		J	–	–
067189	Active Flyash		7440473	Chromium	31.1	µg/L	N	–	–	–
067189	Active Flyash		7439921	Lead	40	µg/L	U	–	–	–
067189	Active Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067189	Active Flyash		7782492	Selenium	82.6	µg/L		–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualfiers Lab	Q3	Q4	Q5
067189	Active Flyash		7440224	Silver	29.3	µg/L		–	–	–
067197	Active Flyash		7440382	Arsenic	85.7	µg/L		JB	–	–
067197	Active Flyash		7440393	Barium	329	µg/L		–	–	–
067197	Active Flyash		7440439	Cadmium	6.5	µg/L		–	–	–
067197	Active Flyash		7440473	Chromium	40.1	µg/L		–	–	–
067197	Active Flyash		7439921	Lead	60.4	µg/L		–	–	–
067197	Active Flyash		7782492	Selenium	110	µg/L		JB	–	–
067197	Active Flyash		7440224	Silver	33.7	µg/L		–	–	–
067224	Active Flyash		7440382	Arsenic	79	µg/L		R	–	–
067224	Active Flyash		7440393	Barium	391	µg/L		R	–	–
067224	Active Flyash		7440439	Cadmium	14.6	µg/L		R	–	–
067224	Active Flyash		7440473	Chromium	49.2	µg/L		–	–	–
067224	Active Flyash		7439921	Lead	99.1	µg/L		R	–	–
067224	Active Flyash		7439976	Mercury	0.2	µg/L	U	R	–	–
067224	Active Flyash		7782492	Selenium	145	µg/L		R	–	–
067224	Active Flyash		7440224	Silver	47.6	µg/L		R	–	–
067225	Active Flyash		7440382	Arsenic	74.9	µg/L		R	–	–
067225	Active Flyash		7440393	Barium	331	µg/L		R	–	–
067225	Active Flyash		7440439	Cadmium	3.3	µg/L	B	R	–	–
067225	Active Flyash		7440473	Chromium	30.7	µg/L		–	–	–
067225	Active Flyash		7439921	Lead	40	µg/L	U	R	–	–
067225	Active Flyash		7439976	Mercury	0.2	µg/L	U	R	–	–
067225	Active Flyash		7782492	Selenium	80	µg/L	U	R	–	–
067225	Active Flyash		7440224	Silver	27.3	µg/L		R	–	–
067507	Active Flyash		7440382	Arsenic	50	µg/L	U	–	–	–
067507	Active Flyash		7440382	Arsenic	50	µg/L	U	–	–	–
067507	Active Flyash		7440393	Barium	207	µg/L		–	–	–
067507	Active Flyash		7440393	Barium	777	µg/L		–	–	–
067507	Active Flyash		7440439	Cadmium	9.4	µg/L		–	–	–
067507	Active Flyash		7440439	Cadmium	2.8	µg/L	B	–	–	–
067507	Active Flyash		7440473	Chromium	17.3	µg/L		–	–	–
067507	Active Flyash		7440473	Chromium	38.7	µg/L		–	–	–
067507	Active Flyash		7439921	Lead	40	µg/L	U	–	–	–
067507	Active Flyash		7439921	Lead	40	µg/L	U	–	–	–
067507	Active Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067507	Active Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067507	Active Flyash		7782492	Selenium	80	µg/L	U	–	–	–
067507	Active Flyash		7782492	Selenium	80	µg/L	U	–	–	–
067507	Active Flyash		7440224	Silver	15.9	µg/L		–	–	–
067507	Active Flyash		7440224	Silver	35.1	µg/L		–	–	–
067016	Inactive Flyash		7440382	Arsenic	0.05	µg/L	U	–	–	–
067016	Inactive Flyash		7440393	Barium	0.592	µg/L		JB	–	–
067016	Inactive Flyash		7440439	Cadmium	0.002	µg/L	U	–	–	–
067016	Inactive Flyash		7440473	Chromium	0.01	µg/L	U	–	–	–
067016	Inactive Flyash		7439921	Lead	0.041	µg/L		JB	–	–
067016	Inactive Flyash		7439976	Mercury	0.000	µg/L	U	–	–	–
067016	Inactive Flyash		7782492	Selenium	0.08	µg/L		–	–	–
067016	Inactive Flyash		7440224	Silver	0.01	µg/L	U	–	–	–
067021	Inactive Flyash		7440382	Arsenic	0.448	µg/L		JB	–	–
067021	Inactive Flyash		7440393	Barium	0.286	µg/L		JB	–	–
067021	Inactive Flyash		7440439	Cadmium	0.002	µg/L	U	–	–	–
067021	Inactive Flyash		7440473	Chromium	0.01	µg/L	U	–	–	–
067021	Inactive Flyash		7439921	Lead	0.049	µg/L		JB	–	–
067021	Inactive Flyash		7439976	Mercury	0.001	µg/L		–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualfiers Lab	Q3	Q4	Q5
067021	Inactive Flyash		7782492	Selenium	0.105	µg/L		JB	–	–
067021	Inactive Flyash		7440224	Silver	0.01	µg/L	U	–	–	–
067025	Inactive Flyash		7440382	Arsenic	0.09	µg/L		JB	–	–
067025	Inactive Flyash		7440393	Barium	0.647	µg/L		JB	–	–
067025	Inactive Flyash		7440439	Cadmium	0.002	µg/L	U	–	–	–
067025	Inactive Flyash		7440473	Chromium	0.016	µg/L		JB	–	–
067025	Inactive Flyash		7439921	Lead	0.04	µg/L	U	–	–	–
067025	Inactive Flyash		7439976	Mercury	0.000	µg/L	U	–	–	–
067025	Inactive Flyash		7782492	Selenium	0.111	µg/L		JB	–	–
067025	Inactive Flyash		7440224	Silver	0.016	µg/L		JB	–	–
067038	Inactive Flyash		7440382	Arsenic	104	µg/L		JB	–	–
067038	Inactive Flyash		7440393	Barium	1858	µg/L		JB	–	–
067038	Inactive Flyash		7440439	Cadmium	2.37	µg/L		JB	–	–
067038	Inactive Flyash		7440473	Chromium	10	µg/L	U	–	–	–
067038	Inactive Flyash		7439921	Lead	40	µg/L	U	–	–	–
067038	Inactive Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067038	Inactive Flyash		7782492	Selenium	132	µg/L		JB	–	–
067038	Inactive Flyash		7440224	Silver	10	µg/L	U	–	–	–
067051	Inactive Flyash		7440382	Arsenic	144	µg/L		JB	–	–
067051	Inactive Flyash		7440393	Barium	1444	µg/L		JB	–	–
067051	Inactive Flyash		7440439	Cadmium	4.34	µg/L		JB	–	–
067051	Inactive Flyash		7440473	Chromium	20	µg/L	U	–	–	–
067051	Inactive Flyash		7439921	Lead	80	µg/L	U	–	–	–
067051	Inactive Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067051	Inactive Flyash		7782492	Selenium	160	µg/L	U	–	–	–
067051	Inactive Flyash		7440224	Silver	37.9	µg/L		JB	–	–
067058	Inactive Flyash		7440382	Arsenic	126	µg/L		JB	–	–
067058	Inactive Flyash		7440393	Barium	809	µg/L		JB	–	–
067058	Inactive Flyash		7440439	Cadmium	4.35	µg/L		JB	–	–
067058	Inactive Flyash		7440473	Chromium	39.9	µg/L		JB	–	–
067058	Inactive Flyash		7439921	Lead	46.1	µg/L		JB	–	–
067058	Inactive Flyash		7439976	Mercury	0.2	µg/L	U	JB	–	–
067058	Inactive Flyash		7782492	Selenium	133	µg/L		–	–	–
067058	Inactive Flyash		7440224	Silver	33.2	µg/L		–	–	–
067065	Inactive Flyash		7440382	Arsenic	80.6	µg/L		–	–	–
067065	Inactive Flyash		7440393	Barium	1609	µg/L		–	–	–
067065	Inactive Flyash		7440439	Cadmium	2	µg/L	U	–	–	–
067065	Inactive Flyash		7440473	Chromium	10	µg/L	U	–	–	–
067065	Inactive Flyash		7439921	Lead	40	µg/L	U	–	–	–
067065	Inactive Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067065	Inactive Flyash		7782492	Selenium	90.3	µg/L		–	–	–
067065	Inactive Flyash		7440224	Silver	10	µg/L	U	–	–	–
067099	Inactive Flyash		7440382	Arsenic	75.1	µg/L		J	–	–
067099	Inactive Flyash		7440393	Barium	1907	µg/L		–	–	–
067099	Inactive Flyash		7440439	Cadmium	11.5	µg/L		J	–	–
067099	Inactive Flyash		7440473	Chromium	68.7	µg/L		–	–	–
067099	Inactive Flyash		7439921	Lead	98.7	µg/L		–	–	–
067099	Inactive Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067099	Inactive Flyash		7782492	Selenium	182	µg/L		–	–	–
067099	Inactive Flyash		7440224	Silver	52.7	µg/L		–	–	–
067114	Inactive Flyash		7440382	Arsenic	65.4	µg/L		–	–	–
067114	Inactive Flyash		7440393	Barium	1061	µg/L		J	–	–
067114	Inactive Flyash		7440439	Cadmium	5.38	µg/L		J	–	–
067114	Inactive Flyash		7440473	Chromium	37.8	µg/L		–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualfiers Lab	Q3	Q4	Q5
067114	Inactive Flyash		7439921	Lead	49.8	µg/L		–	–	–
067114	Inactive Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067114	Inactive Flyash		7782492	Selenium	99.1	µg/L		–	–	–
067114	Inactive Flyash		7440224	Silver	29.7	µg/L		–	–	–
067115	Inactive Flyash		7440382	Arsenic	99.4	µg/L		–	–	–
067115	Inactive Flyash		7440393	Barium	1279	µg/L		J	–	–
067115	Inactive Flyash		7440439	Cadmium	7.05	µg/L		J	–	–
067115	Inactive Flyash		7440473	Chromium	87.9	µg/L		–	–	–
067115	Inactive Flyash		7439921	Lead	82.6	µg/L		–	–	–
067115	Inactive Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067115	Inactive Flyash		7782492	Selenium	187	µg/L		–	–	–
067115	Inactive Flyash		7440224	Silver	75	µg/L		–	–	–
067124	Inactive Flyash		7440382	Arsenic	250	µg/L	U	–	–	–
067124	Inactive Flyash		7440393	Barium	2152	µg/L		–	–	–
067124	Inactive Flyash		7440439	Cadmium	17.4	µg/L		J	–	–
067124	Inactive Flyash		7440473	Chromium	80.7	µg/L		–	–	–
067124	Inactive Flyash		7439921	Lead	100	µg/L		–	–	–
067124	Inactive Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067124	Inactive Flyash		7782492	Selenium	236	µg/L		–	–	–
067124	Inactive Flyash		7440224	Silver	73.2	µg/L		J	–	–
067128	Inactive Flyash		7440382	Arsenic	83.8	µg/L		–	–	–
067128	Inactive Flyash		7440393	Barium	351	µg/L		–	–	–
067128	Inactive Flyash		7440439	Cadmium	4.5	µg/L		–	–	–
067128	Inactive Flyash		7440473	Chromium	25.9	µg/L		–	–	–
067128	Inactive Flyash		7439921	Lead	40	µg/L	U	–	–	–
067128	Inactive Flyash		7439976	Mercury	0.2	µg/L	U	–	–	–
067128	Inactive Flyash		7782492	Selenium	80	µg/L	U	–	–	–
067128	Inactive Flyash		7440224	Silver	20.7	µg/L		J	–	–
061319	South Field		7440382	Arsenic	0.325	µg/L		–	–	–
061319	South Field		7440393	Barium	1.19	µg/L		–	–	–
061319	South Field		7440439	Cadmium	0.014	µg/L		–	–	–
061319	South Field		7440473	Chromium	0.077	µg/L		–	–	–
061319	South Field		7439921	Lead	0.2	µg/L	U	–	–	–
061319	South Field		7439976	Mercury	0.000	µg/L	U	–	–	–
061319	South Field		7782492	Selenium	0.4	µg/L	U	–	–	–
061319	South Field		7440224	Silver	0.142	µg/L		–	–	–
061324	South Field		7440382	Arsenic	0.277	µg/L		–	–	–
061324	South Field		7440393	Barium	0.56	µg/L		–	–	–
061324	South Field		7440439	Cadmium	0.02	µg/L		–	–	–
061324	South Field		7440473	Chromium	0.097	µg/L		–	–	–
061324	South Field		7439921	Lead	0.2	µg/L	U	–	–	–
061324	South Field		7439976	Mercury	0.000	µg/L	U	–	–	–
061324	South Field		7782492	Selenium	0.4	µg/L	U	–	–	–
061324	South Field		7440224	Silver	0.138	µg/L		–	–	–
061329	South Field		7440382	Arsenic	0.25	µg/L	U	–	–	–
061329	South Field		7440393	Barium	1.04	µg/L		–	–	–
061329	South Field		7440439	Cadmium	0.013	µg/L		–	–	–
061329	South Field		7440473	Chromium	0.089	µg/L		–	–	–
061329	South Field		7439921	Lead	0.2	µg/L	U	–	–	–
061329	South Field		7439976	Mercury	0.000	µg/L	U	–	–	–
061329	South Field		7782492	Selenium	0.4	µg/L	U	–	–	–
061329	South Field		7440224	Silver	0.128	µg/L		–	–	–
061334	South Field		7440382	Arsenic	0.12	µg/L		–	–	–
061334	South Field		7440393	Barium	0.512	µg/L		–	–	–

Table A–2. Fernald Environmental Management Project Inorganic Characterization TCLP Data

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualfiers			
							Lab	Q3	Q4	Q5
061334	South Field		7440439	Cadmium	0.002	µg/L		–	–	–
061334	South Field		7440473	Chromium	0.021	µg/L		–	–	–
061334	South Field		7439921	Lead	0.04	µg/L	U	–	–	–
061334	South Field		7439976	Mercury	0.000	µg/L	U	–	–	–
061334	South Field		7782492	Selenium	0.109	µg/L		–	–	–
061334	South Field		7440224	Silver	0.024	µg/L		–	–	–
067326	South Field		7440382	Arsenic	100	µg/L	U	–	–	–
067326	South Field		7440393	Barium	616	µg/L		–	–	–
067326	South Field		7440439	Cadmium	7	µg/L	B	–	–	–
067326	South Field		7440473	Chromium	75.1	µg/L		–	–	–
067326	South Field		7439921	Lead	81.1	µg/L		–	–	–
067326	South Field		7439976	Mercury	0.2	µg/L	U	–	–	–
067326	South Field		7782492	Selenium	138	µg/L		–	–	–
067326	South Field		7440224	Silver	66.2	µg/L	N	–	–	–
067335	South Field		7440382	Arsenic	0.25	µg/L	U	–	–	–
067335	South Field		7440393	Barium	0.69	µg/L		–	–	–
067335	South Field		7440439	Cadmium	0.015	µg/L		–	–	–
067335	South Field		7440473	Chromium	0.122	µg/L		–	–	–
067335	South Field		7439921	Lead	0.157	µg/L		–	–	–
067335	South Field		7439976	Mercury	0.000	µg/L	U	–	–	–
067335	South Field		7782492	Selenium	0.169	µg/L		–	–	–
067335	South Field		7440224	Silver	0.093	µg/L		–	–	–
067360	South Field		7440382	Arsenic	0.25	µg/L	U	–	–	–
067360	South Field		7440393	Barium	0.97	µg/L		–	–	–
067360	South Field		7440439	Cadmium	0.01	µg/L	U	–	–	–
067360	South Field		7440473	Chromium	0.092	µg/L		–	–	–
067360	South Field		7439921	Lead	0.083	µg/L		–	–	–
067360	South Field		7439976	Mercury	0.000	µg/L	U	–	–	–
067360	South Field		7782492	Selenium	0.119	µg/L		–	–	–
067360	South Field		7440224	Silver	0.076	µg/L		–	–	–
067361	South Field		7440382	Arsenic	0.25	µg/L	U	–	–	–
067361	South Field		7439976	Mercury	0.000	µg/L	U	–	–	–
067361	South Field		7782492	Selenium	0.097	µg/L		–	–	–
067362	South Field		7440382	Arsenic	0.25	µg/L	U	–	–	–
067362	South Field		7440393	Barium	0.867	µg/L		–	–	–
067362	South Field		7440439	Cadmium	0.01	µg/L	U	–	–	–
067362	South Field		7440473	Chromium	0.121	µg/L		–	–	–
067362	South Field		7439921	Lead	0.151	µg/L		–	–	–
067362	South Field		7439976	Mercury	0.000	µg/L	U	–	–	–
067362	South Field		7782492	Selenium	0.161	µg/L		–	–	–
067362	South Field		7440224	Silver	0.095	µg/L		–	–	–

Sample No.	Sample Area	Constituent	Result	2-Sigma Error	Units	Q
67507	Active Flyash	Cs-137	< 20		pCi/L	
67507	Active Flyash	Cs-137	< 20		pCi/L	
67507	Active Flyash	Np-237	< 1		pCi/L	
67507	Active Flyash	Pu-238	< 1		pCi/L	
67507	Active Flyash	Pu-239/240	< 1		pCi/L	
67507	Active Flyash	Ra-226	< 3		pCi/L	
67507	Active Flyash	Ra-228	< 4		pCi/L	
67507	Active Flyash	Ru-106	< 150		pCi/L	
67507	Active Flyash	Ru-106	< 150		pCi/L	
67507	Active Flyash	Sr-90	< 5		pCi/L	
67507	Active Flyash	Tc-99	< 30		pCi/L	
67507	Active Flyash	Th-228	< 1		pCi/L	
67507	Active Flyash	Th-230	1		pCi/L	
67507	Active Flyash	Th-232	< 1		pCi/L	
67507	Active Flyash	Th-Total	4.6		µg/l	
67507	Active Flyash	U-234	25	3.9	pCi/L	
67507	Active Flyash	U-235/236	2.7	0.94	pCi/L	
67507	Active Flyash	U-238	27	4.1	pCi/L	
67507	Active Flyash	U-Total	< 1		µg/l	
67397	Solid Waste Landfill	Cs-137	< 20		pCi/L	
67397	Solid Waste Landfill	Cs-137	< 22		pCi/L	R
67397	Solid Waste Landfill	Np-237	< 1		pCi/L	
67397	Solid Waste Landfill	Pu-238	< 1		pCi/L	
67397	Solid Waste Landfill	Pu-239/240	< 1		pCi/L	
67397	Solid Waste Landfill	Ra-226	< 1		pCi/L	
67397	Solid Waste Landfill	Ra-228	< 3		pCi/L	
67397	Solid Waste Landfill	Ru-106	< 150		pCi/L	
67397	Solid Waste Landfill	Ru-106	< 184		pCi/L	R
67397	Solid Waste Landfill	Sr-90	< 5		pCi/L	
67397	Solid Waste Landfill	Tc-99	< 30		pCi/L	
67397	Solid Waste Landfill	Th-228	< 1		pCi/L	
67397	Solid Waste Landfill	Th-230	< 1		pCi/L	
67397	Solid Waste Landfill	Th-232	< 1		pCi/L	
67397	Solid Waste Landfill	Th-Total	< 2.1		µg/l	
67397	Solid Waste Landfill	U-234	8.7	2.18	pCi/L	
67397	Solid Waste Landfill	U-235/236	< 1		pCi/L	
67397	Solid Waste Landfill	U-238	13	2.7	pCi/L	
67397	Solid Waste Landfill	U-Total	35	4.6	µg/l	
67402	Solid Waste Landfill	Cs-137	< 20		pCi/L	
67402	Solid Waste Landfill	Cs-137	< 20		pCi/L	
67402	Solid Waste Landfill	Np-237	< 1		pCi/L	
67402	Solid Waste Landfill	Pu-238	< 1		pCi/L	
67402	Solid Waste Landfill	Pu-239/240	< 1		pCi/L	
67402	Solid Waste Landfill	Ra-226	< 1		pCi/L	
67402	Solid Waste Landfill	Ra-228	< 3		pCi/L	
67402	Solid Waste Landfill	Ru-106	< 150		pCi/L	
67402	Solid Waste Landfill	Ru-106	< 184		pCi/L	R
67402	Solid Waste Landfill	Sr-90	< 5		pCi/L	
67402	Solid Waste Landfill	Tc-99	< 30		pCi/L	
67402	Solid Waste Landfill	Th-228	< 1		pCi/L	
67402	Solid Waste Landfill	Th-230	< 1		pCi/L	
67402	Solid Waste Landfill	Th-232	< 1		pCi/L	
67402	Solid Waste Landfill	Th-Total	< 4		µg/l	
67402	Solid Waste Landfill	U-234	24	4.7	pCi/L	
67402	Solid Waste Landfill	U-235/236	3.2	1.45	pCi/L	
67402	Solid Waste Landfill	U-238	42	6.8	pCi/L	
67402	Solid Waste Landfill	U-Total	113	15	µg/l	

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067245	Solid Waste Landfill		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067245	Solid Waste Landfill		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067245	Solid Waste Landfill		78933	2–Butanone	7	µg/l	J	J	–	–
067245	Solid Waste Landfill		71432	Benzene	5	µg/l	U	–	–	–
067245	Solid Waste Landfill		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067245	Solid Waste Landfill		108907	Chlorobenzene	5	µg/l	U	–	–	–
067245	Solid Waste Landfill		67663	Chloroform	5	µg/l	U	–	–	–
067245	Solid Waste Landfill		110861	Pyridine	20	µg/l	U	–	–	–
067245	Solid Waste Landfill		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067245	Solid Waste Landfill		79016	Trichloroethene	5	µg/l	U	–	–	–
067245	Solid Waste Landfill		75014	Vinyl chloride	10	µg/l	U	–	–	–
067247	Solid Waste Landfill		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067247	Solid Waste Landfill		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067247	Solid Waste Landfill		78933	2–Butanone	4	µg/l	J	J	–	–
067247	Solid Waste Landfill		71432	Benzene	5	µg/l	U	–	–	–
067247	Solid Waste Landfill		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067247	Solid Waste Landfill		108907	Chlorobenzene	5	µg/l	U	–	–	–
067247	Solid Waste Landfill		67663	Chloroform	5	µg/l	U	–	–	–
067247	Solid Waste Landfill		110861	Pyridine	20	µg/l	U	–	–	–
067247	Solid Waste Landfill		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067247	Solid Waste Landfill		79016	Trichloroethene	5	µg/l	U	–	–	–
067247	Solid Waste Landfill		75014	Vinyl chloride	10	µg/l	U	–	–	–
067261	Solid Waste Landfill		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067261	Solid Waste Landfill		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067261	Solid Waste Landfill		78933	2–Butanone	2	µg/l	JB	J	–	–
067261	Solid Waste Landfill		71432	Benzene	5	µg/l	U	–	–	–
067261	Solid Waste Landfill		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067261	Solid Waste Landfill		108907	Chlorobenzene	5	µg/l	U	–	–	–
067261	Solid Waste Landfill		67663	Chloroform	5	µg/l	U	–	–	–
067261	Solid Waste Landfill	R	110861	Pyridine	20	µg/l	U	R	–	–
067261	Solid Waste Landfill		110861	Pyridine	20	µg/l	U	R	–	–
067261	Solid Waste Landfill		127184	Tetrachlorethene	30	µg/l		–	–	–
067261	Solid Waste Landfill		79016	Trichloroethene	5	µg/l	U	–	–	–
067261	Solid Waste Landfill		75014	Vinyl chloride	10	µg/l	U	–	–	–
067264	Solid Waste Landfill		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067264	Solid Waste Landfill		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067264	Solid Waste Landfill		78933	2–Butanone	1	µg/l	JB	J	–	–
067264	Solid Waste Landfill		71432	Benzene	5	µg/l	U	–	–	–
067264	Solid Waste Landfill		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067264	Solid Waste Landfill		108907	Chlorobenzene	5	µg/l	U	–	–	–
067264	Solid Waste Landfill		67663	Chloroform	5	µg/l	U	–	–	–
067264	Solid Waste Landfill	R	110861	Pyridine	20	µg/l	U	R	–	–
067264	Solid Waste Landfill		110861	Pyridine	5	µg/l	J	R	–	–
067264	Solid Waste Landfill		127184	Tetrachlorethene	1	µg/l	J	J	–	–
067264	Solid Waste Landfill		79016	Trichloroethene	5	µg/l	U	–	–	–
067264	Solid Waste Landfill		75014	Vinyl chloride	10	µg/l	U	–	–	–
067301	Solid Waste Landfill		110861	Pyridine	20	µg/l	U	–	–	–
067301	Solid Waste Landfill	R	110861	Pyridine	20	µg/l	U	R	–	–
067303	Solid Waste Landfill		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067303	Solid Waste Landfill		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067303	Solid Waste Landfill		78933	2–Butanone	2	µg/l	J	J	–	–
067303	Solid Waste Landfill		71432	Benzene	5	µg/l	U	–	–	–
067303	Solid Waste Landfill		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067303	Solid Waste Landfill		108907	Chlorobenzene	5	µg/l	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067303	Solid Waste Landfill		67663	Chloroform	5	µg/l	U	–	–	–
067303	Solid Waste Landfill		110861	Pyridine	20	µg/l	U	–	–	–
067303	Solid Waste Landfill		127184	Tetrachlorethene	1	µg/l	J	J	–	–
067303	Solid Waste Landfill		79016	Trichloroethene	5	µg/l	U	–	–	–
067303	Solid Waste Landfill		75014	Vinyl chloride	10	µg/l	U	–	–	–
067309	Solid Waste Landfill		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067309	Solid Waste Landfill		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067309	Solid Waste Landfill		78933	2–Butanone	4	µg/l	J	–	–	–
067309	Solid Waste Landfill		71432	Benzene	5	µg/l	U	–	–	–
067309	Solid Waste Landfill		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067309	Solid Waste Landfill		108907	Chlorobenzene	5	µg/l	U	–	–	–
067309	Solid Waste Landfill		67663	Chloroform	5	µg/l	U	–	–	–
067309	Solid Waste Landfill		110861	Pyridine	20	µg/l	U	–	–	–
067309	Solid Waste Landfill		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067309	Solid Waste Landfill		79016	Trichloroethene	5	µg/l	U	–	–	–
067309	Solid Waste Landfill		75014	Vinyl chloride	10	µg/l	U	–	–	–
067318	Solid Waste Landfill		110861	Pyridine	20	µg/l	U	–	–	–
067319	Solid Waste Landfill		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067319	Solid Waste Landfill		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067319	Solid Waste Landfill		78933	2–Butanone	4	µg/l	J	–	–	–
067319	Solid Waste Landfill		71432	Benzene	5	µg/l	U	–	–	–
067319	Solid Waste Landfill		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067319	Solid Waste Landfill		108907	Chlorobenzene	5	µg/l	U	–	–	–
067319	Solid Waste Landfill		67663	Chloroform	5	µg/l	U	–	–	–
067319	Solid Waste Landfill		110861	Pyridine	20	µg/l	U	–	–	–
067319	Solid Waste Landfill		127184	Tetrachlorethene	1	µg/l	J	–	–	–
067319	Solid Waste Landfill		79016	Trichloroethene	5	µg/l	U	–	–	–
067319	Solid Waste Landfill		75014	Vinyl chloride	10	µg/l	U	–	–	–
067397	Solid Waste Landfill		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067397	Solid Waste Landfill		107062	1,2–Dichloroethane	5	µg/l	U	J	–	–
067397	Solid Waste Landfill		78933	2–Butanone	5	µg/l	J	–	–	–
067397	Solid Waste Landfill		71432	Benzene	5	µg/l	U	–	–	–
067397	Solid Waste Landfill		56235	Carbon Tetrachloride	5	µg/l	U	J	–	–
067397	Solid Waste Landfill		108907	Chlorobenzene	5	µg/l	U	J	–	–
067397	Solid Waste Landfill		67663	Chloroform	5	µg/l	U	–	–	–
067397	Solid Waste Landfill		110861	Pyridine	20	µg/l	U	–	–	–
067397	Solid Waste Landfill		127184	Tetrachlorethene	1	µg/l	J	J	–	–
067397	Solid Waste Landfill		79016	Trichloroethene	5	µg/l	U	–	–	–
067397	Solid Waste Landfill		75014	Vinyl chloride	10	µg/l	U	–	–	–
067719	Solid Waste Landfill		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067719	Solid Waste Landfill		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067719	Solid Waste Landfill		78933	2–Butanone	10	µg/l	U	–	–	–
067719	Solid Waste Landfill		71432	Benzene	5	µg/l	U	–	–	–
067719	Solid Waste Landfill		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067719	Solid Waste Landfill		108907	Chlorobenzene	5	µg/l	U	–	–	–
067719	Solid Waste Landfill		67663	Chloroform	5	µg/l	U	–	–	–
067719	Solid Waste Landfill		110861	Pyridine	20	µg/l	U	–	–	–
067719	Solid Waste Landfill		110861	Pyridine	20	µg/l	U	–	–	–
067719	Solid Waste Landfill		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067719	Solid Waste Landfill		79016	Trichloroethene	5	µg/l	U	–	–	–
067719	Solid Waste Landfill		75014	Vinyl chloride	10	µg/l	U	–	–	–
067003	Lime Sludge Pond		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067003	Lime Sludge Pond		75354	1,1–Dichloroethene	11	µg/l		–	–	–
067003	Lime Sludge Pond		78933	2–Butanone	6	µg/l	J	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067003	Lime Sludge Pond		71432	Benzene	5	µg/l	U	–	–	–
067003	Lime Sludge Pond		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067003	Lime Sludge Pond		108907	Chlorobenzene	5	µg/l	U	–	–	–
067003	Lime Sludge Pond		67663	Chloroform	5	µg/l	U	–	–	–
067003	Lime Sludge Pond		127184	Tetrachlorethene	2	µg/l	J	–	–	–
067003	Lime Sludge Pond		79016	Trichloroethene	5	µg/l	U	–	–	–
067003	Lime Sludge Pond		75014	Vinyl chloride	10	µg/l	U	–	–	–
067007	Lime Sludge Pond		75343	1,1–Dichloroethane	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		71556	1,1,1–Trichloroethane	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		79005	1,1,2–Trichloroethane	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		79345	1,1,2,2–Tetrachloroethane	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		540590	1,2–Dichloroethylene	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		78875	1,2–Dichloropropane	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		78933	2–Butanone	10	µg/l	U	–	–	–
067007	Lime Sludge Pond		591786	2–Hexanone	10	µg/l	U	–	–	–
067007	Lime Sludge Pond		108101	4–Methyl–2–pentanone	10	µg/l	U	–	–	–
067007	Lime Sludge Pond		67641	Acetone	1	µg/l	BJ	–	–	–
067007	Lime Sludge Pond		71432	Benzene	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		75274	Bromodichloromethane	2	µg/l	J	J	–	–
067007	Lime Sludge Pond		75252	Bromoform	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		74839	Bromomethane	10	µg/l	U	–	–	–
067007	Lime Sludge Pond		75150	Carbon disulfide	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		108907	Chlorobenzene	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		75003	Chloroethane	10	µg/l	U	–	–	–
067007	Lime Sludge Pond		67663	Chloroform	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		74873	Chloromethane	10	µg/l	U	–	–	–
067007	Lime Sludge Pond		1E+07	cis–1,3–Dichloropropene	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		124481	Dibromochloromethane	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		100414	Ethylbenzene	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		75092	Methylene chloride	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		108883	Toluene	1	µg/l	J	–	–	–
067007	Lime Sludge Pond		1330207	Total xylenes	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		1E+07	trans–1,3–Dichloropropen	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		79016	Trichloroethene	5	µg/l	U	–	–	–
067007	Lime Sludge Pond		108054	Vinyl Acetate	10	µg/l	U	–	–	–
067007	Lime Sludge Pond		75014	Vinyl chloride	10	µg/l	U	–	–	–
067150	Active Flyash		75354	1,1–Dichloroethene	20	µg/l	U	–	–	–
067150	Active Flyash		107062	1,2–Dichloroethane	20	µg/l	U	–	–	–
067150	Active Flyash		78933	2–Butanone	40	µg/l	U	–	–	–
067150	Active Flyash		71432	Benzene	20	µg/l	U	–	–	–
067150	Active Flyash		56235	Carbon Tetrachloride	20	µg/l	U	–	–	–
067150	Active Flyash		108907	Chlorobenzene	20	µg/l	U	–	–	–
067150	Active Flyash		67663	Chloroform	20	µg/l	U	–	–	–
067150	Active Flyash		110861	Pyridine	20	µg/l	U	J	–	–
067150	Active Flyash	R	110861	Pyridine	20	µg/l	U	R	–	–
067150	Active Flyash		127184	Tetrachlorethene	20	µg/l	U	–	–	–
067150	Active Flyash		79016	Trichloroethene	20	µg/l	U	–	–	–
067150	Active Flyash		75014	Vinyl chloride	40	µg/l	U	–	–	–
067157	Active Flyash		75354	1,1–Dichloroethene	20	µg/l	U	–	–	–
067157	Active Flyash		107062	1,2–Dichloroethane	20	µg/l	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067157	Active Flyash		78933	2–Butanone	9	µg/l	JB	–	–	–
067157	Active Flyash		71432	Benzene	20	µg/l	U	–	–	–
067157	Active Flyash		56235	Carbon Tetrachloride	20	µg/l	U	–	–	–
067157	Active Flyash		108907	Chlorobenzene	20	µg/l	U	–	–	–
067157	Active Flyash		67663	Chloroform	20	µg/l	U	–	–	–
067157	Active Flyash		110861	Pyridine	20	µg/l	U	J	–	–
067157	Active Flyash		127184	Tetrachlorethene	20	µg/l	U	–	–	–
067157	Active Flyash		79016	Trichloroethene	20	µg/l	U	–	–	–
067157	Active Flyash		75014	Vinyl chloride	40	µg/l	U	–	–	–
067162	Active Flyash		75354	1,1–Dichloroethene	20	µg/l	U	–	–	–
067162	Active Flyash		107062	1,2–Dichloroethane	20	µg/l	U	–	–	–
067162	Active Flyash		78933	2–Butanone	40	µg/l	U	–	–	–
067162	Active Flyash		71432	Benzene	20	µg/l	U	–	–	–
067162	Active Flyash		56235	Carbon Tetrachloride	20	µg/l	U	–	–	–
067162	Active Flyash		108907	Chlorobenzene	20	µg/l	U	–	–	–
067162	Active Flyash		67663	Chloroform	20	µg/l	U	–	–	–
067162	Active Flyash		110861	Pyridine	20	µg/l	U	J	–	–
067162	Active Flyash		127184	Tetrachlorethene	20	µg/l	U	–	–	–
067162	Active Flyash		79016	Trichloroethene	20	µg/l	U	–	–	–
067162	Active Flyash		75014	Vinyl chloride	40	µg/l	U	–	–	–
067170	Active Flyash		75354	1,1–Dichloroethene	20	µg/l	U	–	–	–
067170	Active Flyash		107062	1,2–Dichloroethane	20	µg/l	U	–	–	–
067170	Active Flyash		78933	2–Butanone	10	µg/l	J	J	–	–
067170	Active Flyash		71432	Benzene	20	µg/l	U	–	–	–
067170	Active Flyash		56235	Carbon Tetrachloride	20	µg/l	U	–	–	–
067170	Active Flyash		108907	Chlorobenzene	20	µg/l	U	–	–	–
067170	Active Flyash		67663	Chloroform	20	µg/l	U	–	–	–
067170	Active Flyash	R	110861	Pyridine	20	µg/l	U	R	–	–
067170	Active Flyash		110861	Pyridine	20	µg/l	U	R	–	–
067170	Active Flyash		127184	Tetrachlorethene	20	µg/l	U	–	–	–
067170	Active Flyash		79016	Trichloroethene	20	µg/l	U	–	–	–
067170	Active Flyash		75014	Vinyl chloride	40	µg/l	U	–	–	–
067186	Active Flyash		75354	1,1–Dichloroethene	20	µg/l	U	–	–	–
067186	Active Flyash		107062	1,2–Dichloroethane	20	µg/l	U	–	–	–
067186	Active Flyash		78933	2–Butanone	40	µg/l	U	–	–	–
067186	Active Flyash		71432	Benzene	20	µg/l	U	–	–	–
067186	Active Flyash		56235	Carbon Tetrachloride	20	µg/l	U	–	–	–
067186	Active Flyash		108907	Chlorobenzene	20	µg/l	U	–	–	–
067186	Active Flyash		67663	Chloroform	20	µg/l	U	–	–	–
067186	Active Flyash		110861	Pyridine	20	µg/l	U	J	–	–
067186	Active Flyash		127184	Tetrachlorethene	20	µg/l	U	–	–	–
067186	Active Flyash		79016	Trichloroethene	20	µg/l	U	–	–	–
067186	Active Flyash		75014	Vinyl chloride	40	µg/l	U	–	–	–
067189	Active Flyash		75354	1,1–Dichloroethene	20	µg/l	U	–	–	–
067189	Active Flyash		107062	1,2–Dichloroethane	20	µg/l	U	–	–	–
067189	Active Flyash		78933	2–Butanone	40	µg/l	U	–	–	–
067189	Active Flyash		71432	Benzene	20	µg/l	U	–	–	–
067189	Active Flyash		56235	Carbon Tetrachloride	20	µg/l	U	–	–	–
067189	Active Flyash		108907	Chlorobenzene	20	µg/l	U	–	–	–
067189	Active Flyash		67663	Chloroform	20	µg/l	U	–	–	–
067189	Active Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067189	Active Flyash		127184	Tetrachlorethene	20	µg/l	U	–	–	–
067189	Active Flyash		79016	Trichloroethene	20	µg/l	U	–	–	–
067189	Active Flyash		75014	Vinyl chloride	40	µg/l	U	–	–	–

Table A–4. Fernald Environmental Management Project Volatile Organic Characterization TCLP Data

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067197	Active Flyash		75354	1,1–Dichloroethene	20	µg/l	U	–	–	–
067197	Active Flyash		107062	1,2–Dichloroethane	20	µg/l	U	–	–	–
067197	Active Flyash		78933	2–Butanone	7	µg/l	JB	–	–	–
067197	Active Flyash		71432	Benzene	20	µg/l	U	–	–	–
067197	Active Flyash		56235	Carbon Tetrachloride	20	µg/l	U	–	–	–
067197	Active Flyash		108907	Chlorobenzene	20	µg/l	U	–	–	–
067197	Active Flyash		67663	Chloroform	20	µg/l	U	–	–	–
067197	Active Flyash	R	110861	Pyridine	20	µg/l	U	R	–	–
067197	Active Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067197	Active Flyash		127184	Tetrachlorethene	20	µg/l	U	–	–	–
067197	Active Flyash		79016	Trichloroethene	20	µg/l	U	–	–	–
067197	Active Flyash		75014	Vinyl chloride	40	µg/l	U	–	–	–
067224	Active Flyash		75354	1,1–Dichloroethene	20	µg/l	U	–	–	–
067224	Active Flyash		107062	1,2–Dichloroethane	20	µg/l	U	–	–	–
067224	Active Flyash		78933	2–Butanone	40	µg/l	U	–	–	–
067224	Active Flyash		71432	Benzene	20	µg/l	U	–	–	–
067224	Active Flyash		56235	Carbon Tetrachloride	20	µg/l	U	–	–	–
067224	Active Flyash		108907	Chlorobenzene	20	µg/l	U	–	–	–
067224	Active Flyash		67663	Chloroform	20	µg/l	U	–	–	–
067224	Active Flyash		110861	Pyridine	20	µg/l	U	J	–	–
067224	Active Flyash		127184	Tetrachlorethene	20	µg/l	U	–	–	–
067224	Active Flyash		79016	Trichloroethene	20	µg/l	U	–	–	–
067224	Active Flyash		75014	Vinyl chloride	40	µg/l	U	–	–	–
067225	Active Flyash		75354	1,1–Dichloroethene	20	µg/l	U	–	–	–
067225	Active Flyash		107062	1,2–Dichloroethane	20	µg/l	U	–	–	–
067225	Active Flyash		78933	2–Butanone	40	µg/l	U	–	–	–
067225	Active Flyash		71432	Benzene	20	µg/l	U	–	–	–
067225	Active Flyash		56235	Carbon Tetrachloride	20	µg/l	U	–	–	–
067225	Active Flyash		108907	Chlorobenzene	20	µg/l	U	–	–	–
067225	Active Flyash		67663	Chloroform	20	µg/l	U	–	–	–
067225	Active Flyash		110861	Pyridine	20	µg/l	U	J	–	–
067225	Active Flyash		127184	Tetrachlorethene	20	µg/l	U	–	–	–
067225	Active Flyash		79016	Trichloroethene	20	µg/l	U	–	–	–
067225	Active Flyash		75014	Vinyl chloride	40	µg/l	U	–	–	–
067504	Active Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067504	Active Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067504	Active Flyash		78933	2–Butanone	3	µg/l	J	J	–	–
067504	Active Flyash		71432	Benzene	5	µg/l	U	–	–	–
067504	Active Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067504	Active Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067504	Active Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067504	Active Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067504	Active Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067504	Active Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067504	Active Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067016	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067016	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067016	Inactive Flyash		78933	2–Butanone	10	µg/l	U	–	–	–
067016	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067016	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067016	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067016	Inactive Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067016	Inactive Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067016	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067016	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067016	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067021	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067021	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067021	Inactive Flyash		78933	2–Butanone	10	µg/l	U	–	–	–
067021	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067021	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067021	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067021	Inactive Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067021	Inactive Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067021	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067021	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067021	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067023	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067023	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067023	Inactive Flyash		78933	2–Butanone	10	µg/l	U	–	–	–
067023	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067023	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067023	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067023	Inactive Flyash		67663	Chloroform	20	µg/l		–	–	–
067023	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067023	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067023	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067024	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067024	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067024	Inactive Flyash		78933	2–Butanone	10	µg/l	U	–	–	–
067024	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067024	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067024	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067024	Inactive Flyash		67663	Chloroform	19	µg/l		–	–	–
067024	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067024	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067024	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067025	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067025	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067025	Inactive Flyash		78933	2–Butanone	10	µg/l	U	–	–	–
067025	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067025	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067025	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067025	Inactive Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067025	Inactive Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067025	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067025	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067025	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067038	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067038	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067038	Inactive Flyash		78933	2–Butanone	10	µg/l	U	–	–	–
067038	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067038	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067038	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067038	Inactive Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067038	Inactive Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067038	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067038	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067038	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067051	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067051	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067051	Inactive Flyash		78933	2–Butanone	4	µg/l	J	J	–	–
067051	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067051	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067051	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067051	Inactive Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067051	Inactive Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067051	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067051	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067051	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067058	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067058	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067058	Inactive Flyash		78933	2–Butanone	6	µg/l	J	J	–	–
067058	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067058	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067058	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067058	Inactive Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067058	Inactive Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067058	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067058	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067058	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067065	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067065	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067065	Inactive Flyash		78933	2–Butanone	10	µg/l	U	–	–	–
067065	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067065	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067065	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067065	Inactive Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067065	Inactive Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067065	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067065	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067065	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067099	Inactive Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067114	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067114	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067114	Inactive Flyash		78933	2–Butanone	1	µg/l	J	–	–	–
067114	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067114	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067114	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067114	Inactive Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067114	Inactive Flyash		110861	Pyridine	20	µg/l	U	–	–	–
067114	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067114	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067114	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067115	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067115	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067115	Inactive Flyash		78933	2–Butanone	2	µg/l	J	–	–	–
067115	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067115	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067115	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067115	Inactive Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067115	Inactive Flyash	R	110861	Pyridine	25	µg/l	U	R	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067115	Inactive Flyash		110861	Pyridine	20	µg/l	U	R	–	–
067115	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067115	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067115	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067124	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067124	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067124	Inactive Flyash		78933	2–Butanone	10	µg/l	U	–	–	–
067124	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067124	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067124	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067124	Inactive Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067124	Inactive Flyash		110861	Pyridine	20	µg/l	U	R	–	–
067124	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067124	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067124	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
067128	Inactive Flyash		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067128	Inactive Flyash		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067128	Inactive Flyash		78933	2–Butanone	10	µg/l	U	–	–	–
067128	Inactive Flyash		71432	Benzene	5	µg/l	U	–	–	–
067128	Inactive Flyash		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067128	Inactive Flyash		108907	Chlorobenzene	5	µg/l	U	–	–	–
067128	Inactive Flyash		67663	Chloroform	5	µg/l	U	–	–	–
067128	Inactive Flyash		110861	Pyridine	20	µg/l	U	R	–	–
067128	Inactive Flyash		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067128	Inactive Flyash		79016	Trichloroethene	5	µg/l	U	–	–	–
067128	Inactive Flyash		75014	Vinyl chloride	10	µg/l	U	–	–	–
061319	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
061319	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
061319	South Field		78933	2–Butanone	3	µg/l	BJ	JB	–	–
061319	South Field		71432	Benzene	5	µg/l	U	–	–	–
061319	South Field		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
061319	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
061319	South Field		67663	Chloroform	5	µg/l	U	JB	–	–
061319	South Field		110861	Pyridine	20	µg/l	U	–	–	–
061319	South Field	R	110861	Pyridine	20	µg/l	U	R	–	–
061319	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
061319	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
061319	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–
061324	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
061324	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
061324	South Field		78933	2–Butanone	1	µg/l	BJ	JB	–	–
061324	South Field		71432	Benzene	5	µg/l	U	–	–	–
061324	South Field		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
061324	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
061324	South Field		67663	Chloroform	5	µg/l	U	JB	–	–
061324	South Field		110861	Pyridine	20	µg/l	U	–	–	–
061324	South Field	R	110861	Pyridine	20	µg/l	U	R	–	–
061324	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
061324	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
061324	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–
061329	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
061329	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
061329	South Field		78933	2–Butanone	3	µg/l	BJ	JB	–	–
061329	South Field		71432	Benzene	5	µg/l	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
061329	South Field		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
061329	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
061329	South Field		67663	Chloroform	5	µg/l	U	JB	–	–
061329	South Field		110861	Pyridine	20	µg/l	U	–	–	–
061329	South Field	R	110861	Pyridine	20	µg/l	U	R	–	–
061329	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
061329	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
061329	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–
061334	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
061334	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
061334	South Field		78933	2–Butanone	2	µg/l	J	JB	–	–
061334	South Field		71432	Benzene	5	µg/l	U	–	–	–
061334	South Field		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
061334	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
061334	South Field		67663	Chloroform	1	µg/l	BJ	JB	–	–
061334	South Field		110861	Pyridine	20	µg/l	U	–	–	–
061334	South Field	R	110861	Pyridine	20	µg/l	U	R	–	–
061334	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
061334	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
061334	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–
067326	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067326	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067326	South Field		78933	2–Butanone	2	µg/l	JB	JB	–	–
067326	South Field		71432	Benzene	5	µg/l	U	–	–	–
067326	South Field		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067326	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
067326	South Field		67663	Chloroform	5	µg/l	U	–	–	–
067326	South Field		110861	Pyridine	20	µg/l	U	–	–	–
067326	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067326	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
067326	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–
067335	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067335	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067335	South Field		78933	2–Butanone	2	µg/l	J	–	–	–
067335	South Field		71432	Benzene	5	µg/l	U	–	–	–
067335	South Field		56235	Carbon Tetrachloride	5	µg/l	U	J	–	–
067335	South Field		57749	Chlordane	0.5	µg/l	U	–	–	–
067335	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
067335	South Field		67663	Chloroform	5	µg/l	U	–	–	–
067335	South Field		110861	Pyridine	20	µg/l	U	–	–	–
067335	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067335	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
067335	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–
067360	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067360	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067360	South Field		78933	2–Butanone	2	µg/l	J	–	–	–
067360	South Field		71432	Benzene	5	µg/l	U	–	–	–
067360	South Field		56235	Carbon Tetrachloride	5	µg/l	U	J	–	–
067360	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
067360	South Field		67663	Chloroform	5	µg/l	U	–	–	–
067360	South Field		110861	Pyridine	20	µg/l	U	–	–	–
067360	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067360	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
067360	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067361	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067361	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067361	South Field		78933	2–Butanone	2	µg/l	J	–	–	–
067361	South Field		71432	Benzene	5	µg/l	U	–	–	–
067361	South Field		56235	Carbon Tetrachloride	5	µg/l	U	J	–	–
067361	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
067361	South Field		67663	Chloroform	5	µg/l	U	–	–	–
067361	South Field		110861	Pyridine	20	µg/l	U	–	–	–
067361	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067361	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
067361	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–
067362	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067362	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067362	South Field		78933	2–Butanone	3	µg/l	J	–	–	–
067362	South Field		71432	Benzene	5	µg/l	U	–	–	–
067362	South Field		56235	Carbon Tetrachloride	5	µg/l	U	J	–	–
067362	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
067362	South Field		67663	Chloroform	5	µg/l	U	–	–	–
067362	South Field		110861	Pyridine	20	µg/l	U	–	–	–
067362	South Field		127184	Tetrachlorethene	1	µg/l	J	–	–	–
067362	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
067362	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–
067369	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067369	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067369	South Field		78933	2–Butanone	10	µg/l	J	–	–	–
067369	South Field		71432	Benzene	5	µg/l	U	–	–	–
067369	South Field		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067369	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
067369	South Field		67663	Chloroform	5	µg/l	U	–	–	–
067369	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067369	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
067369	South Field		75014	Vinyl chloride	10	µg/l	U	J	–	–
067801	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067801	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067801	South Field		78933	2–Butanone	10	µg/l	U	–	–	–
067801	South Field		71432	Benzene	5	µg/l	U	–	–	–
067801	South Field		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067801	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
067801	South Field		67663	Chloroform	5	µg/l	U	–	–	–
067801	South Field		110861	Pyridine	20	µg/l	U	–	–	–
067801	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067801	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
067801	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–
067802	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067802	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067802	South Field		78933	2–Butanone	4	µg/l	J	–	–	–
067802	South Field		71432	Benzene	5	µg/l	U	–	–	–
067802	South Field		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067802	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
067802	South Field		67663	Chloroform	5	µg/l	U	–	–	–
067802	South Field		110861	Pyridine	20	µg/l	U	–	–	–
067802	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067802	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
067802	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers			
							Lab	Q3	Q4	Q5
067803	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067803	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067803	South Field		78933	2–Butanone	10	µg/l	U	–	–	–
067803	South Field		71432	Benzene	5	µg/l	U	–	–	–
067803	South Field		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067803	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
067803	South Field		67663	Chloroform	5	µg/l	U	–	–	–
067803	South Field		110861	Pyridine	20	µg/l	U	–	–	–
067803	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067803	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
067803	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–
067804	South Field		75354	1,1–Dichloroethene	5	µg/l	U	–	–	–
067804	South Field		107062	1,2–Dichloroethane	5	µg/l	U	–	–	–
067804	South Field		78933	2–Butanone	2	µg/l	J	–	–	–
067804	South Field		71432	Benzene	5	µg/l	U	–	–	–
067804	South Field		56235	Carbon Tetrachloride	5	µg/l	U	–	–	–
067804	South Field		108907	Chlorobenzene	5	µg/l	U	–	–	–
067804	South Field		67663	Chloroform	5	µg/l	U	–	–	–
067804	South Field		110861	Pyridine	20	µg/l	U	–	–	–
067804	South Field		127184	Tetrachlorethene	5	µg/l	U	–	–	–
067804	South Field		79016	Trichloroethene	5	µg/l	U	–	–	–
067804	South Field		75014	Vinyl chloride	10	µg/l	U	–	–	–

Table A–5. Fernald Environmental Management Project Semivolatile Organic Characterization TCLP Data Page 1

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067245	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067245	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	–	–	–
067245	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067245	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067245	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067245	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	–	–	–
067245	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	–	–	–
067245	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067245	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067245	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	–	–	–
067245	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	–	–	–
067245	Solid Waste Landfill		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067247	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067247	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	–	–	–
067247	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067247	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067247	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067247	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	–	–	–
067247	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	–	–	–
067247	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067247	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067247	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	–	–	–
067247	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	–	–	–
067247	Solid Waste Landfill		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067261	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067261	Solid Waste Landfill	R	106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067261	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	R	–	–
067261	Solid Waste Landfill	R	95487	2–Methylphenol	20	µg/L	U	R	–	–
067261	Solid Waste Landfill	R	121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
067261	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
067261	Solid Waste Landfill	R	95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067261	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067261	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067261	Solid Waste Landfill	R	88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067261	Solid Waste Landfill	R	108394	3–Methylphenol	20	µg/L	U	R	–	–
067261	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	–	–	–
067261	Solid Waste Landfill	R	106445	4–Methylphenol	20	µg/L	U	R	–	–
067261	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	R	–	–
067261	Solid Waste Landfill	R	118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067261	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067261	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067261	Solid Waste Landfill	R	87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067261	Solid Waste Landfill	R	67721	Hexachloroethane	20	µg/L	U	R	–	–
067261	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	R	–	–
067261	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	R	–	–
067261	Solid Waste Landfill	R	98953	Nitrobenzene	20	µg/L	U	R	–	–
067261	Solid Waste Landfill		87865	Pentachlorophenol	8	µg/L	J	J	–	–
067261	Solid Waste Landfill	R	87865	Pentachlorophenol	100	µg/L	U	R	–	–
067264	Solid Waste Landfill	R	106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067264	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067264	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	R	–	–
067264	Solid Waste Landfill	R	95487	2–Methylphenol	20	µg/L	U	R	–	–
067264	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
067264	Solid Waste Landfill	R	121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–

Table A–5. Fernald Environmental Management Project Semivolatile Organic Characterization TCLP Data Page 2

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067264	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067264	Solid Waste Landfill	R	95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067264	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067264	Solid Waste Landfill	R	88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067264	Solid Waste Landfill	R	108394	3–Methylphenol	20	µg/L	U	R	–	–
067264	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	R	–	–
067264	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	R	–	–
067264	Solid Waste Landfill	R	106445	4–Methylphenol	20	µg/L	U	R	–	–
067264	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067264	Solid Waste Landfill	R	118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067264	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067264	Solid Waste Landfill	R	87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067264	Solid Waste Landfill	R	67721	Hexachloroethane	20	µg/L	U	R	–	–
067264	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	R	–	–
067264	Solid Waste Landfill	R	98953	Nitrobenzene	20	µg/L	U	R	–	–
067264	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	R	–	–
067264	Solid Waste Landfill		87865	Pentachlorophenol	9	µg/L	J	R	–	–
067264	Solid Waste Landfill	R	87865	Pentachlorophenol	100	µg/L	U	R	–	–
067301	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067301	Solid Waste Landfill	R	106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067301	Solid Waste Landfill	R	95487	2–Methylphenol	20	µg/L	U	R	–	–
067301	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	–	–	–
067301	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067301	Solid Waste Landfill	R	121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
067301	Solid Waste Landfill	R	95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067301	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	J	–	–
067301	Solid Waste Landfill	R	88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067301	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067301	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	–	–	–
067301	Solid Waste Landfill	R	108394	3–Methylphenol	20	µg/L	U	R	–	–
067301	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	–	–	–
067301	Solid Waste Landfill	R	106445	4–Methylphenol	20	µg/L	U	R	–	–
067301	Solid Waste Landfill	R	118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067301	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067301	Solid Waste Landfill	R	87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067301	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067301	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	–	–	–
067301	Solid Waste Landfill	R	67721	Hexachloroethane	20	µg/L	U	R	–	–
067301	Solid Waste Landfill	R	98953	Nitrobenzene	20	µg/L	U	R	–	–
067301	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	–	–	–
067301	Solid Waste Landfill	R	87865	Pentachlorophenol	100	µg/L	U	R	–	–
067301	Solid Waste Landfill		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067303	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067303	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	–	–	–
067303	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067303	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	J	–	–
067303	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067303	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	–	–	–
067303	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	–	–	–
067303	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067303	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067303	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	–	–	–
067303	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	–	–	–
067303	Solid Waste Landfill		87865	Pentachlorophenol	100	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067309	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067309	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	–	–	–
067309	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067309	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067309	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	204	µg/L	U	–	–	–
067309	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	–	–	–
067309	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	–	–	–
067309	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067309	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067309	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	–	–	–
067309	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	–	–	–
067309	Solid Waste Landfill		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067318	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067318	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	–	–	–
067318	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067318	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067318	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067318	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	–	–	–
067318	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	–	–	–
067318	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067318	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067318	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	–	–	–
067318	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	–	–	–
067318	Solid Waste Landfill		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067319	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067319	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	–	–	–
067319	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067319	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067319	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067319	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	–	–	–
067319	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	–	–	–
067319	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067319	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067319	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	–	–	–
067319	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	–	–	–
067319	Solid Waste Landfill		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067397	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067397	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	–	–	–
067397	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067397	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067397	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067397	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	–	–	–
067397	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	–	–	–
067397	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067397	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067397	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	–	–	–
067397	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	–	–	–
067397	Solid Waste Landfill		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067719	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		95487	2–Methylphenol	20	µg/L	U	R	–	–
067719	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–

Table A–5. Fernald Environmental Management Project Semivolatile Organic Characterization TCLP Data

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067719	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067719	Solid Waste Landfill		95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067719	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067719	Solid Waste Landfill		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		108394	3–Methylphenol	20	µg/L	U	R	–	–
067719	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		106445	4–Methylphenol	20	µg/L	U	R	–	–
067719	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		67721	Hexachloroethane	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		98953	Nitrobenzene	20	µg/L	U	–	–	–
067719	Solid Waste Landfill		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067719	Solid Waste Landfill		87865	Pentachlorophenol	100	µg/L	U	R	–	–
067150	Active Flyash	R	106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067150	Active Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	J	–	–
067150	Active Flyash		95487	2–Methylphenol	20	µg/L	U	J	–	–
067150	Active Flyash	R	95487	2–Methylphenol	20	µg/L	U	R	–	–
067150	Active Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	J	–	–
067150	Active Flyash	R	121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
067150	Active Flyash	R	95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067150	Active Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	J	–	–
067150	Active Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	J	–	–
067150	Active Flyash	R	88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067150	Active Flyash		108394	3–Methylphenol	20	µg/L	U	J	–	–
067150	Active Flyash	R	108394	3–Methylphenol	20	µg/L	U	R	–	–
067150	Active Flyash		106445	4–Methylphenol	20	µg/L	U	J	–	–
067150	Active Flyash	R	106445	4–Methylphenol	20	µg/L	U	R	–	–
067150	Active Flyash	R	118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067150	Active Flyash		118741	Hexachlorobenzene	20	µg/L	U	J	–	–
067150	Active Flyash		87683	Hexachlorobutadiene	20	µg/L	U	J	–	–
067150	Active Flyash	R	87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067150	Active Flyash	R	67721	Hexachloroethane	20	µg/L	U	R	–	–
067150	Active Flyash		67721	Hexachloroethane	20	µg/L	U	J	–	–
067150	Active Flyash		98953	Nitrobenzene	20	µg/L	U	J	–	–
067150	Active Flyash	R	98953	Nitrobenzene	20	µg/L	U	R	–	–
067150	Active Flyash		87865	Pentachlorophenol	100	µg/L	U	J	–	–
067150	Active Flyash	R	87865	Pentachlorophenol	100	µg/L	U	R	–	–
067157	Active Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	J	–	–
067157	Active Flyash		95487	2–Methylphenol	20	µg/L	U	J	–	–
067157	Active Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	J	–	–
067157	Active Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	J	–	–
067157	Active Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	J	–	–
067157	Active Flyash		108394	3–Methylphenol	20	µg/L	U	J	–	–
067157	Active Flyash		106445	4–Methylphenol	20	µg/L	U	J	–	–
067157	Active Flyash		118741	Hexachlorobenzene	20	µg/L	U	J	–	–
067157	Active Flyash		87683	Hexachlorobutadiene	20	µg/L	U	J	–	–
067157	Active Flyash		67721	Hexachloroethane	20	µg/L	U	J	–	–
067157	Active Flyash		98953	Nitrobenzene	20	µg/L	U	J	–	–
067157	Active Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067162	Active Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	J	–	–
067162	Active Flyash		95487	2–Methylphenol	20	µg/L	U	J	–	–
067162	Active Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	J	–	–
067162	Active Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	J	–	–
067162	Active Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	J	–	–
067162	Active Flyash		108394	3–Methylphenol	20	µg/L	U	J	–	–
067162	Active Flyash		106445	4–Methylphenol	20	µg/L	U	J	–	–
067162	Active Flyash		118741	Hexachlorobenzene	20	µg/L	U	J	–	–
067162	Active Flyash		87683	Hexachlorobutadiene	20	µg/L	U	J	–	–
067162	Active Flyash		67721	Hexachloroethane	20	µg/L	U	J	–	–
067162	Active Flyash		98953	Nitrobenzene	20	µg/L	U	J	–	–
067162	Active Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067170	Active Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067170	Active Flyash	R	106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067170	Active Flyash	R	95487	2–Methylphenol	20	µg/L	U	R	–	–
067170	Active Flyash		95487	2–Methylphenol	20	µg/L	U	R	–	–
067170	Active Flyash	R	121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
067170	Active Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
067170	Active Flyash	R	95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067170	Active Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067170	Active Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067170	Active Flyash	R	88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067170	Active Flyash	R	108394	3–Methylphenol	20	µg/L	U	R	–	–
067170	Active Flyash		108394	3–Methylphenol	20	µg/L	U	R	–	–
067170	Active Flyash		106445	4–Methylphenol	20	µg/L	U	R	–	–
067170	Active Flyash	R	106445	4–Methylphenol	20	µg/L	U	R	–	–
067170	Active Flyash		118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067170	Active Flyash	R	118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067170	Active Flyash		87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067170	Active Flyash	R	87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067170	Active Flyash		67721	Hexachloroethane	20	µg/L	U	R	–	–
067170	Active Flyash	R	67721	Hexachloroethane	20	µg/L	U	R	–	–
067170	Active Flyash	R	98953	Nitrobenzene	20	µg/L	U	R	–	–
067170	Active Flyash		98953	Nitrobenzene	20	µg/L	U	R	–	–
067170	Active Flyash	R	87865	Pentachlorophenol	100	µg/L	U	R	–	–
067170	Active Flyash		87865	Pentachlorophenol	100	µg/L	U	R	–	–
067186	Active Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	J	–	–
067186	Active Flyash		95487	2–Methylphenol	20	µg/L	U	J	–	–
067186	Active Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067186	Active Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	J	–	–
067186	Active Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067186	Active Flyash		108394	3–Methylphenol	20	µg/L	U	J	–	–
067186	Active Flyash		106445	4–Methylphenol	20	µg/L	U	J	–	–
067186	Active Flyash		118741	Hexachlorobenzene	20	µg/L	U	J	–	–
067186	Active Flyash		87683	Hexachlorobutadiene	20	µg/L	U	J	–	–
067186	Active Flyash		67721	Hexachloroethane	20	µg/L	U	J	–	–
067186	Active Flyash		98953	Nitrobenzene	20	µg/L	U	J	–	–
067186	Active Flyash		87865	Pentachlorophenol	100	µg/L	U	J	–	–
067189	Active Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067189	Active Flyash		95487	2–Methylphenol	20	µg/L	U	–	–	–
067189	Active Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067189	Active Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067189	Active Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067189	Active Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–

Table A–5. Fernald Environmental Management Project Semivolatile Organic Characterization TCLP Data

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067189	Active Flyash		106445	4–Methylphenol	20	µg/L	U	–	–	–
067189	Active Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067189	Active Flyash		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067189	Active Flyash		67721	Hexachloroethane	20	µg/L	U	–	–	–
067189	Active Flyash		98953	Nitrobenzene	20	µg/L	U	–	–	–
067189	Active Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067197	Active Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067197	Active Flyash	R	106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067197	Active Flyash		95487	2–Methylphenol	20	µg/L	U	R	–	–
067197	Active Flyash	R	95487	2–Methylphenol	20	µg/L	U	R	–	–
067197	Active Flyash	R	121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
067197	Active Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067197	Active Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067197	Active Flyash	R	95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067197	Active Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067197	Active Flyash	R	88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067197	Active Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–
067197	Active Flyash	R	108394	3–Methylphenol	20	µg/L	U	R	–	–
067197	Active Flyash		106445	4–Methylphenol	20	µg/L	U	R	–	–
067197	Active Flyash	R	106445	4–Methylphenol	20	µg/L	U	R	–	–
067197	Active Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067197	Active Flyash	R	118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067197	Active Flyash		87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067197	Active Flyash	R	87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067197	Active Flyash	R	67721	Hexachloroethane	20	µg/L	U	R	–	–
067197	Active Flyash		67721	Hexachloroethane	20	µg/L	U	R	–	–
067197	Active Flyash		98953	Nitrobenzene	20	µg/L	U	R	–	–
067197	Active Flyash	R	98953	Nitrobenzene	20	µg/L	U	R	–	–
067197	Active Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067197	Active Flyash	R	87865	Pentachlorophenol	100	µg/L	U	R	–	–
067224	Active Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	J	–	–
067224	Active Flyash		95487	2–Methylphenol	20	µg/L	U	J	–	–
067224	Active Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067224	Active Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	J	–	–
067224	Active Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067224	Active Flyash		108394	3–Methylphenol	20	µg/L	U	J	–	–
067224	Active Flyash		106445	4–Methylphenol	20	µg/L	U	J	–	–
067224	Active Flyash		118741	Hexachlorobenzene	20	µg/L	U	J	–	–
067224	Active Flyash		87683	Hexachlorobutadiene	20	µg/L	U	J	–	–
067224	Active Flyash		67721	Hexachloroethane	20	µg/L	U	J	–	–
067224	Active Flyash		98953	Nitrobenzene	20	µg/L	U	J	–	–
067224	Active Flyash		87865	Pentachlorophenol	100	µg/L	U	J	–	–
067225	Active Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	J	–	–
067225	Active Flyash		95487	2–Methylphenol	20	µg/L	U	J	–	–
067225	Active Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067225	Active Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	J	–	–
067225	Active Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	J	–	–
067225	Active Flyash		108394	3–Methylphenol	20	µg/L	U	J	–	–
067225	Active Flyash		106445	4–Methylphenol	20	µg/L	U	J	–	–
067225	Active Flyash		118741	Hexachlorobenzene	20	µg/L	U	J	–	–
067225	Active Flyash		87683	Hexachlorobutadiene	20	µg/L	U	J	–	–
067225	Active Flyash		67721	Hexachloroethane	20	µg/L	U	J	–	–
067225	Active Flyash		98953	Nitrobenzene	20	µg/L	U	J	–	–
067225	Active Flyash		87865	Pentachlorophenol	100	µg/L	U	J	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067504	Active Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067504	Active Flyash		95487	2–Methylphenol	20	µg/L	U	–	–	–
067504	Active Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067504	Active Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067504	Active Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067504	Active Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–
067504	Active Flyash		106445	4–Methylphenol	20	µg/L	U	–	–	–
067504	Active Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067504	Active Flyash		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067504	Active Flyash		67721	Hexachloroethane	20	µg/L	U	–	–	–
067504	Active Flyash		98953	Nitrobenzene	20	µg/L	U	–	–	–
067504	Active Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067016	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067016	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	–	–	–
067016	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067016	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067016	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067016	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–
067016	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	–	–	–
067016	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067016	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067016	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	–	–	–
067016	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	–	–	–
067016	Inactive Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067021	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067021	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	–	–	–
067021	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067021	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067021	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067021	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–
067021	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	–	–	–
067021	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067021	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067021	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	–	–	–
067021	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	–	–	–
067021	Inactive Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067025	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067025	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	–	–	–
067025	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067025	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067025	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067025	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–
067025	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	–	–	–
067025	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067025	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067025	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	–	–	–
067025	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	–	–	–
067025	Inactive Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067038	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067038	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	–	–	–
067038	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067038	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067038	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067038	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067038	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	–	–	–
067038	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067038	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067038	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	–	–	–
067038	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	–	–	–
067038	Inactive Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067051	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067051	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	–	–	–
067051	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067051	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067051	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067051	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–
067051	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	–	–	–
067051	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067051	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067051	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	–	–	–
067051	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	–	–	–
067051	Inactive Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067058	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067058	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	–	–	–
067058	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067058	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067058	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067058	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–
067058	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	–	–	–
067058	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067058	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067058	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	–	–	–
067058	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	–	–	–
067058	Inactive Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067065	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067065	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	–	–	–
067065	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067065	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067065	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067065	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–
067065	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	–	–	–
067065	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067065	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067065	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	–	–	–
067065	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	–	–	–
067065	Inactive Flyash		87865	Pentachlorophenol	8	µg/L	J	J	–	–
067099	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067099	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	–	–	–
067099	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067099	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067099	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067099	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–
067099	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	–	–	–
067099	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067099	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067099	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	–	–	–
067099	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	–	–	–
067099	Inactive Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067114	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067114	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	–	–	–
067114	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067114	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067114	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067114	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	–	–	–
067114	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	–	–	–
067114	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067114	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067114	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	–	–	–
067114	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	–	–	–
067114	Inactive Flyash		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067115	Inactive Flyash	R	106467	1,4–Dichlorobenzene	25	µg/L	U	R	–	–
067115	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067115	Inactive Flyash	R	95487	2–Methylphenol	25	µg/L	U	R	–	–
067115	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	R	–	–
067115	Inactive Flyash	R	121142	2,4–Dinitrotoluene	25	µg/L	U	R	–	–
067115	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
067115	Inactive Flyash	R	95954	2,4,5–Trichlorophenol	120	µg/L	U	R	–	–
067115	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067115	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067115	Inactive Flyash	R	88062	2,4,6–Trichlorophenol	25	µg/L	U	R	–	–
067115	Inactive Flyash	R	108394	3–Methylphenol	25	µg/L	U	R	–	–
067115	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	R	–	–
067115	Inactive Flyash	R	106445	4–Methylphenol	25	µg/L	U	R	–	–
067115	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	R	–	–
067115	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067115	Inactive Flyash	R	118741	Hexachlorobenzene	25	µg/L	U	R	–	–
067115	Inactive Flyash	R	87683	Hexachlorobutadiene	25	µg/L	U	R	–	–
067115	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067115	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	R	–	–
067115	Inactive Flyash	R	67721	Hexachloroethane	25	µg/L	U	R	–	–
067115	Inactive Flyash	R	98953	Nitrobenzene	25	µg/L	U	R	–	–
067115	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	R	–	–
067115	Inactive Flyash	R	87865	Pentachlorophenol	120	µg/L	U	R	–	–
067115	Inactive Flyash		87865	Pentachlorophenol	100	µg/L	U	R	–	–
067124	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067124	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	R	–	–
067124	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
067124	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067124	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067124	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	R	–	–
067124	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	R	–	–
067124	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067124	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067124	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	R	–	–
067124	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	R	–	–
067124	Inactive Flyash		87865	Pentachlorophenol	100	µg/L	U	R	–	–
067128	Inactive Flyash		106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
067128	Inactive Flyash		95487	2–Methylphenol	20	µg/L	U	R	–	–
067128	Inactive Flyash		121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
067128	Inactive Flyash		95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
067128	Inactive Flyash		88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
067128	Inactive Flyash		108394	3–Methylphenol	20	µg/L	U	R	–	–

3527

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067128	Inactive Flyash		106445	4–Methylphenol	20	µg/L	U	R	–	–
067128	Inactive Flyash		118741	Hexachlorobenzene	20	µg/L	U	R	–	–
067128	Inactive Flyash		87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
067128	Inactive Flyash		67721	Hexachloroethane	20	µg/L	U	R	–	–
067128	Inactive Flyash		98953	Nitrobenzene	20	µg/L	U	R	–	–
067128	Inactive Flyash		87865	Pentachlorophenol	100	µg/L	U	R	–	–
061319	South Field	R	106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
061319	South Field		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
061319	South Field	R	95487	2–Methylphenol	20	µg/L	U	R	–	–
061319	South Field		95487	2–Methylphenol	20	µg/L	U	–	–	–
061319	South Field		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
061319	South Field	R	121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
061319	South Field		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
061319	South Field	R	95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
061319	South Field		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
061319	South Field	R	88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
061319	South Field	R	108394	3–Methylphenol	20	µg/L	U	R	–	–
061319	South Field		108394	3–Methylphenol	20	µg/L	U	–	–	–
061319	South Field	R	106445	4–Methylphenol	20	µg/L	U	R	–	–
061319	South Field		106445	4–Methylphenol	20	µg/L	U	–	–	–
061319	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
061319	South Field	R	118741	Hexachlorobenzene	20	µg/L	U	R	–	–
061319	South Field	R	87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
061319	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
061319	South Field	R	67721	Hexachloroethane	20	µg/L	U	R	–	–
061319	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
061319	South Field	R	98953	Nitrobenzene	20	µg/L	U	R	–	–
061319	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
061319	South Field		87865	Pentachlorophenol	20	µg/L	J	–	–	–
061319	South Field	R	87865	Pentachlorophenol	100	µg/L	U	R	–	–
061324	South Field		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
061324	South Field	R	106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
061324	South Field	R	95487	2–Methylphenol	20	µg/L	U	R	–	–
061324	South Field		95487	2–Methylphenol	20	µg/L	U	–	–	–
061324	South Field	R	121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
061324	South Field		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
061324	South Field	R	95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
061324	South Field		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
061324	South Field		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
061324	South Field	R	88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
061324	South Field		108394	3–Methylphenol	20	µg/L	U	–	–	–
061324	South Field	R	108394	3–Methylphenol	20	µg/L	U	R	–	–
061324	South Field	R	106445	4–Methylphenol	20	µg/L	U	R	–	–
061324	South Field		106445	4–Methylphenol	20	µg/L	U	–	–	–
061324	South Field	R	118741	Hexachlorobenzene	20	µg/L	U	R	–	–
061324	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
061324	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
061324	South Field	R	87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
061324	South Field	R	67721	Hexachloroethane	20	µg/L	U	R	–	–
061324	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
061324	South Field	R	98953	Nitrobenzene	20	µg/L	U	R	–	–
061324	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
061324	South Field		87865	Pentachlorophenol	16	µg/L	J	–	–	–
061324	South Field	R	87865	Pentachlorophenol	100	µg/L	U	R	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
061329	South Field		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
061329	South Field	R	106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
061329	South Field	R	95487	2–Methylphenol	20	µg/L	U	R	–	–
061329	South Field		95487	2–Methylphenol	20	µg/L	U	–	–	–
061329	South Field	R	121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
061329	South Field		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
061329	South Field		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
061329	South Field	R	95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
061329	South Field	R	88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
061329	South Field		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
061329	South Field		108394	3–Methylphenol	20	µg/L	U	–	–	–
061329	South Field	R	108394	3–Methylphenol	20	µg/L	U	R	–	–
061329	South Field	R	106445	4–Methylphenol	20	µg/L	U	R	–	–
061329	South Field		106445	4–Methylphenol	20	µg/L	U	–	–	–
061329	South Field	R	118741	Hexachlorobenzene	20	µg/L	U	R	–	–
061329	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
061329	South Field	R	87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
061329	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
061329	South Field	R	67721	Hexachloroethane	20	µg/L	U	R	–	–
061329	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
061329	South Field	R	98953	Nitrobenzene	20	µg/L	U	R	–	–
061329	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
061329	South Field		87865	Pentachlorophenol	13	µg/L	J	–	–	–
061329	South Field	R	87865	Pentachlorophenol	100	µg/L	U	R	–	–
061334	South Field		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
061334	South Field	R	106467	1,4–Dichlorobenzene	20	µg/L	U	R	–	–
061334	South Field	R	95487	2–Methylphenol	20	µg/L	U	R	–	–
061334	South Field		95487	2–Methylphenol	20	µg/L	U	–	–	–
061334	South Field		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
061334	South Field	R	121142	2,4–Dinitrotoluene	20	µg/L	U	R	–	–
061334	South Field		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
061334	South Field	R	95954	2,4,5–Trichlorophenol	100	µg/L	U	R	–	–
061334	South Field	R	88062	2,4,6–Trichlorophenol	20	µg/L	U	R	–	–
061334	South Field		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
061334	South Field		108394	3–Methylphenol	20	µg/L	U	–	–	–
061334	South Field	R	108394	3–Methylphenol	20	µg/L	U	R	–	–
061334	South Field	R	106445	4–Methylphenol	20	µg/L	U	R	–	–
061334	South Field		106445	4–Methylphenol	20	µg/L	U	–	–	–
061334	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
061334	South Field	R	118741	Hexachlorobenzene	20	µg/L	U	R	–	–
061334	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
061334	South Field	R	87683	Hexachlorobutadiene	20	µg/L	U	R	–	–
061334	South Field	R	67721	Hexachloroethane	20	µg/L	U	R	–	–
061334	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
061334	South Field	R	98953	Nitrobenzene	20	µg/L	U	R	–	–
061334	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
061334	South Field		87865	Pentachlorophenol	100	µg/L	U	–	–	–
061334	South Field	R	87865	Pentachlorophenol	100	µg/L	U	R	–	–
067326	South Field		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067326	South Field		95487	2–Methylphenol	20	µg/L	U	–	–	–
067326	South Field		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067326	South Field		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067326	South Field		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067326	South Field		108394	3–Methylphenol	20	µg/L	U	–	–	–

3527

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067326	South Field		106445	4–Methylphenol	20	µg/L	U	–	–	–
067326	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067326	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067326	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
067326	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
067326	South Field		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067335	South Field		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067335	South Field		95487	2–Methylphenol	20	µg/L	U	–	–	–
067335	South Field		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067335	South Field		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067335	South Field		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067335	South Field		108394	3–Methylphenol	20	µg/L	U	–	–	–
067335	South Field		106445	4–Methylphenol	20	µg/L	U	–	–	–
067335	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067335	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067335	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
067335	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
067335	South Field		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067360	South Field		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067360	South Field		95487	2–Methylphenol	20	µg/L	U	–	–	–
067360	South Field		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067360	South Field		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067360	South Field		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067360	South Field		108394	3–Methylphenol	20	µg/L	U	–	–	–
067360	South Field		106445	4–Methylphenol	20	µg/L	U	–	–	–
067360	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067360	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067360	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
067360	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
067360	South Field		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067361	South Field		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067361	South Field		95487	2–Methylphenol	20	µg/L	U	–	–	–
067361	South Field		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067361	South Field		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067361	South Field		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067361	South Field		108394	3–Methylphenol	20	µg/L	U	–	–	–
067361	South Field		106445	4–Methylphenol	20	µg/L	U	–	–	–
067361	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067361	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067361	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
067361	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
067361	South Field		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067362	South Field		106467	1,4–Dichlorobenzene	20	µg/L	U	–	–	–
067362	South Field		95487	2–Methylphenol	20	µg/L	U	–	–	–
067362	South Field		121142	2,4–Dinitrotoluene	20	µg/L	U	–	–	–
067362	South Field		95954	2,4,5–Trichlorophenol	100	µg/L	U	–	–	–
067362	South Field		88062	2,4,6–Trichlorophenol	20	µg/L	U	–	–	–
067362	South Field		108394	3–Methylphenol	20	µg/L	U	–	–	–
067362	South Field		106445	4–Methylphenol	20	µg/L	U	–	–	–
067362	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067362	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067362	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
067362	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
067362	South Field		87865	Pentachlorophenol	100	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067801	South Field		106467	1,4-Dichlorobenzene	20	µg/L	U	–	–	–
067801	South Field		95487	2-Methylphenol	20	µg/L	U	–	–	–
067801	South Field		121142	2,4-Dinitrotoluene	20	µg/L	U	–	–	–
067801	South Field		95954	2,4,5-Trichlorophenol	100	µg/L	U	–	–	–
067801	South Field		88062	2,4,6-Trichlorophenol	20	µg/L	U	–	–	–
067801	South Field		108394	3-Methylphenol	20	µg/L	U	R	–	–
067801	South Field		106445	4-Methylphenol	20	µg/L	U	–	–	–
067801	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067801	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067801	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
067801	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
067801	South Field		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067802	South Field		106467	1,4-Dichlorobenzene	20	µg/L	U	–	–	–
067802	South Field		95487	2-Methylphenol	20	µg/L	U	–	–	–
067802	South Field		121142	2,4-Dinitrotoluene	20	µg/L	U	–	–	–
067802	South Field		95954	2,4,5-Trichlorophenol	100	µg/L	U	–	–	–
067802	South Field		88062	2,4,6-Trichlorophenol	20	µg/L	U	–	–	–
067802	South Field		108394	3-Methylphenol	20	µg/L	U	R	–	–
067802	South Field		106445	4-Methylphenol	20	µg/L	U	–	–	–
067802	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067802	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067802	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
067802	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
067802	South Field		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067803	South Field		106467	1,4-Dichlorobenzene	20	µg/L	U	–	–	–
067803	South Field		95487	2-Methylphenol	20	µg/L	U	–	–	–
067803	South Field		121142	2,4-Dinitrotoluene	20	µg/L	U	–	–	–
067803	South Field		95954	2,4,5-Trichlorophenol	100	µg/L	U	–	–	–
067803	South Field		88062	2,4,6-Trichlorophenol	20	µg/L	U	–	–	–
067803	South Field		108394	3-Methylphenol	20	µg/L	U	R	–	–
067803	South Field		106445	4-Methylphenol	20	µg/L	U	–	–	–
067803	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067803	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067803	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
067803	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
067803	South Field		87865	Pentachlorophenol	100	µg/L	U	–	–	–
067804	South Field		106467	1,4-Dichlorobenzene	20	µg/L	U	–	–	–
067804	South Field		95487	2-Methylphenol	20	µg/L	U	–	–	–
067804	South Field		121142	2,4-Dinitrotoluene	20	µg/L	U	–	–	–
067804	South Field		95954	2,4,5-Trichlorophenol	100	µg/L	U	–	–	–
067804	South Field		88062	2,4,6-Trichlorophenol	20	µg/L	U	–	–	–
067804	South Field		108394	3-Methylphenol	20	µg/L	U	R	–	–
067804	South Field		106445	4-Methylphenol	20	µg/L	U	–	–	–
067804	South Field		118741	Hexachlorobenzene	20	µg/L	U	–	–	–
067804	South Field		87683	Hexachlorobutadiene	20	µg/L	U	–	–	–
067804	South Field		67721	Hexachloroethane	20	µg/L	U	–	–	–
067804	South Field		98953	Nitrobenzene	20	µg/L	U	–	–	–
067804	South Field		87865	Pentachlorophenol	100	µg/L	U	–	–	–

Table A-6. Fernald Environmental Management Project Pesticide/PCB Characterization TCLP Data

3527

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067245	Solid Waste Landfill		94757	2,4-D	10	µg/L	U	–	–	–
067245	Solid Waste Landfill		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067245	Solid Waste Landfill		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067245	Solid Waste Landfill		72208	Endrin	0.1	µg/L	U	–	–	–
067245	Solid Waste Landfill		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067245	Solid Waste Landfill		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067245	Solid Waste Landfill		76448	Heptachlor	0.05	µg/L	U	–	–	–
067245	Solid Waste Landfill		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067245	Solid Waste Landfill		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067245	Solid Waste Landfill		8001352	Toxaphene	1	µg/L	U	–	–	–
067247	Solid Waste Landfill		94757	2,4-D	10	µg/L	U	–	–	–
067247	Solid Waste Landfill		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067247	Solid Waste Landfill		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067247	Solid Waste Landfill		72208	Endrin	0.1	µg/L	U	–	–	–
067247	Solid Waste Landfill		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067247	Solid Waste Landfill		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067247	Solid Waste Landfill		76448	Heptachlor	0.05	µg/L	U	–	–	–
067247	Solid Waste Landfill		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067247	Solid Waste Landfill		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067247	Solid Waste Landfill		8001352	Toxaphene	1	µg/L	U	–	–	–
067261	Solid Waste Landfill		94757	2,4-D	10	µg/L	U	–	–	–
067261	Solid Waste Landfill		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067261	Solid Waste Landfill		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067261	Solid Waste Landfill		72208	Endrin	0.1	µg/L	U	–	–	–
067261	Solid Waste Landfill		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067261	Solid Waste Landfill		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067261	Solid Waste Landfill		76448	Heptachlor	0.05	µg/L	U	–	–	–
067261	Solid Waste Landfill		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067261	Solid Waste Landfill		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067261	Solid Waste Landfill		8001352	Toxaphene	1	µg/L	U	–	–	–
067264	Solid Waste Landfill		94757	2,4-D	10	µg/L	U	–	–	–
067264	Solid Waste Landfill		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067264	Solid Waste Landfill		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067264	Solid Waste Landfill		72208	Endrin	0.1	µg/L	U	–	–	–
067264	Solid Waste Landfill		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067264	Solid Waste Landfill		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067264	Solid Waste Landfill		76448	Heptachlor	0.05	µg/L	U	–	–	–
067264	Solid Waste Landfill		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067264	Solid Waste Landfill		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067264	Solid Waste Landfill		8001352	Toxaphene	1	µg/L	U	–	–	–
067301	Solid Waste Landfill		94757	2,4-D	10	µg/L	U	–	–	–
067301	Solid Waste Landfill		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067301	Solid Waste Landfill	DL	5103719	alpha-Chlordane	2	µg/L	U	R	–	–
067301	Solid Waste Landfill		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067301	Solid Waste Landfill		72208	Endrin	0.1	µg/L	U	–	–	–
067301	Solid Waste Landfill	DL	72208	Endrin	0.4	µg/L	U	R	–	–
067301	Solid Waste Landfill		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067301	Solid Waste Landfill	DL	58899	gamma-BHC (Lindane)	0.2	µg/L	U	R	–	–
067301	Solid Waste Landfill	DL	5103742	gamma-Chlordane	2	µg/L	U	R	–	–
067301	Solid Waste Landfill		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067301	Solid Waste Landfill	DL	76448	Heptachlor	0.2	µg/L	U	R	–	–
067301	Solid Waste Landfill		76448	Heptachlor	0.05	µg/L	U	–	–	–
067301	Solid Waste Landfill		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067301	Solid Waste Landfill	DL	1024573	Heptachlor epoxide	0.2	µg/L	U	R	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067301	Solid Waste Landfill	DL	72435	Methoxychlor	2	µg/L	U	R	–	–
067301	Solid Waste Landfill		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067301	Solid Waste Landfill	DL	8001352	Toxaphene	4	µg/L	U	R	–	–
067301	Solid Waste Landfill		8001352	Toxaphene	1	µg/L	U	–	–	–
067303	Solid Waste Landfill		94757	2,4–D	10	µg/L	U	–	–	–
067303	Solid Waste Landfill		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067303	Solid Waste Landfill		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067303	Solid Waste Landfill		72208	Endrin	0.1	µg/L	U	–	–	–
067303	Solid Waste Landfill		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067303	Solid Waste Landfill		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067303	Solid Waste Landfill		76448	Heptachlor	0.05	µg/L	U	–	–	–
067303	Solid Waste Landfill		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067303	Solid Waste Landfill		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067303	Solid Waste Landfill		8001352	Toxaphene	1	µg/L	U	–	–	–
067309	Solid Waste Landfill		94757	2,4–D	10	µg/L	U	–	–	–
067309	Solid Waste Landfill		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067318	Solid Waste Landfill		94757	2,4–D	10	µg/L	U	–	–	–
067318	Solid Waste Landfill		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067318	Solid Waste Landfill		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067318	Solid Waste Landfill		57749	Chlordane	0.5	µg/L	U	–	–	–
067318	Solid Waste Landfill		72208	Endrin	0.1	µg/L	U	–	–	–
067318	Solid Waste Landfill		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067318	Solid Waste Landfill		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067318	Solid Waste Landfill		76448	Heptachlor	0.05	µg/L	U	–	–	–
067318	Solid Waste Landfill		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067318	Solid Waste Landfill		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067318	Solid Waste Landfill		8001352	Toxaphene	1	µg/L	U	–	–	–
067319	Solid Waste Landfill		94757	2,4–D	10	µg/L	U	–	–	–
067319	Solid Waste Landfill		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067319	Solid Waste Landfill		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067319	Solid Waste Landfill		57749	Chlordane	0.5	µg/L	U	–	–	–
067319	Solid Waste Landfill		72208	Endrin	0.1	µg/L	U	–	–	–
067319	Solid Waste Landfill		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067319	Solid Waste Landfill		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067319	Solid Waste Landfill		76448	Heptachlor	0.05	µg/L	U	–	–	–
067319	Solid Waste Landfill		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067319	Solid Waste Landfill		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067319	Solid Waste Landfill		8001352	Toxaphene	1	µg/L	U	–	–	–
067402	Solid Waste Landfill		94757	2,4–D	10	µg/L	U	–	–	–
067402	Solid Waste Landfill		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067402	Solid Waste Landfill		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067402	Solid Waste Landfill		72208	Endrin	0.1	µg/L	U	–	–	–
067402	Solid Waste Landfill		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067402	Solid Waste Landfill		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067402	Solid Waste Landfill		76448	Heptachlor	0.05	µg/L	U	–	–	–
067402	Solid Waste Landfill		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067402	Solid Waste Landfill		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067402	Solid Waste Landfill		8001352	Toxaphene	1	µg/L	U	–	–	–
067003	Lime Sludge Pond		94757	2,4–D	12	µg/L	U	–	–	–
067003	Lime Sludge Pond		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067003	Lime Sludge Pond		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067003	Lime Sludge Pond		72208	Endrin	0.1	µg/L	U	–	–	–
067003	Lime Sludge Pond		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067003	Lime Sludge Pond		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067003	Lime Sludge Pond		76448	Heptachlor	0.05	µg/L	U	–	–	–
067003	Lime Sludge Pond		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067003	Lime Sludge Pond		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067003	Lime Sludge Pond		8001352	Toxaphene	1	µg/L	U	–	–	–
067007	Lime Sludge Pond		94757	2,4-D	12	µg/L	U	–	–	–
067007	Lime Sludge Pond		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067007	Lime Sludge Pond		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067007	Lime Sludge Pond		72208	Endrin	0.1	µg/L	U	–	–	–
067007	Lime Sludge Pond		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067007	Lime Sludge Pond		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067007	Lime Sludge Pond		76448	Heptachlor	0.05	µg/L	U	–	–	–
067007	Lime Sludge Pond		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067007	Lime Sludge Pond		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067007	Lime Sludge Pond		8001352	Toxaphene	1	µg/L	U	–	–	–
067150	Active Flyash		94757	2,4-D	10	µg/L	U	–	–	–
067150	Active Flyash		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067150	Active Flyash		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067150	Active Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067150	Active Flyash		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067150	Active Flyash		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067150	Active Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067150	Active Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067150	Active Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067150	Active Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067157	Active Flyash		94757	2,4-D	10	µg/L	U	–	–	–
067157	Active Flyash		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067157	Active Flyash		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067157	Active Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067157	Active Flyash		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067157	Active Flyash		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067157	Active Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067157	Active Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067157	Active Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067157	Active Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067162	Active Flyash		94757	2,4-D	10	µg/L	U	–	–	–
067162	Active Flyash		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067162	Active Flyash		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067162	Active Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067162	Active Flyash		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067162	Active Flyash		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067162	Active Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067162	Active Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067162	Active Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067162	Active Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067170	Active Flyash		94757	2,4-D	10	µg/L	U	–	–	–
067170	Active Flyash		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067170	Active Flyash		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067170	Active Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067170	Active Flyash		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067170	Active Flyash		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067170	Active Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067170	Active Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067170	Active Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067170	Active Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067186	Active Flyash		94757	2,4–D	10	µg/L	U	–	–	–
067186	Active Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067186	Active Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067186	Active Flyash	DL	5103719	alpha–Chlordane	1	µg/L	U	R	–	–
067186	Active Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067186	Active Flyash	DL	72208	Endrin	0.2	µg/L	U	R	–	–
067186	Active Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067186	Active Flyash	DL	58899	gamma–BHC (Lindane)	0.1	µg/L	U	R	–	–
067186	Active Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067186	Active Flyash	DL	5103742	gamma–Chlordane	1	µg/L	U	R	–	–
067186	Active Flyash	DL	76448	Heptachlor	0.1	µg/L	U	R	–	–
067186	Active Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067186	Active Flyash	DL	1024573	Heptachlor epoxide	0.1	µg/L	U	R	–	–
067186	Active Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067186	Active Flyash	DL	72435	Methoxychlor	1	µg/L	U	R	–	–
067186	Active Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067186	Active Flyash	DL	8001352	Toxaphene	2	µg/L	U	R	–	–
067186	Active Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067189	Active Flyash		94757	2,4–D	10	µg/L	U	–	–	–
067189	Active Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067189	Active Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067189	Active Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067189	Active Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067189	Active Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067189	Active Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067189	Active Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067189	Active Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067189	Active Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067197	Active Flyash		94757	2,4–D	10	µg/L	U	–	–	–
067197	Active Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067197	Active Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067197	Active Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067197	Active Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067197	Active Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067197	Active Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067197	Active Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067197	Active Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067197	Active Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067224	Active Flyash		94757	2,4–D	10	µg/L	U	–	–	–
067224	Active Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067224	Active Flyash	R	5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067224	Active Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	R	–	–
067224	Active Flyash		72208	Endrin	0.44	µg/L	BX	R	–	–
067224	Active Flyash	R	72208	Endrin	0.1	µg/L	U	JB	–	–
067224	Active Flyash	R	58899	gamma–BHC (Lindane)	0.05	µg/L	U	JB	–	–
067224	Active Flyash		58899	gamma–BHC (Lindane)	0.2	µg/L	BX	R	–	–
067224	Active Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	R	–	–
067224	Active Flyash	R	5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067224	Active Flyash	R	76448	Heptachlor	0.05	µg/L	U	JB	–	–
067224	Active Flyash		76448	Heptachlor	0.16	µg/L	BX	R	–	–
067224	Active Flyash	R	1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067224	Active Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	R	–	–
067224	Active Flyash	R	72435	Methoxychlor	0.5	µg/L	U	–	–	–
067224	Active Flyash		72435	Methoxychlor	0.5	µg/L	U	R	–	–

3527

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067224	Active Flyash	R	8001352	Toxaphene	1	µg/L	U	–	–	–
067224	Active Flyash		8001352	Toxaphene	1	µg/L	U	R	–	–
067225	Active Flyash		94757	2,4-D	10	µg/L	U	–	–	–
067225	Active Flyash		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067225	Active Flyash	R	5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067225	Active Flyash		5103719	alpha-Chlordane	0.5	µg/L	U	R	–	–
067225	Active Flyash		72208	Endrin	0.45	µg/L	BX	R	–	–
067225	Active Flyash	R	72208	Endrin	0.1	µg/L	U	JB	–	–
067225	Active Flyash		58899	gamma-BHC (Lindane)	0.18	µg/L	BX	R	–	–
067225	Active Flyash	R	58899	gamma-BHC (Lindane)	0.05	µg/L	U	JB	–	–
067225	Active Flyash	R	5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067225	Active Flyash		5103742	gamma-Chlordane	0.5	µg/L	U	R	–	–
067225	Active Flyash		76448	Heptachlor	0.16	µg/L	BX	R	–	–
067225	Active Flyash	R	76448	Heptachlor	0.05	µg/L	U	JB	–	–
067225	Active Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	R	–	–
067225	Active Flyash	R	1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067225	Active Flyash	R	72435	Methoxychlor	0.5	µg/L	U	–	–	–
067225	Active Flyash		72435	Methoxychlor	0.5	µg/L	U	R	–	–
067225	Active Flyash	R	8001352	Toxaphene	1	µg/L	U	–	–	–
067225	Active Flyash		8001352	Toxaphene	1	µg/L	U	R	–	–
067507	Active Flyash		94757	2,4-D	10	µg/L	U	–	–	–
067507	Active Flyash		94757	2,4-D	10	µg/L	U	–	–	–
067507	Active Flyash		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067507	Active Flyash		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067507	Active Flyash		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067507	Active Flyash		57749	Chlordane	0.5	µg/L	U	–	–	–
067507	Active Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067507	Active Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067507	Active Flyash	DL	72208	Endrin	0.2	µg/L	U	R	–	–
067507	Active Flyash		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067507	Active Flyash		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067507	Active Flyash	DL	58899	gamma-BHC (Lindane)	0.1	µg/L	U	R	–	–
067507	Active Flyash		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067507	Active Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067507	Active Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067507	Active Flyash	DL	72435	Methoxychlor	1	µg/L	U	R	–	–
067507	Active Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067507	Active Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067507	Active Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067507	Active Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067507	Active Flyash	DL	8001352	Toxaphene	2	µg/L	U	R	–	–
067016	Inactive Flyash		94757	2,4-D	12	µg/L	U	–	–	–
067016	Inactive Flyash		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067016	Inactive Flyash		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–
067016	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067016	Inactive Flyash		58899	gamma-BHC (Lindane)	0.05	µg/L	U	–	–	–
067016	Inactive Flyash		5103742	gamma-Chlordane	0.5	µg/L	U	–	–	–
067016	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067016	Inactive Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067016	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067016	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067021	Inactive Flyash		94757	2,4-D	12	µg/L	U	–	–	–
067021	Inactive Flyash		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067021	Inactive Flyash		5103719	alpha-Chlordane	0.5	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067021	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067021	Inactive Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067021	Inactive Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067021	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067021	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067021	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067025	Inactive Flyash		94757	2,4–D	12	µg/L	U	–	–	–
067025	Inactive Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067025	Inactive Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067025	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067025	Inactive Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067025	Inactive Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067025	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067025	Inactive Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067025	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067025	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067038	Inactive Flyash		94757	2,4–D	12	µg/L	U	–	–	–
067038	Inactive Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067038	Inactive Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067038	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067038	Inactive Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067038	Inactive Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067038	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067038	Inactive Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067038	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067038	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067051	Inactive Flyash		94757	2,4–D	12	µg/L	U	–	–	–
067051	Inactive Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067051	Inactive Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067051	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067051	Inactive Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067051	Inactive Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067051	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067051	Inactive Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067051	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067051	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067058	Inactive Flyash		94757	2,4–D	12	µg/L	U	–	–	–
067058	Inactive Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067058	Inactive Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067058	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067058	Inactive Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067058	Inactive Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067058	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067058	Inactive Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067058	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067058	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067065	Inactive Flyash		94757	2,4–D	12	µg/L	U	–	–	–
067065	Inactive Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067065	Inactive Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067065	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067065	Inactive Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067065	Inactive Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067065	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067065	Inactive Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067065	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067065	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067099	Inactive Flyash		94757	2,4–D	11	µg/L	U	–	–	–
067099	Inactive Flyash		93721	2,4,5–TP (Silvex)	2.1	µg/L	U	–	–	–
067099	Inactive Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067099	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067099	Inactive Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067099	Inactive Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067099	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067099	Inactive Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067099	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067099	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067114	Inactive Flyash		94757	2,4–D	10	µg/L	U	–	–	–
067114	Inactive Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067114	Inactive Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067114	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067114	Inactive Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067114	Inactive Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067114	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067114	Inactive Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067114	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067114	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067115	Inactive Flyash		94757	2,4–D	10	µg/L	U	–	–	–
067115	Inactive Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067115	Inactive Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067115	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067115	Inactive Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067115	Inactive Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067115	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067115	Inactive Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067115	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067115	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067124	Inactive Flyash		94757	2,4–D	10	µg/L	U	–	–	–
067124	Inactive Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067124	Inactive Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067124	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067124	Inactive Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067124	Inactive Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067124	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067124	Inactive Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067124	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067124	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
067128	Inactive Flyash		94757	2,4–D	10	µg/L	U	–	–	–
067128	Inactive Flyash		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067128	Inactive Flyash		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067128	Inactive Flyash		72208	Endrin	0.1	µg/L	U	–	–	–
067128	Inactive Flyash		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067128	Inactive Flyash		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067128	Inactive Flyash		76448	Heptachlor	0.05	µg/L	U	–	–	–
067128	Inactive Flyash		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067128	Inactive Flyash		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067128	Inactive Flyash		8001352	Toxaphene	1	µg/L	U	–	–	–
061319	South Field		94757	2,4–D	12	µg/L	U	–	–	–
061319	South Field		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
061319	South Field		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
061319	South Field		72208	Endrin	0.1	µg/L	U	–	–	–
061319	South Field		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
061319	South Field		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
061319	South Field		76448	Heptachlor	0.05	µg/L	U	–	–	–
061319	South Field		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
061319	South Field		72435	Methoxychlor	0.5	µg/L	U	–	–	–
061319	South Field		8001352	Toxaphene	1	µg/L	U	–	–	–
061324	South Field		94757	2,4–D	12	µg/L	U	–	–	–
061324	South Field		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
061324	South Field		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
061324	South Field		72208	Endrin	0.1	µg/L	U	–	–	–
061324	South Field		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
061324	South Field		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
061324	South Field		76448	Heptachlor	0.05	µg/L	U	–	–	–
061324	South Field		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
061324	South Field		72435	Methoxychlor	0.5	µg/L	U	–	–	–
061324	South Field		8001352	Toxaphene	1	µg/L	U	–	–	–
061329	South Field		94757	2,4–D	12	µg/L	U	–	–	–
061329	South Field		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
061329	South Field		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
061329	South Field		72208	Endrin	0.1	µg/L	U	–	–	–
061329	South Field		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
061329	South Field		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
061329	South Field		76448	Heptachlor	0.05	µg/L	U	–	–	–
061329	South Field		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
061329	South Field		72435	Methoxychlor	0.5	µg/L	U	–	–	–
061329	South Field		8001352	Toxaphene	1	µg/L	U	–	–	–
061334	South Field		94757	2,4–D	12	µg/L	U	–	–	–
061334	South Field		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
061334	South Field		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
061334	South Field		72208	Endrin	0.1	µg/L	U	–	–	–
061334	South Field		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
061334	South Field		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
061334	South Field		76448	Heptachlor	0.05	µg/L	U	–	–	–
061334	South Field		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
061334	South Field		72435	Methoxychlor	0.5	µg/L	U	–	–	–
061334	South Field		8001352	Toxaphene	1	µg/L	U	–	–	–
067326	South Field		94757	2,4–D	10	µg/L	U	–	–	–
067326	South Field		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067326	South Field		5103719	alpha–Chlordane	0.5	µg/L	U	–	–	–
067326	South Field		72208	Endrin	0.1	µg/L	U	–	–	–
067326	South Field		58899	gamma–BHC (Lindane)	0.05	µg/L	U	–	–	–
067326	South Field		5103742	gamma–Chlordane	0.5	µg/L	U	–	–	–
067326	South Field		76448	Heptachlor	0.05	µg/L	U	–	–	–
067326	South Field		1024573	Heptachlor epoxide	0.05	µg/L	U	–	–	–
067326	South Field		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067326	South Field		8001352	Toxaphene	1	µg/L	U	–	–	–
067335	South Field		94757	2,4–D	10	µg/L	U	–	–	–
067335	South Field		93721	2,4,5–TP (Silvex)	1.8	µg/L	U	–	–	–
067335	South Field	R	5103719	alpha–Chlordane	0.62	µg/L	U	R	–	–
067335	South Field		5103719	alpha–Chlordane	0.5	µg/L	U	J	–	–
067335	South Field		72208	Endrin	0.1	µg/L	U	–	–	–
067335	South Field	R	72208	Endrin	0.12	µg/L	U	R	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067335	South Field		58899	gamma-BHC (Lindane)	0.05	µg/L	U	J	–	–
067335	South Field	R	58899	gamma-BHC (Lindane)	0.062	µg/L	U	R	–	–
067335	South Field	R	5103742	gamma-Chlordane	0.62	µg/L	U	R	–	–
067335	South Field		5103742	gamma-Chlordane	0.5	µg/L	U	J	–	–
067335	South Field	R	76448	Heptachlor	0.062	µg/L	U	R	–	–
067335	South Field		76448	Heptachlor	0.05	µg/L	U	–	–	–
067335	South Field		1024573	Heptachlor epoxide	0.05	µg/L	U	J	–	–
067335	South Field	R	1024573	Heptachlor epoxide	0.062	µg/L	U	R	–	–
067335	South Field		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067335	South Field	R	72435	Methoxychlor	0.62	µg/L	U	R	–	–
067335	South Field		8001352	Toxaphene	1	µg/L	U	–	–	–
067335	South Field	R	8001352	Toxaphene	1.2	µg/L	U	R	–	–
067360	South Field		94757	2,4-D	10	µg/L	U	–	–	–
067360	South Field		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067360	South Field		5103719	alpha-Chlordane	0.5	µg/L	U	J	–	–
067360	South Field	R	5103719	alpha-Chlordane	0.5	µg/L	U	R	–	–
067360	South Field	R	72208	Endrin	0.1	µg/L	U	R	–	–
067360	South Field		72208	Endrin	0.1	µg/L	U	–	–	–
067360	South Field		58899	gamma-BHC (Lindane)	0.05	µg/L	U	J	–	–
067360	South Field	R	58899	gamma-BHC (Lindane)	0.05	µg/L	U	R	–	–
067360	South Field		5103742	gamma-Chlordane	0.5	µg/L	U	J	–	–
067360	South Field	R	5103742	gamma-Chlordane	0.5	µg/L	U	R	–	–
067360	South Field		76448	Heptachlor	0.05	µg/L	U	–	–	–
067360	South Field	R	76448	Heptachlor	0.05	µg/L	U	R	–	–
067360	South Field		1024573	Heptachlor epoxide	0.05	µg/L	U	J	–	–
067360	South Field	R	1024573	Heptachlor epoxide	0.05	µg/L	U	R	–	–
067360	South Field	R	72435	Methoxychlor	0.5	µg/L	U	R	–	–
067360	South Field		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067360	South Field	R	8001352	Toxaphene	1	µg/L	U	R	–	–
067360	South Field		8001352	Toxaphene	1	µg/L	U	–	–	–
067361	South Field		94757	2,4-D	10	µg/L	U	–	–	–
067361	South Field		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067361	South Field		5103719	alpha-Chlordane	0.5	µg/L	U	J	–	–
067361	South Field	R	5103719	alpha-Chlordane	0.5	µg/L	U	R	–	–
067361	South Field		72208	Endrin	0.1	µg/L	U	–	–	–
067361	South Field	R	72208	Endrin	0.1	µg/L	U	R	–	–
067361	South Field	R	58899	gamma-BHC (Lindane)	0.05	µg/L	U	R	–	–
067361	South Field		58899	gamma-BHC (Lindane)	0.05	µg/L	U	J	–	–
067361	South Field		5103742	gamma-Chlordane	0.5	µg/L	U	J	–	–
067361	South Field	R	5103742	gamma-Chlordane	0.5	µg/L	U	R	–	–
067361	South Field	R	76448	Heptachlor	0.05	µg/L	U	R	–	–
067361	South Field		76448	Heptachlor	0.05	µg/L	U	–	–	–
067361	South Field		1024573	Heptachlor epoxide	0.05	µg/L	U	J	–	–
067361	South Field	R	1024573	Heptachlor epoxide	0.05	µg/L	U	R	–	–
067361	South Field	R	72435	Methoxychlor	0.5	µg/L	U	R	–	–
067361	South Field		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067361	South Field		8001352	Toxaphene	1	µg/L	U	–	–	–
067361	South Field	R	8001352	Toxaphene	1	µg/L	U	R	–	–
067362	South Field		94757	2,4-D	10	µg/L	U	–	–	–
067362	South Field		93721	2,4,5-TP (Silvex)	1.8	µg/L	U	–	–	–
067362	South Field	R	5103719	alpha-Chlordane	0.5	µg/L	U	R	–	–
067362	South Field		5103719	alpha-Chlordane	0.5	µg/L	U	J	–	–
067362	South Field	R	72208	Endrin	0.1	µg/L	U	R	–	–
067362	South Field		72208	Endrin	0.1	µg/L	U	–	–	–

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers			
							Lab	Q3	Q4	Q5
067362	South Field	R	58899	gamma–BHC (Lindane)	0.05	µg/L	U	R	–	–
067362	South Field		58899	gamma–BHC (Lindane)	0.05	µg/L	U	J	–	–
067362	South Field		5103742	gamma–Chlordane	0.5	µg/L	U	J	–	–
067362	South Field	R	5103742	gamma–Chlordane	0.5	µg/L	U	R	–	–
067362	South Field	R	76448	Heptachlor	0.05	µg/L	U	R	–	–
067362	South Field		76448	Heptachlor	0.05	µg/L	U	–	–	–
067362	South Field		1024573	Heptachlor epoxide	0.05	µg/L	U	J	–	–
067362	South Field	R	1024573	Heptachlor epoxide	0.05	µg/L	U	R	–	–
067362	South Field	R	72435	Methoxychlor	0.5	µg/L	U	R	–	–
067362	South Field		72435	Methoxychlor	0.5	µg/L	U	–	–	–
067362	South Field	R	8001352	Toxaphene	1	µg/L	U	R	–	–
067362	South Field		8001352	Toxaphene	1	µg/L	U	–	–	–

3527

FEMP Sample No.	Area	Suffix	CAS No.	Constituent	Result	Units	Qualifiers Lab	Q3	Q4	Q5
067397	Solid Waste Landfill	D	0-010	Alkalinity as CaCO3	48	mg/l		R	–	–
067397	Solid Waste Landfill		0-010	Alkalinity as CaCO3	48	mg/l		–	–	–
067397	Solid Waste Landfill		7664417	Ammonia	0.1	mg/l	U	–	–	–
067397	Solid Waste Landfill		16887006	Chloride	0.96	mg/l		–	–	–
067397	Solid Waste Landfill		0-002	Fluoride	1.5	mg/l		–	–	–
067397	Solid Waste Landfill		14797558	Nitrate	5.58	mg/l		–	–	–
067397	Solid Waste Landfill		0-259	Oxidation-Reduction Potential	243.7	mg/l		–	–	–
067397	Solid Waste Landfill	D	0-259	Oxidation-Reduction Potential	241.4	mg/l		R	–	–
067397	Solid Waste Landfill		1-006	pH	7.28	Std Unit		–	–	–
067397	Solid Waste Landfill	D	1-006	pH	7.2	Std Unit		R	–	–
067397	Solid Waste Landfill		14265442	Phosphate	0.04	mg/l		–	–	–
067397	Solid Waste Landfill		12143452	Sulfate	9.19	mg/l		–	–	–
067397	Solid Waste Landfill		1-012	Total Organic Carbon	8.13	mg/l		–	–	–
067402	Solid Waste Landfill		0-010	Alkalinity as CaCO3	45	mg/l		–	–	–
067402	Solid Waste Landfill		7664417	Ammonia	0.102	mg/l		–	–	–
067402	Solid Waste Landfill		16887006	Chloride	0.93	mg/l		–	–	–
067402	Solid Waste Landfill		0-002	Fluoride	1.4	mg/l		–	–	–
067402	Solid Waste Landfill		14797558	Nitrate	5.58	mg/l		–	–	–
067402	Solid Waste Landfill		1-006	pH	7.22	Std Unit		–	–	–
067402	Solid Waste Landfill		14265442	Phosphate	0.03	mg/l		–	–	–
067402	Solid Waste Landfill		12143452	Sulfate	16.5	mg/l		–	–	–
067402	Solid Waste Landfill		1-012	Total Organic Carbon	4.38	mg/l		–	–	–
067507	Active Flyash	D	1-013	Ignitability	110	Deg C	U	R	–	–
067507	Active Flyash	D	1-006	pH	6.89	Std Unit		R	–	–

Table A-8. Validation Qualifier Codes Used with Characterization Data

Codes related to Identification:

U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

(No Code) = Confirmed identification.

[IDL is defined as the lowest measurable quantity above that of random noise multiplied times a factor of two (2)]

R = Results unusable. Analyte may or may not be present in the sample. Supporting data necessary to confirm result. Resampling and reanalysis are necessary.

N = Tentative identification. Consider present. Special methods may be needed to confirm its presence ar absence in future sampling efforts.

Codes Related To Quantitation:

J = Analyte present. Reported value may not be accurate or precise.

UJ = Not detected, quantitation limit may be inaccurate or imprecise.

Codes Related to Radiochemical Samples:

J = Analyte present. Reported value may not be accurate or precise. Qualifier is applied where:

- Calculated total uranium value is outside the acceptance limits.
- Calculated percent enrichment value is outside the acceptance limits.
- Calculated U-234 to U-238 activity is outside the acceptance limits.

R = Result unusable. Analyte may or may not be present in the sample. Qualifier is applied where QC data not located or where QC data exceeds control limits. Supporting data necessary to confirm result. Resampling and reanalysis are necessary.

TABLE A-9

SUMMARY STATISTICAL ANALYSIS - SOLID WASTE LANDFILL CHEMICAL CONSTITUENTS (CHARACTERIZATION DATA)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a] (µg/L)	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef. of Var. (%)
2-Butanone	8 /8	1.000 - 7.000	N	3.625	4.000	2.337	4.913	53.038
Aluminum	5 /5	631.00 -1260.0	L[f]	923.37	967.00	713.86	1194.4	25.787
Arsenic	1 /1	2.100 - 2.100	[c]	[c]	2.100	2.100[c]	2.100[c]	NA
Barium	12 /12	63.700 -1260.0	L[e]	755.35	943.50	362.59	2522.0[d]	60.789
Cadmium	4 /4	5.300 -10.600	L[f]	6.899	6.350	4.854[d]	9.806	32.909
Calcium	4 /4	17300 - 20100	L[f]	18970	19300	17561	20492[d]	6.417
Chromium	6 /6	79.900 -92.900	L[f]	84.468	83.000	80.608	88.513	5.799
Copper	1 /1	12.800 -12.800	[c]	[c]	12.800	12.800[c]	12.800[c]	NA
Iron	4 /4	472.00 -1020.0	L[f]	774.28	865.00	518.17	1157.0[d]	29.350
Lead	4 /4	2.300 -89.500	L[f]	14.680	40.350	1.380[d]	156.20[d]	109.07
Magnesium	4 /4	4170.0 -4760.0	L[f]	4489.8	4525.0	4203.5	4795.5[d]	5.541
Manganese	4 /4	3.500 - 9.600	L[f]	6.809	8.000	3.998	11.594[d]	36.183
Pentachlorophenol	1 /1	8.000 - 8.000	[c]	[c]	8.000	8.000[c]	8.000[c]	NA
Potassium	2 /2	272.00 -489.00	[c]	[c]	380.50	272.00[c]	489.00[c]	40.326
Selenium	6 /6	110.00 -377.00	L[f]	157.89	140.00	109.99[d]	226.65	57.687
Silicon	5 /5	2937.0 -4340.0	L[f]	3442.8	3460.0	2951.8	4015.4	16.540
Silver	6 /6	72.600 -81.400	L[f]	75.613	74.900	73.098	78.214	4.187

FER/OU2TS/WP758.A9/7-12-92

TABLE A-9
(Continued)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a] (µg/L)	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef. of Var. (%)
Sodium	4 /4	971.00 -2280.0	L[f]	1470.5	1465.0	958.38[d]	2256.3	36.435
Tetrachloroethene	5 /5	1.000 -30.000	L[f]	1.974	1.000	0.463[d]	8.418	190.72
Zinc	4 /4	68.100 -263.00	L[f]	122.18	123.35	55.292[d]	269.98[d]	64.844

NA - Not Applicable

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Distribution failed the Correlation Coefficient Test and therefore could not be definitively determined. It is treated as log-normal.

[f]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal.

TABLE A-10

SUMMARY STATISTICAL ANALYSIS - LIME SLUDGE PONDS CHEMICAL CONSTITUENTS
(CHARACTERIZATION DATA)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef. of Var. (%)
1,1-Dichloroethene	1 /1	11.000 -11.000	c	c	11.000	11.000[c]	11.000[c]	NA
2-Butanone	1 /1	6.000 - 6.000	c	c	6.000	6.000[c]	6.000[c]	NA
Acetone	1 /1	1.000 - 1.000	c	c	1.000	1.000[c]	1.000[c]	NA
Arsenic	2 /2	380.00 -499.00	c	c	439.50	380.00[c]	499.00[c]	19.146
Barium	2 /2	513.00 -639.00	c	c	576.00	513.00[c]	639.00[c]	15.468
Bromodichloromethane	1 /1	2.000 - 2.000	c	c	2.000	2.000[c]	2.000[c]	NA
Cadmium	2 /2	34.600 -43.800	c	c	39.200	34.600[c]	43.800[c]	16.595
Chromium	2 /2	91.800 -111.00	c	c	101.40	91.800[c]	111.00[c]	13.389
Lead	2 /2	204.00 -276.00	c	c	240.00	204.00[c]	276.00[c]	21.213
Selenium	1 /1	475.00 -475.00	c	c	475.00	475.00[c]	475.00[c]	NA
Silver	2 /2	145.00 -154.00	c	c	149.50	145.00[c]	154.00[c]	4.257
Tetrachloroethene	1 /1	2.000 - 2.000	c	c	2.000	2.000[c]	2.000[c]	NA
Toluene	1 /1	1.000 - 1.000	c	c	1.000	1.000[c]	1.000[c]	NA

NA - Not applicable

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

FER/OU2TS/WP758.A10/7-12-92

TABLE A-11

SUMMARY STATISTICAL ANALYSIS - SOUTH FIELD - CHEMICAL CONSTITUENTS (CHARACTERIZATION DATA)

Chemical	Frequency of Dectection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef. of Var. (%)
2-Butanone	12 /12	1.000 -10.000	L[e]	3.000	2.000	2.019	4.313	77.850
Arsenic	3 /3	0.120 - 0.325	L[f]	0.221	0.277	0.090[d]	0.545[d]	44.552
Barium	8 /8	0.512 -616.00	L[e]	77.729	0.919	0.056[d]	16488[d]	279.81
Barium[g]	7 /7	0.512 - 1.190	N	0.833	0.867	0.646	1.020	30.548
Cadmium	6 /8	0.002 - 7.000	L[f]	0.019	0.014	0.004	0.103	279.46
Chloroform	1 /1	1.000 - 1.000	[c]	[c]	1.000	1.000[c]	1.000[c]	NA
Chromium	8 /8	0.021 -75.100	L[e]	9.465	0.095	0.003[d]	6133.2[d]	280.20
Chromium[g]	7 /7	0.021 - 0.122	N	0.088	0.092	0.063	0.113	38.493
Lead	4 /4	0.083 -81.100	L[f]	0.632	0.154	0.014[d]	28.927	198.72
Pentachlorophenol	3 /3	13.000 -20.000	L[f]	16.083	16.000	11.185[d]	23.126[d]	21.501
Selenium	6 /6	0.097 -138.00	L[f]	0.410	0.140	0.039[d]	4.305	243.56
Silver	8 /8	0.024 -66.200	L[e]	8.362	0.112	0.003[d]	4357.0[d]	279.48
Silver[g]	7 /7	0.024 - 0.142	N	0.099	0.095	0.069	0.130	41.904
Tetrachloroethene	1 /1	1.000 - 1.000	[c]	[c]	1.000	1.000[c]	1.000[c]	NA

NA - Not applicable.

TABLE A-11
(Continued)

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Distribution failed the Correlation Coefficient Test and therefore could not be definitively determined. It is treated as log-normal.

[f]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal

[g]Statistics for constituent with outliers rejected.

TABLE A-12

SUMMARY STATISTICAL ANALYSIS - LIME SLUDGE PONDS RADIOLOGICAL CONSTITUENTS CHARACTERIZATION DATA

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef. of Var (%)
Gross alpha	5 /5	7950.0 - 31400	L[f]	20471	25000	12097	34643[d]	40.359
Gross beta	5 /5	1470.0 -7150.0	L[f]	4359.8	5170.0	2407.0	7896.8[d]	42.702
Ra-226	5 /5	1.630 - 5.260	L[f]	3.247	3.380	2.144	4.918	38.186
Ra-222	2 /5	3.440 - 3.680	L[f]	2.185	3.440	1.423[d]	3.356	45.947
Th-228	1 /5	1.990 - 1.990	L[f]	0.709	1.200	0.406[d]	1.237	77.079
Th-230	2 /2	1.020 - 4.670	L[f]	1.186	1.020	0.477[d]	2.949	100.96
U-234	2 /2	2031.0 -8300.0	c	c	5165.5	2031.0[c]	8300.0[c]	85.817
U-235/236	2 /2	178.00 -1000.0	c	c	589.00	178.00[c]	1000.0[c]	98.683
U-238	2 /2	2528.0 -8580.0	c	c	5554.0	2528.0[c]	8580.0[c]	77.051
U-Total[g]	5 /5	6850.0 -100000	L[d]	40180	75400	13895	116189[d]	68.069

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Statistics for constituent with outliers rejected.

[f]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal.

TABLE A-13

SUMMARY STATISTICAL ANALYSIS - SOLID LANDFILL - RADIOLOGICAL CONSTITUENTS (CHARACTERIZATION DATA)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef. of Var. (%)
Ra-226	1 /3	1.610 - 1.610	L[d]	0.738	1.000	0.237[c]	2.304[c]	73.662
Th-228	3 /3	3.340 - 7.210	L[d]	4.895	4.870	2.559[c]	9.364[c]	37.920
Th-230	3 /3	3.100 -13.000	L[d]	5.073	3.240	1.284[c]	20.051[c]	88.042
U-234	3 /3	5.910 -10.300	L[d]	7.434	6.750	4.559[c]	12.123[c]	30.447
U-235/236	1 /3	1.150 - 1.150	L[d]	0.660	1.000	0.293[c]	1.485[c]	52.364
U-238	3 /3	3.610 - 6.800	L[d]	4.976	5.020	2.918[c]	8.487[c]	31.080
U-Total	3 /3	8.060 -12.400	L[d]	9.890	9.680	6.869[c]	14.240[c]	21.829

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[d]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It
is treated as log-normal.

TABLE A-14

SUMMARY STATISTICAL ANALYSIS - SOUTH FIELD - RADIOLOGICAL CONSTITUENTS (CHARACTERIZATION DATA)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef of Var. (%)
Gross alpha	1 /3	45.700 -45.700	L[d]	32.483	50.000	19.282[c]	54.723[c]	32.178
Ra-226	3 /3	1.340 - 1.980	L[d]	1.671	1.760	1.193[c]	2.343[c]	19.203
Th-228	3 /3	2.520 - 3.120	L[d]	2.884	3.050	2.366[c]	3.514[c]	11.326
Th-230	2 /3	1.740 - 2.630	L[d]	1.318	1.740	0.307[c]	5.657[c]	65.900
U-234	3 /3	11.500 -12.400	L[d]	11.994	12.100	11.242[c]	12.797[c]	3.819
U-235/236	1 /3	1.130 - 1.130	L[d]	0.656	1.000	0.297[c]	1.451[c]	51.230
U-238	3 /3	10.100 -11.700	L[d]	10.947	11.100	9.654[c]	12.412[c]	7.370
U-Total	3 /3	23.000 -30.200	L[d]	25.826	24.800	20.375[c]	32.736[c]	14.412

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[d]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It
is treated as log-normal.

APPENDIX B

251A

APPENDIX B

CLIPPER PRINTOUT - TREATABILITY DATA

APPENDIX B - TABLES OF CONTENTS

Clipper Printout

EXPLANATION OF THE TREATABILITY CLIPPER PROGRAM

The data base package was created by Malcolm Thomas with Clipper software. The following list provides an explanation of each type of information contained in the treatability data table. Where -9.999 appears, no data was entered.

- Comp. Sample - The entries in this column are either "Y" or "N". "Y" indicates that a sample is a composite (i.e., waste from more than one raw waste sample) was used in mixing the treatability sample. "N" indicates that only one waste sample was used (or in the case of the raw materials [play sand] samples, no waste).

- Fernald Sample # - These are six digit numbers, which the Fernald sample tracking system uses. If a sample is a composite, a new Fernald number is assigned by the treatability laboratory. If a sample is not a composite, the sample number assigned to the untreated waste sample at Fernald is used.

- Treatability Sample # - Each treatability sample is assigned a unique number. The first four digits represent the laboratory notebook. The next two digits represent the page in the notebook on which the sample formulation data is entered. The last two digits represent the containers in which the sample is cured.

- ETDC Sample # - Each sample container that is logged into the treatability laboratory is assigned a unique number, even if a sample is shipped in several containers. If more than one ETDC sample is used in mixing a sample, then a "0" appears in this column.

- Comment - Self explanatory.

- ETDC #1 Waste - If more than one ETDC sample is used in a sample, then the first waste appears in this column.

- ETDC #2 Waste - If waste from two sample containers is used, the ETDC sample number from the second container is entered in this column.

- ETDC #1 Fly Ash - If fly ash is used in a sample, the ETDC number from the sample container is entered.

- ETDC #2 Fly Ash - If fly ash from two containers is used, the second container number is entered.

- Fernald #1 Waste - If more than one Fernald sample was used, the Fernald sample number from the first waste is entered.

- Fernald #2 Waste - If two Fernald waste samples were used, the sample number for the second sample is entered.

- Fernald #1 Fly Ash - This column lists the Fernald sample numbers of the fly ash used in the sample.

- Fernald #2 Fly Ash - If flyash from two Fernald flyash samples was used, the sample number of the second flyash is entered here.

- Mold Mix Date - This represents the date on which a sample was mixed with reagents and placed in the containers to begin the curing process.

- Planned Days to Cure - These dates are 28 days after the mold mix date.

- UCS Date - The date on which the sample was unconfined compressive strength (UCS) tested. This date should be the same as the "Planned Days to Cure" date.

- Mold Crush Date - The date on which the cured treatability samples were crushed to a particle size meeting the requirements of the TCLP.

- MTCLP Extract Date - The date on which the MTCLP extraction was started.

- MTCLP Ship Date - The date on which the MTCLP extract was shipped to the analytical laboratory.

- MTCLP Analysis Date - The date on which the metals analysis was completed.

- TCLP Extract Date - The date on which the analytical laboratory performed the TCLP extraction.

- TCLP Ship Date - The date on which the crushed samples were shipped from the treatability laboratory to the analytical laboratory.

- TCLP Analysis Date - The date on which the TCLP analysis was completed for metals and organics.

- PCT Ship Date - This heading is for vitrification samples. It is not applicable to Operable Unit 2.

- Amount of Waste - The mass of waste, in grams, used in mixing the treatability samples.

- Amount of Soil - This heading is for vitrification samples. It is not applicable to Operable Unit 2.

- Soil Origin - This heading is for vitrification samples. It is not applicable to Operable Unit 2.

- Type of Cement - Either Type 1 or Type 2 portland cement was used.

- Amount of Cement - The mass of cement, in grams, used in the treatability sample.

- Fly Ash Origin - Site fly ash from the Operable Unit 2, versus commercial fly ash was used in the treatability study.

- Amount of Fly Ash - The mass of fly ash, in grams, used in the treatability sample.

- Amount of Sodium Silicate - The mass of sodium silicate, in grams, used in the treatability sample.
- Amount of Attapulg - The mass of attapulgite, in grams, used in the sample.
- Amount of Clinoptil - The mass of clinoptilolite, in grams, used in the sample.
- Amount of H_2O - The amount of water, in grams, used in the sample.
- Amount of Sodium H. - Not applicable.
- Hand Mix - An "N" indicates that a mechanical mixer was used to mix the sample.
- Sieve Size - Typically, the waste was passed through a sieve before it was used to make treatability samples. This column lists the size of the openings in the sieve.
- Weight Not Passing Sieve - This column reports the mass of material in the raw sample that would not pass through the sieve.
- Percent Not Passing Sieve - The percentage of the raw sample that would not pass through the seive.
- Temperature of Oven - This heading is for vitrification samples. It is not applicable to Operable Unit 2.
- Time of Sample Heating (min) - This heading is for vitrification samples. It is not applicable to Operable Unit 2.
- Normalized Waste - To make it easier to compare the various formulations, all of the reagents were adjusted to a normalized waste quantity of 100 grams.
- % of H_2O in Waste - Percent of raw waste that is water.
- Normalized Water - The mass of water, in grams, used for each 100 grams of waste to mix the samples.
- Normalized Na Silicate - The mass of sodium silicate, in grams, used for each 100 grams of waste to make the treatability sample.
- Dry Blend - The sum, in grams, of normalized cement, normalized fly ash, normalized attapulgite, and normalized clinoptilolite, used in the sample.
- Normalized Cement - The mass of cement in grams, used for each 100 grams of waste.
- Normalized Fly Ash - The mass of fly ash, in grams, used for each 100 grams of waste.
- Normalized Attapulg - The mass of attapulgite, in grams, is used for each 100 grams of waste.

- Normalized Clinoptil - The mass of clinoptilolite, in grams, used for each 100 grams of waste.
- Normalized Soil - This is for vitrification and is not applicable to Operable Unit 2.
- Normalized N Hydro - This is for vitrification and is not applicable to Operable Unit 2.
- % of Waste - The mass of waste used to make the treatability sample divided by the mass of the mixed treatability sample, multiplied by 100.
- % of Cement - The mass of cement used to make the treatability sample, divided by the mass of the sample, multiplied by 100.
- % of Fly Ash - The mass of fly ash used to make the treatability sample, divided by the mass of the sample, multiplied by 100.
- % of Sodium Silicate - The mass of sodium silicate used to make the treatability sample, divided by the mass of the sample, multiplied by 100.
- % of Attapulg - The mass of attapulgite used to make the treatability sample, divided by the mass of the sample, multiplied by 100.
- % of Clinoptil - The mass of clinoptilolite used to make the treatability sample, divided by the mass of the sample, multiplied by 100.
- % of H_2O - The mass of water added to make the treatability sample, divided by the mass of the sample, multiplied by 100.
- Notes: Specifically, description of waste before and after mixing.
- pH of Waste - This measurement is made on a mixture of raw waste and water.
- Eh of Waste (mV) - This measurement, in millivolts, is made on a mixture of raw waste and water.
- pH of Fly Ash - This measurement is made on a mixture of raw waste and water.
- Eh of Fly Ash - This measurement, in millivolts, is made on a mixture of raw waste and water.
- pH of Mixture - This measurement is made on the newly mixed treatability sample after all reagents have been added.
- Eh of Mixture - This measurement, in millivolts, is made in the same manner as the pH of the mixture.
- Waste Moisture Content - This is the percent moisture of the raw waste used in mixing the treatability sample.
- Fly Ash Moisture Content - The percent moisture in the raw fly ash.

- Mixture Moisture Content - The percent moisture of the newly mixed, wet treatability sample.

- Temp Rise - The amount that the temperature of the mixture rises, in degrees centigrade, approximately 10 minutes after the sample has been mixed.

  Time between end of mixing and taking of temperature rise.

- Crushed Moisture Content - The percent moisture of the sample after it has cured at least 28 days.

- Shear Strength - Preliminary process data in tons per square foot.

- Pocket Penetr - A measurement of the penetration resistance of the sample after one day of curing with a pocket penetrometer. Two instruments were used. Readings of greater than 700 are in pounds per square inch. The other readings are in tons per square foot.

- Gross Alpha (dpm) - The number given represents the alpha activity of radionuclides in disintegrations per minute in a 4 milliliter sample of MTCLP extraction fluid. The number has been corrected for background and counter efficiency.

- Gross Beta (dpm) - The number given represents the beta activity of radionuclides in disintegration per minute in a 4 milliliter sample of MTCLP extraction fluid. The number has been corrected for background and instrument efficiency.

- Gross Alpha (pCi/*l*) - Gross alpha activity of MTCLP extraction fluid expressed in picoCuries per liter.

- Gross Beta (pCi/*l*) - Gross beta activity of the MTCLP extraction fluid expressed in picoCuries per liter.

- Total Uranium - The concentration of uranium, in parts per million (ppm), in the MTCLP extraction fluid.

- UCS - The unconfined compressive strength, in pounds per square inch, of a treatability sample that has cured for 28 days. UCS values above 525 psi exceed instrument calibration.

- Bulking Factor - The percent increase in volume of the waste due to treatment.

- Bulking Density - The density of the treated sample in grams per cubic centimeter.

- Permeability - A measurement of the ability of water to seep through a treatability sample. Units are centimeters per second.

- pH of MTCLP Deter Test - There are two TCLP extraction fluids - Type 1 and Type 2. A test is performed on each sample to determine which type of fluid is used. The pH of the determination test solution, which is given in this column, is the basis for the decision.

- pH of MTCLP - The pH of the MTCLP extraction fluid upon completion of the treatability sample extraction.

- Type (1/2) - Type of extraction fluid used to perform the MTCLP extraction.

259

OU-2

GENERAL SAMPLE INFORMATION

07/07/92

COMP. SAMPLE	FERNALD SAMPLE #	TREATABILITY SAMPLE #	ETDC SAMPLE #	COMMENT	ETDC #1 WASTE	ETDC #2 WASTE	ETDC #1 FLYASH	ETDC #2 FLYASH	FERNALD #1 WASTE	FERNALD #2 WASTE	FERNALD #1 FLYASH	FERNALD #2 FLYASH
Y	75201	10162413	0	SOLID WASTE LANDFILL, RUN 1	751		764		67432		67436	
Y	75201	10162513	0	SOLID WASTE LANDFILL, RUN 2	751		764		67432		67436	
Y	75201	10162613	0	SOLID WASTE LANDFILL, RUN 3	751		764		67432		67436	
Y	75201	10162713	0	SOLID WASTE LANDFILL, RUN 4	751		764		67432		67436	
Y	75201	10162813	0	SOLID WASTE LANDFILL, RUN 5	751		764		67432		67436	
Y	75201	10162913	0	SOLID WASTE LANDFILL, RUN 6	751		764		67432		67436	
Y	75201	10163001	0	SOLID WASTE LANDFILL, RUN 7, REPEAT	751		764		67432		67436	
Y	75201	10163013	0	SOLID WASTE LANDFILL, RUN 7	751		764		67432		67436	
Y	75201	10163213	0	SOLID WASTE LANDFILL, RUN 8	752		764		67432		67436	
Y	75201	10163413	0	SOLID WASTE LANDFILL, RUN 9	752		764		67432		67436	
Y	75201	10163613	0	SOLID WASTE LANDFILL, RUN 10	753		764		67432		67436	
Y	75202	10164213	0	LIME SLUDGE POND, WRONG MIXTURE	733		764		67431		67436	
Y	75202	10164413	0	LIME SLUDGE POND, RUN 2	733		764		67431		67436	
Y	75202	10164613	0	LIME SLUDGE POND, RUN 3	733		764		67431		67436	
Y	75202	10164813	0	LIME SLUDGE POND, RUN 4	733		764		67431		67436	
Y	75202	10165013	0	LIME SLUDGE POND, RUN 5	736		764		67431		67436	
Y	75202	10165213	0	LIME SLUDGE POND, RUN 6	736		766	764	67431		67436	
Y	75202	10165413	0	LIME SLUDGE POND, RUN 7	736		766		67431		67436	
Y	75202	10165613	0	LIME SLUDGE POND, RUN 8	736		766		67431		67436	
Y	75202	10165813	0	LIME SLUDGE POND, RUN 10	736	735	766		67431		67436	
Y	75202	10166013	0	LIME SLUDGE POND, RUN 11	735		766		67431		67436	
Y	75202	10166213	0	LIME SLUDGE POND, RUN 12	735		766		67431		67436	
Y	75203	10166413	0	SOLID WASTE LANDFILL, RUN 11	753		766		67432		67436	
Y	75203	10166613	0	SOLID WASTE LANDFILL, RUN 12	753		766		67432		67436	
Y	75202	10166813	0	LIME SLUDGE POND, RUN 1	735		766		67431		67436	
Y	75202	10167013	0	LIME SLUDGE POND, RUN 9	735		766		67431		67436	
Y	75202	10167213	0	LIME SLUDGE POND, RUN 13	735		766		67431		67436	
Y	75202	10167413	0	LIME SLUDGE POND, RUN 14	735		766		67431		67436	
Y	75204	10167613	0	LIME SLUDGE POND, RUN 15	735	732	766	770	67431		67436	67411
Y	75205	10167813	0	LIME SLUDGE POND, RUN 16	732		770		67431		67411	
Y	75206	10168213	0	SOUTH FIELD, RUN 2	740		770		67433		67411	
Y	75206	10168413	0	SOUTH FIELD, RUN 1	740		770		67433		67411	
Y	75206	10168613	0	SOUTH FIELD, RUN 3	740		770		67433		67411	
Y	75206	10168813	0	SOUTH FIELD, RUN 4	740	745	770		67433		67411	
Y	75206	10169013	0	SOUTH FIELD, RUN 5	740	745	770		67433		67411	
Y	75206	10169213	0	SOUTH FIELD, RUN 6	745		770		67433		67411	
Y	75206	10169413	0	SOUTH FIELD, RUN 7	745		770		67433		67411	
Y	75206	10169613	0	SOUTH FIELD, RUN 8	745		770		67433		67411	
Y	75206	10169813	0	SOUTH FIELD, RUN 9	745		770		67433		67411	
Y	75207	10310213	0	SOUTH FIELD, RUN 10	745		829		67433		67441	
Y	75207	10310413	0	SOUTH FIELD, RUN 11	745	741	829		67433		67441	
Y	75207	10310613	0	SOUTH FIELD, RUN 12	745	741	829		67433		67441	
Y	75207	10310813	0	SOUTH FIELD, RUN 10, DUP.	741		829		67433		67441	
Y	75208	10311013	0	SOUTH FIELD, RUN 3, DUP.	741		765		67433		67436	
Y	75208	10311213	0	SOUTH FIELD, RUN 6, DUP.	741		765		67433		67436	
Y	75202	10311413	0	LIME SLUDGE POND, RUN 5, DUP.	732		765		67431		67436	
Y	75202	10311613	0	LIME SLUDGE POND, RUN 10, DUP.	732		765		67431		67436	
Y	75202	10311813	0	LIME SLUDGE POND, RUN 16, DUP.	734		765		67431		67436	
Y	75201	10312013	0	SOLID WASTE LANDFILL, RUN 3, DUP.	753		765		67432		67436	
Y	75201	10312213	0	SOLID WASTE LANDFILL, RUN 7, DUP.	753		765		67432		67436	
Y	75201	10312413	0	SOLID WASTE LANDFILL, RUN 12, DUP.	753	754	765		67432		67436	

COMP. SAMPLE	FERNALD SAMPLE #	TREATABILITY SAMPLE #	ETDC SAMPLE #	COMMENT	ETDC #1 WASTE	ETDC #2 WASTE	ETDC #1 FLYASH	ETDC #2 FLYASH	FERNALD #1 WASTE	FERNALD #2 WASTE	FERNALD #1 FLYASH	FERNALD #2 FLYASH
N	75209	10312613	0	RAW MATERIALS, RUN 1								
N	75209	10312813	0	RAW MATERIALS, RUN 2								
N	75209	10313023	0	RAW MATERIALS, RUN 3								
N	75209	10313213	0	RAW MATERIALS, RUN 4								
N	75209	10313413	0	RAW MATERIALS, RUN 5								
N	75209	10313613	0	RAW MATERIALS, RUN 6								
N	75209	10313813	0	RAW MATERIALS, RUN 7								
N	67431	10371213	734	LIME SLUDGE POND, RUN 3 (STAGE II)								
N	67431	10371413	734	LIME SLUDGE POND, RUN 2 (STAGE II)								
N	67431	10371613	739	LIME SLUDGE POND, RUN 1 (STAGE II)								
N	67431	10371813	739	LIME SLUDGE POND, RUN 4 (STAGE II)								
N	67431	10372013	739	LIME SLUDGE POND, RUN 5 (STAGE II)								
N	67431	10372213	739	LIME SLUDGE POND, RUN 6 (STAGE II)								
N	67431	10372413	737	LIME SLUDGE POND, RUN 7 (STAGE II)								
N	67431	10372613	737	LIME SLUDGE POND, RUN 8 (STAGE II)								
N	67431	10372813	737	LIME SLUDGE POND, RUN 9 (STAGE II)								
N	67431	10373013	737	LIME SLUDGE POND, RUN 7, DUP. (STAGE II)								
N	67431	10373213	737	LIME SLUDGE POND, RUN 3, DUP.(STAGE II)								
Y	75202	10373401	0	LIME SLUDGE POND, RUN 1 (LONG-TERM)	737		765		67431		67436	
Y	75202	10373402	0	LIME SLUDGE POND, RUN 1 (LONG-TERM)	737		765		67431		67436	
Y	75202	10373601	0	LIME SLUDGE POND, RUN 2 (LONG-TERM)	737	734	765		67431		67436	
Y	75202	10373602	0	LIME SLUDGE POND, RUN 2 (LONG-TERM)	737	734	765		67431		67436	
Y	75202	10373801	0	LIME SLUDGE POND, RUN 3 (LONG-TERM)	737	734	769		67431		67410	
Y	75202	10373802	0	LIME SLUDGE POND, RUN 3 (LONG-TERM)	737	734	769		67431		67410	

OU-2
DATE INFORMATION (PART 1 OF 2)

FERNALD SAMPLE #	TREATABILITY SAMPLE #	ETDC SAMPLE #	COMMENT	MOLD MIX DATE	PLANNED DAYS TO CURE	UCS DATE	MOLD CRUSH DATE	MTCLP EXTRACT DATE	MTCLP SHIP DATE	MTCLP ANALYSIS DATE	TCLP EXTRACT DATE	TCLP SHIP DATE	TCLP ANALYSIS DATE	PCT SHIP DATE
75201	10162413	0		09/23/91	10/21/91	10/21/91	10/23/91	10/23/91	10/29/91	11/12/91	11/01/91	10/28/91	11/05/91	
75201	10162513	0		09/24/91	10/22/91	10/22/91	10/23/91	10/23/91	10/29/91	11/12/91	11/01/91	10/28/91	11/05/91	
75201	10162613	0		09/24/91	10/22/91	10/22/91	10/23/91	10/23/91	10/29/91	11/12/91	11/01/91	10/28/91	11/05/91	
75201	10162713	0		09/24/91	10/22/91	10/22/91	10/23/91	10/23/91	10/29/91	11/12/91	11/01/91	10/28/91	11/05/91	
75201	10162813	0		09/24/91	10/22/91	10/22/91	10/23/91	10/23/91	10/29/91	11/12/91	11/01/91	10/28/91	11/05/91	
75201	10162913	0		09/24/91	10/22/91	10/22/91	10/23/91	10/23/91	10/29/91	11/12/91	11/01/91	10/28/91	11/05/91	
75201	10163001	0	NO MTCLP OR TCLP DONE	11/08/91	12/06/91	12/06/91								
75201	10163013	0		09/25/91	10/23/91	10/23/91	10/24/91	10/24/91	10/29/91	11/12/91	11/03/91	10/31/91	11/13/91	
75201	10163213	0		09/25/91	10/23/91	10/23/91	10/24/91	10/24/91	10/29/91	11/12/91	11/03/91	10/31/91	11/13/91	
75201	10163413	0		09/25/91	10/23/91	10/23/91	10/24/91	10/24/91	10/29/91	11/12/91	11/03/91	10/31/91	11/13/91	
75201	10163613	0	NO TCLP DONE	09/25/91	10/23/91	10/23/91	10/24/91	10/24/91	10/29/91	11/12/91				
75202	10164213	0	NO TCLP DONE	09/25/91	10/23/91	10/23/91	10/24/91	10/24/91	10/31/91	11/11/91				
75202	10164413	0		09/25/91	10/23/91	10/23/91	10/24/91	10/24/91	10/31/91	11/11/91	11/03/91	10/31/91	11/13/91	
75202	10164613	0		09/26/91	10/24/91	10/24/91	10/28/91	10/28/91	10/31/91	11/11/91	11/03/91	10/31/91	11/13/91	
75202	10164813	0	NO TCLP DONE	09/26/91	10/24/91	10/24/91	10/28/91	10/28/91	10/31/91	11/11/91				
75202	10165013	0		09/26/91	10/24/91	10/24/91	11/04/91	10/28/91	10/31/91	11/11/91	11/07/91	11/06/91	11/19/91	
75202	10165213	0		09/26/91	10/24/91	10/24/91	10/28/91	10/28/91	10/31/91	11/11/91	11/03/91	10/31/91	11/13/91	
75202	10165413	0		09/26/91	10/24/91	10/24/91	10/28/91	10/28/91	10/31/91	11/11/91	11/03/91	10/31/91	11/13/91	
75202	10165613	0		09/26/91	10/24/91	10/24/91	10/28/91	10/28/91	10/31/91	11/11/91	11/03/91	10/31/91	11/13/91	
75202	10165813	0		09/26/91	10/24/91	10/24/91	11/04/91	10/28/91	10/31/91	11/11/91	11/07/91	11/06/91	11/19/91	
75202	10166013	0	NO TCLP DONE	09/26/91	10/24/91	10/24/91	10/28/91	10/28/91	10/31/91	11/11/91				
75202	10166213	0	NO TCLP DONE	09/26/91	10/24/91	10/24/91	10/29/91	10/29/91	11/01/91	11/11/91				
75203	10166413	0		09/27/91	10/25/91	10/25/91	10/29/91	10/29/91	11/01/91	11/11/91	11/03/91	10/31/91	11/13/91	
75203	10166613	0		09/27/91	10/25/91	10/25/91	10/29/91	10/29/91	11/01/91	11/11/91	11/03/91	10/31/91	11/13/91	
75202	10166813	0	NO TCLP DONE	09/27/91	10/25/91	10/25/91	10/29/91	10/29/91	11/01/91	11/11/91				
75202	10167013	0		09/27/91	10/25/91	10/25/91	10/29/91	10/29/91	11/01/91	11/11/91	11/03/91	10/31/91	11/13/91	
75202	10167213	0		09/27/91	10/25/91	10/25/91	10/29/91	10/29/91	11/01/91	11/11/91	11/03/91	10/31/91	11/13/91	
75202	10167413	0		09/27/91	10/25/91	10/25/91	10/29/91	10/29/91	11/01/91	11/11/91	11/03/91	10/31/91	11/13/91	
75204	10167613	0	NO TCLP DONE	09/27/91	10/25/91	10/25/91	10/29/91	10/29/91	11/01/91	11/11/91				
75205	10167813	0		09/30/91	10/28/91	10/28/91	11/04/91	11/04/91	11/18/91	12/16/91	11/07/91	11/06/91	11/19/91	
75206	10168213	0	NO TCLP DONE	10/01/91	10/29/91	10/29/91	10/29/91	11/04/91	11/06/91	11/15/91				
75206	10168413	0		10/01/91	10/29/91	10/29/91	10/29/91	11/04/91	11/06/91	11/15/91	11/12/91	11/01/91	11/19/91	
75206	10168613	0		10/01/91	10/29/91	10/29/91	10/29/91	11/04/91	11/06/91	11/15/91	11/12/91	11/01/91	11/20/91	
75206	10168813	0	NO TCLP DONE	10/02/91	10/30/91	10/30/91	10/30/91	11/04/91	11/06/91	11/15/91				
75206	10169013	0		10/02/91	10/30/91	10/30/91	10/30/91	11/04/91	11/06/91	11/15/91	11/12/91	11/01/91	11/20/91	
75206	10169213	0		10/02/91	10/30/91	10/30/91	10/30/91	11/04/91	11/06/91	11/15/91	11/12/91	11/01/91	11/20/91	
75206	10169413	0	NO TCLP DONE	10/02/91	10/30/91	10/30/91	10/30/91	11/04/91	11/06/91	11/15/91				
75206	10169613	0		10/03/91	10/31/91	10/31/91	10/31/91	11/04/91	11/06/91	11/15/91	11/12/91	11/01/91	11/20/91	
75206	10169813	0		10/04/91	11/01/91	11/01/91	11/04/91	11/04/91	11/06/91	11/15/91	11/07/91	11/06/91	11/19/91	
75207	10310213	0		10/07/91	11/04/91	11/04/91	11/04/91	11/07/91	11/11/91	11/21/91	11/07/91	11/06/91	11/19/91	
75207	10310413	0	NO TCLP DONE	10/07/91	11/04/91	11/04/91	11/04/91	11/07/91	11/11/91	11/21/91				
75207	10310613	0	NO TCLP DONE	10/07/91	11/04/91	11/04/91	11/04/91	11/07/91	11/11/91	11/21/91				
75207	10310813	0		10/07/91	11/04/91	11/04/91	11/04/91	11/07/91	11/11/91	11/21/91	11/07/91	11/06/91	11/19/91	
75208	10311013	0		10/08/91	11/05/91	11/05/91	11/05/91	11/07/91	11/11/91	11/21/91	11/14/91	11/07/91	11/25/91	
75208	10311213	0		10/08/91	11/05/91	11/05/91	11/05/91	11/07/91	11/11/91	11/21/91	11/14/91	11/07/91	11/25/91	
75202	10311413	0		10/08/91	11/05/91	11/05/91	11/05/91	11/07/91	11/11/91	11/21/91	11/14/91	11/07/91	11/25/91	
75202	10311613	0		10/08/91	11/05/91	11/05/91	11/05/91	11/07/91	11/11/91	11/21/91	11/14/91	11/07/91	11/25/91	
75202	10311813	0		10/09/91	11/06/91	11/06/91	11/06/91	11/07/91	11/11/91	11/21/91	11/14/91	11/07/91	11/25/91	
75201	10312013	0		10/09/91	11/06/91	11/06/91	11/06/91	11/07/91	11/11/91	11/21/91	11/14/91	11/07/91	11/25/91	
75201	10312213	0		10/09/91	11/06/91	11/06/91	11/06/91	11/07/91	11/11/91	11/21/91	11/14/91	11/07/91	11/25/91	

FERNALD SAMPLE #	TREATABILITY SAMPLE #	ETDC SAMPLE #	COMMENT	MOLD MIX DATE	PLANNED DAYS TO CURE	UCS DATE	MOLD CRUSH DATE	MTCLP EXTRACT DATE	MTCLP SHIP DATE	MTCLP ANALYSIS DATE	TCLP EXTRACT DATE	TCLP SHIP DATE	TCLP ANALYSIS DATE	PCT SHIP DATE
75201	10312413	0		10/09/91	11/06/91	11/06/91	11/06/91	11/07/91	11/11/91	11/21/91	11/14/91	11/07/91	11/25/91	
75209	10312613	0	NO MTCLP DONE	10/14/91	11/11/91	11/12/91	11/12/91				11/20/91	11/14/91	11/22/91	
75209	10312813	0	NO MTCLP DONE	10/14/91	11/11/91	11/13/91	11/13/91				11/20/91	11/14/91	11/22/91	
75209	10313023	0	NO MTCLP DONE	10/14/91	11/11/91	11/13/91	11/13/91				11/20/91	11/14/91	11/22/91	
75209	10313213	0	NO MTCLP DONE	10/14/91	11/11/91	11/13/91	11/13/91				11/20/91	11/14/91	11/22/91	
75209	10313413	0	NO MTCLP DONE	10/15/91	11/12/91	11/12/91	11/12/91				11/20/91	11/14/91	11/22/91	
75209	10313613	0	NO MTCLP DONE	10/15/91	11/12/91	11/12/91	11/12/91				11/20/91	11/14/91	11/22/91	
75209	10313813	0	NO MTCLP DONE	10/15/91	11/12/91	11/12/91	11/12/91				11/20/91	11/14/91	11/22/91	
67431	10371213	734		11/07/91	12/05/91	12/05/91	12/05/91	12/17/91	12/18/91	12/30/91	12/11/91	12/10/91	12/12/91	
67431	10371413	734		11/07/91	12/05/91	12/05/91	12/05/91	12/17/91	12/18/91	12/30/91	12/11/91	12/10/91	12/12/91	
67431	10371613	739		11/07/91	12/05/91	12/05/91	12/05/91	12/17/91	12/18/91	12/30/91	12/11/91	12/10/91	12/12/91	
67431	10371813	739		11/07/91	12/05/91	12/05/91	12/05/91	12/17/91	12/18/91	12/30/91	12/11/91	12/10/91	12/12/91	
67431	10372013	739		11/07/91	12/05/91	12/05/91	12/05/91	12/17/91	12/18/91	12/30/91	12/11/91	12/10/91	12/12/91	
67431	10372213	739		11/07/91	12/05/91	12/05/91	12/05/91	12/17/91	12/18/91	12/30/91	12/11/91	12/10/91	12/12/91	
67431	10372413	737		11/08/91	12/06/91	12/06/91	12/09/91	12/17/91	12/18/91	12/30/91	12/11/91	12/10/91	12/12/91	
67431	10372613	737		11/08/91	12/06/91	12/06/91	12/09/91	12/17/91	12/18/91	12/30/91	12/11/91	12/10/91	12/12/91	
67431	10372813	737		11/08/91	12/06/91	12/06/91	12/09/91	12/17/91	12/18/91	12/30/91	12/11/91	12/10/91	12/12/91	
67431	10373013	737		11/13/91	12/11/91	12/11/91	12/11/91	12/17/91	12/18/91	12/30/91	12/17/91	12/13/91	12/19/91	
67431	10373213	737		11/14/91	12/12/91	12/12/91	12/12/91	12/17/91	12/18/91	12/30/91	12/17/91	12/13/91	12/18/91	
75202	10373401	0	NO TCLP DONE	11/14/91	12/12/91	12/12/91	12/12/91	12/17/91	12/18/91	12/30/91				
75202	10373402	0	NO MTCLP OR TCLP DONE	11/14/91	12/12/91	02/12/92								
75202	10373601	0	NO TCLP DONE	11/14/91	12/12/91	12/12/91	12/12/91	12/17/91	12/18/91	12/30/91				
75202	10373602	0	NO MTCLP OR TCLP DONE	11/14/91	12/12/91	02/12/92								
75202	10373801	0	NO TCLP DONE	11/15/91	12/13/91	12/13/91	12/13/91	12/17/91	12/18/91	12/30/91				
75202	10373802	0	NO MTCLP OR TCLP DONE	01/15/92	02/12/92	02/13/92								

OU-2
DATE INFORMATION (PART 2 OF 2)

07/07/92

FERNALD SAMPLE #	TREATABILITY SAMPLE #	ETDC SAMPLE #	PCT ANALYSIS DATE	PCT EXTRACT DATE	STATIC EXTRACT DATE	STATIC SHIP DATE	STATIC ANALYSIS DATE	RADON E. EXTRACT DATE	RADON E. SHIP DATE	RADON E. ANALYSIS DATE	RADON-7 EXTRACT DATE	RADON-7 SHIP DATE	RADON-7 ANALYSIS DATE	RADON-30 EXTRACT DATE	RADON-30 SHIP DATE	RADON-30 ANALYSIS DATE
75201	10162413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10162513	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10162613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10162713	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10162813	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10162913	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10163001	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10163013	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10163213	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10163413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10163613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10164213	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10164413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10164613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10164813	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10165013	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10165213	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10165413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10165613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10165813	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10166013	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10166213	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75203	10166413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75203	10166613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10166813	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10167013	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10167213	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10167413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75204	10167613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75205	10167813	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75206	10168213	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75206	10168413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75206	10168613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75206	10168813	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75206	10169013	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75206	10169213	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75206	10169413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75206	10169613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75206	10169813	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75207	10310213	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75207	10310413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75207	10310613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75207	10310813	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75208	10311013	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75208	10311213	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10311413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10311613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10311813	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10312013	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75201	10312213	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /

OU-2
Page No. 2
07/07/92

FERNALD SAMPLE #	TREATABILITY SAMPLE #	ETDC SAMPLE #	PCT ANALYSIS DATE	PCT EXTRACT DATE	STATIC EXTRACT DATE	STATIC SHIP DATE	STATIC ANALYSIS DATE	RADON E. EXTRACT DATE	RADON E. SHIP DATE	RADON E. ANALYSIS DATE	RADON-7 EXTRACT DATE	RADON-7 SHIP DATE	RADON-7 ANALYSIS DATE	RADON-30 EXTRACT DATE	RADON-30 SHIP DATE	RADON-30 ANALYSIS DATE
75201	10312413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75209	10312613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75209	10312813	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75209	10313023	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75209	10313213	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75209	10313413	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75209	10313613	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75209	10313813	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
67431	10371213	734	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
67431	10371413	734	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
67431	10371613	739	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
67431	10371813	739	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
67431	10372013	739	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
67431	10372213	739	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
67431	10372413	737	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
67431	10372613	737	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
67431	10372813	737	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
67431	10373013	737	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
67431	10373213	737	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10373401	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10373402	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10373601	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10373602	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10373801	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
75202	10373802	0	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /

OU-2
FORMULATION INFORMATION (PART 1 OF 5)

07/07/92

FERNALD SAMPLE #	TREATABILITY SAMPLE #	ETDC SAMPLE #	COMMENT	AMOUNT OF WASTE(g)	AMOUNT OF SOIL(g)	SOIL ORIGIN	TYPE OF CEMENT	AMOUNT OF CEMENT(g)	FLYASH ORIGIN	AMOUNT OF FLYASH(g)	AMOUNT OF SODIUM S.(g)	AMOUNT OF ATTAPULG.(g)
75201	10162413	0	SOLID WASTE LANDFILL, RUN 1	600	0		1	150	SITE	300	0	30
75201	10162513	0	SOLID WASTE LANDFILL, RUN 2	600	0		1	150	SITE	300	30	0
75201	10162613	0	SOLID WASTE LANDFILL, RUN 3	600	0		1	150	SITE	300	30	30
75201	10162713	0	SOLID WASTE LANDFILL, RUN 4	600	0		1	150	SITE	150	0	30
75201	10162813	0	SOLID WASTE LANDFILL, RUN 5	600	0		1	150	SITE	150	30	0
75201	10162913	0	SOLID WASTE LANDFILL, RUN 6	600	0		1	300	SITE	300	0	10
75201	10163001	0	SOLID WASTE LANDFILL, RUN 7, REPEAT	600	0		1	300	SITE	300	30	0
75201	10163013	0	SOLID WASTE LANDFILL, RUN 7	600	0		1	300	SITE	300	30	0
75201	10163213	0	SOLID WASTE LANDFILL, RUN 8	600	0		1	300	SITE	150	0	10
75201	10163413	0	SOLID WASTE LANDFILL, RUN 9	600	0		1	300	SITE	150	30	0
75201	10163613	0	SOLID WASTE LANDFILL, RUN 10	600	0		1	90	SITE	180	0	6
75202	10164213	0	LIME SLUDGE POND, WRONG MIXTURE	600	0		2	150	SITE	300	0	15
75202	10164413	0	LIME SLUDGE POND, RUN 2	600	0		2	150	SITE	300	30	0
75202	10164613	0	LIME SLUDGE POND, RUN 3	600	0		2	150	SITE	300	30	30
75202	10164813	0	LIME SLUDGE POND, RUN 4	600	0		2	150	SITE	150	0	30
75202	10165013	0	LIME SLUDGE POND, RUN 5	600	0		2	150	SITE	150	30	0
75202	10165213	0	LIME SLUDGE POND, RUN 6	600	0		2	300	SITE	300	0	30
75202	10165413	0	LIME SLUDGE POND, RUN 7	600	0		2	300	SITE	300	30	0
75202	10165613	0	LIME SLUDGE POND, RUN 8	600	0		2	300	SITE	150	0	30
75202	10165813	0	LIME SLUDGE POND, RUN 10	600	0		2	90	SITE	180	0	18
75202	10166013	0	LIME SLUDGE POND, RUN 11	600	0		2	90	SITE	180	18	0
75202	10166213	0	LIME SLUDGE POND, RUN 12	600	0		2	90	SITE	180	18	18
75203	10166413	0	SOLID WASTE LANDFILL, RUN 11	600	0		1	90	SITE	180	18	0
75203	10166613	0	SOLID WASTE LANDFILL, RUN 12	600	0		1	90	SITE	180	18	6
75202	10166813	0	LIME SLUDGE POND, RUN 1	600	0		2	150	SITE	300	0	30
75202	10167013	0	LIME SLUDGE POND, RUN 9	600	0		2	300	SITE	150	30	0
75202	10167213	0	LIME SLUDGE POND, RUN 13	600	0		1	300	SITE	300	0	30
75202	10167413	0	LIME SLUDGE POND, RUN 14	600	0		1	300	SITE	300	30	0
75204	10167613	0	LIME SLUDGE POND, RUN 15	900	0		1	225	SITE	225	0	0
75205	10167813	0	LIME SLUDGE POND, RUN 16	600	0		1	150	SITE	150	30	30
75206	10168213	0	SOUTH FIELD, RUN 2	600	0		1	150	SITE	300	30	0
75206	10168413	0	SOUTH FIELD, RUN 1	600	0		1	150	SITE	300	0	30
75206	10168613	0	SOUTH FIELD, RUN 3	600	0		1	150	SITE	300	30	30
75206	10168813	0	SOUTH FIELD, RUN 4	600	0		1	150	SITE	150	0	30
75206	10169013	0	SOUTH FIELD, RUN 5	600	0		1	150	SITE	150	30	0
75206	10169213	0	SOUTH FIELD, RUN 6	600	0		1	300	SITE	300	0	30
75206	10169413	0	SOUTH FIELD, RUN 7	600	0		1	300	SITE	300	30	0
75206	10169613	0	SOUTH FIELD, RUN 8	600	0		1	300	SITE	150	0	30
75206	10169813	0	SOUTH FIELD, RUN 9	600	0		1	300	SITE	150	30	0
75207	10310213	0	SOUTH FIELD, RUN 10	600	0		1	150	SITE	300	0	18
75207	10310413	0	SOUTH FIELD, RUN 11	600	0		1	150	SITE	300	18	0
75207	10310613	0	SOUTH FIELD, RUN 12	600	0		1	150	SITE	300	18	18
75207	10310813	0	SOUTH FIELD, RUN 10, DUP.	600	0		1	150	SITE	300	0	18
75208	10311013	0	SOUTH FIELD, RUN 3, DUP.	600	0		1	150	SITE	300	30	30
75208	10311213	0	SOUTH FIELD, RUN 6, DUP.	600	0		1	300	SITE	300	0	30
75202	10311413	0	LIME SLUDGE POND, RUN 5, DUP.	600	0		2	150	SITE	150	30	0
75202	10311613	0	LIME SLUDGE POND, RUN 10, DUP.	600	0		2	90	SITE	180	0	18
75202	10311813	0	LIME SLUDGE POND, RUN 16, DUP.	600	0		1	150	SITE	150	30	30
75201	10312013	0	SOLID WASTER LANDFILL, RUN 3, DUP.	600	0		1	150	SITE	300	30	30
75201	10312213	0	SOLID WASTE LANDFILL, RUN 7, DUP.	600	0		1	300	SITE	300	30	0
75201	10312413	0	SOLID WASTE LANDFILL, RUN 12, DUP.	600	0		1	90	SITE	180	18	6

FERNALD SAMPLE #	TREATABILITY SAMPLE #	ETDC SAMPLE #	COMMENT	AMOUNT OF WASTE(g)	AMOUNT OF SOIL(g)	SOIL ORIGIN	TYPE OF CEMENT	AMOUNT OF CEMENT(g)	FLYASH ORIGIN	AMOUNT OF FLYASH(g)	AMOUNT OF SODIUM S.(g)	AMOUNT OF ATTAPULG.(g)
75209	10312613	0	RAW MATERIALS, RUN 1	900	0		1	300	NONE	0	0	10
75209	10312813	0	RAW MATERIALS, RUN 2	975	0		1	113	NONE	0	23	8
75209	10313023	0	RAW MATERIALS, RUN 3	900	0		2	300	NONE	0	30	0
75209	10313213	0	RAW MATERIALS, RUN 4	975	0		2	113	NONE	0	23	23
75209	10313413	0	RAW MATERIALS, RUN 5	900	0		1	300	NONE	0	0	30
75209	10313613	0	RAW MATERIALS, RUN 6	1125	0		1	225	NONE	0	0	45
75209	10313813	0	RAW MATERIALS, RUN 7	900	0		1	300	NONE	0	0	30
67431	10371213	734	LIME SLUDGE POND, RUN 3 (STAGE II)	600	0		2	450	NONE	0	30	30
67431	10371413	734	LIME SLUDGE POND, RUN 2 (STAGE II)	600	0		2	450	NONE	0	30	0
67431	10371613	739	LIME SLUDGE POND, RUN 1 (STAGE II)	600	0		2	450	NONE	0	0	30
67431	10371813	739	LIME SLUDGE POND, RUN 4 (STAGE II)	600	0		2	300	NONE	0	0	30
67431	10372013	739	LIME SLUDGE POND, RUN 5 (STAGE II)	600	0		2	300	NONE	0	31	0
67431	10372213	739	LIME SLUDGE POND, RUN 6 (STAGE II)	599	0		2	300	NONE	0	30	30
67431	10372413	737	LIME SLUDGE POND, RUN 7 (STAGE II)	600	0		1	304	NONE	0	0	31
67431	10372613	737	LIME SLUDGE POND, RUN 8 (STAGE II)	600	0		1	300	NONE	0	30	0
67431	10372813	737	LIME SLUDGE POND, RUN 9 (STAGE II)	601	0		1	300	NONE	0	30	30
67431	10373013	737	LIME SLUDGE POND, RUN 7, DUP. (STAGE II)	601	0		1	304	NONE	0	0	31
67431	10373213	737	LIME SLUDGE POND, RUN 3, DUP. (STAGE II)	600	0		2	450	NONE	0	30	30
75202	10373401	0	LIME SLUDGE POND, RUN 1 (LONG-TERM)	601	0		2	90	SITE	180	19	0
75202	10373402	0	LIME SLUDGE POND, RUN 1 (LONG-TERM)	601	0		2	90	SITE	180	19	0
75202	10373601	0	LIME SLUDGE POND, RUN 2 (LONG-TERM)	601	0		2	300	SITE	151	0	31
75202	10373602	0	LIME SLUDGE POND, RUN 2 (LONG-TERM)	601	0		2	300	SITE	151	0	31
75202	10373801	0	LIME SLUDGE POND, RUN 3 (LONG-TERM)	600	0		2	150	SITE	300	31	30
75202	10373802	0	LIME SLUDGE POND, RUN 3 (LONG-TERM)	600	0		2	150	SITE	300	31	30

OU-2
FORMULATION INFORMATION (PART 2 OF 5)

Page No. 1
07/07/92

TREATABILITY SAMPLE #	AMOUNT OF CLINOPTI.(g)	AMOUNT OF H20	AMOUNT OF SODIUM H.(g)	HAND MIX	BENTONITE	SIEVE SIZE(in.)	WEIGHT NOT PASSING SEIVE(g)	PERCENT NOT PASSING SEIVE(%)	TEMPERATURE OF OVEN(C)	TIME OF SAMPLE HEATING(min.)
10162413	30	389	0	N		0.187	0	0.0		
10162513	0	308	0	N		0.187	0	0.0		
10162613	30	314	0	N		0.187	0	0.0		
10162713	30	340	0	N		0.187	0	0.0		
10162813	0	285	0	N		0.187	0	0.0		
10162913	10	320	0	N		0.187	0	0.0		
10163001	0	340	0	N		0.187	0	0.0		
10163013	0	340	0	N		0.187	0	0.0		
10163213	10	280	0	N		0.187	0	0.0		
10163413	0	300	0	N		0.187	65	2.8		
10163613	6	290	0	N		0.187	65	2.8		
10164213	15	190	0	N		N/S	0	0.0		
10164413	0	150	0	N		N/S	0	0.0		
10164613	30	237	0	N		0.187	0	0.0		
10164813	30	238	0	N		0.187	0	0.0		
10165013	0	150	0	N		N/S	0	0.0		
10165213	30	200	0	N		N/S	0	0.0		
10165413	0	180	0	N		N/S	0	0.0		
10165613	30	280	0	Y		N/S	0	0.0		
10165813	18	180	0	Y		N/S	0	0.0		
10166013	0	100	0	Y		N/S	0	0.0		
10166213	18	160	0	N		N/S	0	0.0		
10166413	0	255	0	N		0.187	0	0.0		
10166613	6	270	0	N		0.187	0	0.0		
10166813	30	216	0	N		N/S	0	0.0		
10167013	0	150	0	N		N/S	0	0.0		
10167213	30	260	0	N		N/S	0	0.0		
10167413	0	200	0	N		N/S	0	0.0		
10167613	0	200	0	N		N/S	0	0.0		
10167813	30	210	0	N		N/S	0	0.0		
10168213	0	360	0	N		0.187	0	0.0		
10168413	30	400	0	N		0.187	0	0.0		
10168613	30	360	0	N		0.187	0	0.0		
10168813	30	450	0	N		0.187	420	35.0		
10169013	0	300	0	N		0.187	420	35.0		
10169213	30	450	0	N		0.187	400	25.0		
10169413	0	330	0	N		0.187	400	25.0		
10169613	30	450	0	N		0.187	400	25.0		
10169813	0	360	0	N		0.187	400	25.0		
10310213	18	390	0	N		0.187	0	0.0		
10310413	0	360	0	N		0.187	0	0.0		
10310613	18	390	0	N		0.187	0	0.0		
10310813	18	390	0	N		0.187	0	0.0		
10311013	30	360	0	N		0.187	40	3.1		
10311213	30	450	0	N		0.187	40	3.1		
10311413	0	150	0	N		N/S	0	0.0		
10311613	18	180	0	N		N/S	0	0.0		
10311813	30	210	0	N		N/S	0	0.0		
10312013	30	320	0	N		0.187	30	1.6		
10312213	0	350	0	N		0.187	30	1.6		
10312413	6	290	0	N		0.187	30	1.6		

OU-2
Page No. 2
07/07/92

TREATABILITY SAMPLE #	AMOUNT OF CLINOPTI.(g)	AMOUNT OF H20	AMOUNT OF SODIUM H.(g)	HAND MIX	BENTONITE	SIEVE SIZE(in.)	WEIGHT NOT PASSING SEIVE(g)	PERCENT NOT PASSING SEIVE(%)	TEMPERATURE OF OVEN(C)	TIME OF SAMPLE HEATING(min.)
10312613	10	300	0	N		N/S	0	0.0		
10312813	8	330	0	N		N/S	0	0.0		
10313023	0	270	0	N		N/S	0	0.0		
10313213	23	279	0	N		N/S	0	0.0		
10313413	30	315	0	N		N/S	0	0.0		
10313613	45	420	0	N		N/S	0	0.0		
10313813	30	330	0	N		N/S	0	0.0		
10371213	30	250	0	N		0.187	0	0.0		
10371413	0	100	0	N		0.187	0	0.0		
10371613	30	206	0	N		0.187	0	0.0		
10371813	30	122	0	N		0.187	0	0.0		
10372013	0	50	0	N		0.187	0	0.0		
10372213	30	51	0	N		0.187	0	0.0		
10372413	30	120	0	N		0.187	0	0.0		
10372613	0	0	0	N		0.187	0	0.0		
10372813	30	60	0	N		0.187	0	0.0		
10373013	30	129	0	N		0.187	0	0.0		
10373213	31	252	0	N		0.187	0	0.0		
10373401	0	126	0	N		0.187	0	0.0		
10373402	0	126	0	N		0.187	0	0.0		
10373601	31	300	0	N		0.187	0	0.0		
10373602	31	300	0	N		0.187	0	0.0		
10373801	30	210	0	N		0.187	0	0.0		
10373802	30	210	0	N		0.187	0	0.0		

OU-2
FORMULATION INFORMATION (PART 3 OF 5)

Page No. 1
07/07/92

TREATABILITY SAMPLE #	NORMALIZED WASTE	% OF H2O IN WASTE	NORMALIZED WATER	NORMALIZED NA SILICATE	DRY BLEND	NORMALIZED CEMENT	NORMALIZED FLYASH	NORMALIZED ATTAPULG.	NORMALIZED CLINOPTI.	NORMALIZED SOIL	NORMALIZED NA. HYDRO.
10162413	100	0	65	0	85	25	50	5	5	0	0
10162513	100	0	51	5	75	25	50	0	0	0	0
10162613	100	0	52	5	85	25	50	5	5	0	0
10162713	100	0	57	0	60	25	25	5	5	0	0
10162813	100	0	48	5	50	25	25	0	0	0	0
10162913	100	0	53	0	103	50	50	2	2	0	0
10163001	100	0	57	5	100	50	50	0	0	0	0
10163013	100	0	57	5	100	50	50	0	0	0	0
10163213	100	0	47	0	78	50	25	2	2	0	0
10163413	100	0	50	5	75	50	25	0	0	0	0
10163613	100	0	48	0	47	15	30	1	1	0	0
10164213	100	40	32	0	80	25	50	3	3	0	0
10164413	100	40	25	5	75	25	50	0	0	0	0
10164613	100	40	40	5	85	25	50	5	5	0	0
10164813	100	40	40	0	60	25	25	5	5	0	0
10165013	100	40	25	5	50	25	25	0	0	0	0
10165213	100	40	33	0	110	50	50	5	5	0	0
10165413	100	40	30	5	100	50	50	0	0	0	0
10165613	100	40	47	0	85	50	25	5	5	0	0
10165813	100	40	30	0	51	15	30	3	3	0	0
10166013	100	40	17	3	45	15	30	0	0	0	0
10166213	100	40	27	3	51	15	30	3	3	0	0
10166413	100	0	43	3	45	15	30	0	0	0	0
10166613	100	0	45	3	47	15	30	1	1	0	0
10166813	100	40	36	0	85	25	50	5	5	0	0
10167013	100	40	25	5	75	50	25	0	0	0	0
10167213	100	40	43	0	110	50	50	5	5	0	0
10167413	100	40	33	5	100	50	50	0	0	0	0
10167613	100	40	22	0	50	25	25	0	0	0	0
10167813	100	40	35	5	60	25	25	5	5	0	0
10168213	100	13	60	5	75	25	50	0	0	0	0
10168413	100	13	67	0	85	25	50	5	5	0	0
10168613	100	13	60	5	85	25	50	5	5	0	0
10168813	100	13	75	0	60	25	25	5	5	0	0
10169013	100	13	50	5	50	25	25	0	0	0	0
10169213	100	13	75	0	110	50	50	5	5	0	0
10169413	100	13	55	5	100	50	50	0	0	0	0
10169613	100	13	75	0	85	50	25	5	5	0	0
10169813	100	13	60	5	75	50	25	0	0	0	0
10310213	100	13	65	0	81	25	50	3	3	0	0
10310413	100	13	60	3	75	25	50	0	0	0	0
10310613	100	13	65	3	81	25	50	3	3	0	0
10310813	100	13	65	0	81	25	50	3	3	0	0
10311013	100	13	60	5	85	25	50	5	5	0	0
10311213	100	13	75	0	110	50	50	5	5	0	0
10311413	100	40	25	5	50	25	25	0	0	0	0
10311613	100	40	30	0	51	15	30	3	3	0	0
10311813	100	40	35	5	60	25	25	5	5	0	0
10312013	100	0	53	5	85	25	50	5	5	0	0
10312213	100	0	58	5	100	50	50	0	0	0	0
10312413	100	0	48	3	47	15	30	1	1	0	0

270

3527

TREATABILITY SAMPLE #	NORMALIZED WASTE	% OF H2O IN WASTE	NORMALIZED WATER	NORMALIZED NA SILICATE	DRY BLEND	NORMALIZED CEMENT	NORMALIZED FLYASH	NORMALIZED ATTAPULG.	NORMALIZED CLINOPTI.	NORMALIZED SOIL	NORMALIZED NA. HYDRO.
10312613	100	-9.99	33	0	36	33	0	1	1	0	0
10312813	100	-9.99	34	2	13	12	0	1	1	0	0
10313023	100	-9.99	30	3	33	33	0	0	0	0	0
10313213	100	-9.99	29	2	16	12	0	2	2	0	0
10313413	100	-9.99	35	0	40	33	0	3	3	0	0
10313613	100	-9.99	37	0	28	20	0	4	4	0	0
10313813	100	-9.99	37	0	40	33	0	3	3	0	0
10371213	100	40	42	5	85	75	0	5	5	0	0
10371413	100	40	17	5	75	75	0	0	0	0	0
10371613	100	40	34	0	85	75	0	5	5	0	0
10371813	100	40	20	0	60	50	0	5	5	0	0
10372013	100	40	8	5	50	50	0	0	0	0	0
10372213	100	40	8	5	60	50	0	5	5	0	0
10372413	100	40	20	0	61	51	0	5	5	0	0
10372613	100	40	0	5	50	50	0	0	0	0	0
10372813	100	40	10	5	60	50	0	5	5	0	0
10373013	100	40	21	0	61	51	0	5	5	0	0
10373213	100	40	42	5	85	75	0	5	5	0	0
10373401	100	40	21	3	45	15	30	0	0	0	0
10373402	100	40	21	3	45	15	30	0	0	0	0
10373601	100	40	50	0	85	50	25	5	5	0	0
10373602	100	40	50	0	85	50	25	5	5	0	0
10373801	100	40	35	5	85	25	50	5	5	0	0
10373802	100	40	35	5	85	25	50	5	5	0	0

OU-2
FORMULATION INFORMATION (PART 4 OF 5)

Page No. 1
07/07/92

TREATABILITY SAMPLE #	% OF WASTE	% OF CEMENT	% OF FLYASH	% OF SODIUM SILICATE	% OF ATTAPULG	% OF CLINOPTI	% OF H2O
10162413	40.0	10.0	20.0	0.0	2.0	2.0	26.0
10162513	43.2	10.8	21.6	2.2	0.0	0.0	22.2
10162613	41.3	10.3	20.6	2.1	2.1	2.1	21.6
10162713	46.2	11.5	11.5	0.0	2.3	2.3	26.2
10162813	49.4	12.3	12.3	2.5	0.0	0.0	23.5
10162913	39.0	19.5	19.5	0.0	0.6	0.6	20.8
10163001	38.2	19.1	19.1	1.9	0.0	0.0	21.7
10163013	38.2	19.1	19.1	1.9	0.0	0.0	21.7
10163213	44.4	22.2	11.1	0.0	0.7	0.7	20.7
10163413	43.5	21.7	10.9	2.2	0.0	0.0	21.7
10163613	51.2	7.7	15.4	0.0	0.5	0.5	24.7
10164213	47.2	11.8	23.6	0.0	1.2	1.2	15.0
10164413	48.8	12.2	24.4	2.4	0.0	0.0	12.2
10164613	43.6	10.9	21.8	2.2	2.2	2.2	17.2
10164813	50.1	12.5	12.5	0.0	2.5	2.5	19.9
10165013	55.6	13.9	13.9	2.8	0.0	0.0	13.9
10165213	41.1	20.5	20.5	0.0	2.1	2.1	13.7
10165413	42.6	21.3	21.3	2.1	0.0	0.0	12.8
10165613	43.2	21.6	10.8	0.0	2.2	2.2	20.1
10165813	55.2	8.3	16.6	0.0	1.7	1.7	16.6
10166013	60.7	9.1	18.2	1.8	0.0	0.0	10.1
10166213	55.4	8.3	16.6	1.7	1.7	1.7	14.8
10166413	52.5	7.9	15.7	1.6	0.0	0.0	22.3
10166613	51.3	7.7	15.4	1.5	0.5	0.5	23.1
10166813	45.2	11.3	22.6	0.0	2.3	2.3	16.3
10167013	48.8	24.4	12.2	2.4	0.0	0.0	12.2
10167213	39.5	19.7	19.7	0.0	2.0	2.0	17.1
10167413	42.0	21.0	21.0	2.1	0.0	0.0	14.0
10167613	58.1	14.5	14.5	0.0	0.0	0.0	12.9
10167813	50.0	12.5	12.5	2.5	2.5	2.5	17.5
10168213	41.7	10.4	20.8	2.1	0.0	0.0	25.0
10168413	39.7	9.9	19.9	0.0	2.0	2.0	26.5
10168613	40.0	10.0	20.0	2.0	2.0	2.0	24.0
10168813	42.6	10.6	10.6	0.0	2.1	2.1	31.9
10169013	48.8	12.2	12.2	2.4	0.0	0.0	24.4
10169213	35.1	17.5	17.5	0.0	1.8	1.8	26.3
10169413	38.5	19.2	19.2	1.9	0.0	0.0	21.2
10169613	38.5	19.2	9.6	0.0	1.9	1.9	28.8
10169813	41.7	20.8	10.4	2.1	0.0	0.0	25.0
10310213	40.7	10.2	20.3	0.0	1.2	1.2	26.4
10310413	42.0	10.5	21.0	1.3	0.0	0.0	25.2
10310613	40.2	10.0	20.1	1.2	1.2	1.2	26.1
10310813	40.7	10.2	20.3	0.0	1.2	1.2	26.4
10311013	40.0	10.0	20.0	2.0	2.0	2.0	24.0
10311213	35.1	17.5	17.5	0.0	1.8	1.8	26.3
10311413	55.6	13.9	13.9	2.8	0.0	0.0	13.9
10311613	55.2	8.3	16.6	0.0	1.7	1.7	16.6
10311813	50.0	12.5	12.5	2.5	2.5	2.5	17.5
10312013	41.1	10.3	20.5	2.1	2.1	2.1	21.9
10312213	38.0	19.0	19.0	1.9	0.0	0.0	22.2
10312413	50.4	7.6	15.1	1.5	0.5	0.5	24.4

272

3527

TREATABILITY SAMPLE #	% OF WASTE	% OF CEMENT	% OF FLYASH	% OF SODIUM SILICATE	% OF ATTAPULG	% OF CLINOPTI	% OF H2O
10312613	59.2	19.7	0.0	0.0	0.7	0.7	19.7
10312813	67.0	7.7	0.0	1.5	0.5	0.5	22.7
10313023	60.0	20.0	0.0	2.0	0.0	0.0	18.0
10313213	68.0	7.8	0.0	1.6	1.6	1.6	19.5
10313413	57.1	19.0	0.0	0.0	1.9	1.9	20.0
10313613	60.5	12.1	0.0	0.0	2.4	2.4	22.6
10313813	56.6	18.9	0.0	0.0	1.9	1.9	20.8
10371213	43.2	32.4	0.0	2.2	2.2	2.2	18.0
10371413	50.8	38.1	0.0	2.6	0.0	0.0	8.5
10371613	45.6	34.2	0.0	0.0	2.3	2.3	15.7
10371813	55.4	27.7	0.0	0.0	2.8	2.8	11.3
10372013	61.2	30.6	0.0	3.1	0.0	0.0	5.1
10372213	57.6	28.8	0.0	2.9	2.9	2.9	4.9
10372413	55.4	28.0	0.0	0.0	2.8	2.8	11.0
10372613	64.5	32.3	0.0	3.3	0.0	0.0	0.0
10372813	57.2	28.5	0.0	2.9	2.9	2.9	5.7
10373013	54.9	27.7	0.0	0.0	2.8	2.8	11.8
10373213	43.1	32.3	0.0	2.2	2.2	2.2	18.1
10373401	59.1	8.9	17.7	1.8	0.0	0.0	12.4
10373402	59.1	8.9	17.7	1.8	0.0	0.0	12.4
10373601	42.5	21.2	10.7	0.0	2.2	2.2	21.2
10373602	42.5	21.2	10.7	0.0	2.2	2.2	21.2
10373801	44.4	11.1	22.2	2.3	2.2	2.2	15.5
10373802	44.4	11.1	22.2	2.3	2.2	2.2	15.5

OU-2
FORMULATION INFORMATION (PART 5 OF 5)

07/07/92

TREATABILITY SAMPLE #	COMMENT	GENERAL DESCRIPTION OF WASTE(before and after mixing)
10162413	SOLID WASTE LANDFILL, RUN 1	Recovery % = 78 Before: dry After: paste-like
10162513	SOLID WASTE LANDFILL, RUN 2	Recovery % = 78 Description: not reported
10162613	SOLID WASTE LANDFILL, RUN 3	Recovery % = 78 Before: dry After: paste-like
10162713	SOLID WASTE LANDFILL, RUN 4	Recovery % = 78 Before: dry After: paste-like
10162813	SOLID WASTE LANDFILL, RUN 5	Recovery %=78 Before: dry powder/fine granules(red-brown) After: brown, granular paste w/free liquid
10162913	SOLID WASTE LANDFILL, RUN 6	Recovery % = 78 Before: dry powder/fine granules(red-brown) After: fine, granular wet paste (brown)
10163001	SOLID WASTE LANDFILL, RUN 7, REPEAT	Recovery % = 78 Before: dry powder/fine granules (red-brown) After: fine, granular wet paste (brown)
10163013	SOLID WASTE LANDFILL, RUN 7	Recovery % = 78 Before: dry powder/fine granules (red-brown) After: fine, granular wet paste (brown)
10163213	SOLID WASTE LANDFILL, RUN 8	Recovery % = 82 Before: dry powder/fine granules (red-brown) After: fine, granular wet paste (brown)
10163413	SOLID WASTE LANDFILL, RUN 9	Recovery % = 82 Before: dry powder/fine granules (red-brown) After: fine, granular wet paste (brown)
10163613	SOLID WASTE LANDFILL, RUN 10	Recovery % = 80 Before: brownish waste After: muddish, paste-like mixture
10164213	LIME SLUDGE POND, WRONG MIXTURE	Before: whitish gray After: darker gray mixture (agglomerated)
10164413	LIME SLUDGE POND, RUN 2	Before: whitish gray After: paste-like, dark gray, sticky mixture
10164613	LIME SLUDGE POND, RUN 3	Before: soft, tan gray After: gray, smooth, moist paste
10164813	LIME SLUDGE POND, RUN 4	Before: tan, gray material After: moist, smooth, gray paste
10165013	LIME SLUDGE POND, RUN 5	Before: moist, multicolor, soft clay After: gray, almost soupy paste
10165213	LIME SLUDGE POND, RUN 6	Before: soft, moist, multicolor, clay-like After: gray, moist paste
10165413	LIME SLUDGE POND, RUN 7	Before: soft, moist, clay-like, multicolor After: gray, paste-like, stickier
10165613	LIME SLUDGE POND, RUN 8	Before: soft, moist, clay-like, multicolor After: gray, paste-like, stickier
10165813	LIME SLUDGE POND, RUN 10	Before: soft, moist, clay-like, multicolor After: gray, paste-like, stickier
10166013	LIME SLUDGE POND, RUN 11	Before: soft, moist, clay-like, multicolor After: gray, paste-like, stickier
10166213	LIME SLUDGE POND, RUN 12	Before: soft, moist, clay-like, multicolor After: gray, paste-like, stickier
10166413	SOLID WASTE LANDFILL, RUN 11	Recovery % = 80 Before: dry, reddish-brown After: wet, granular paste
10166613	SOLID WASTE LANDFILL, RUN 12	Recovery % = 80 Before: dry, reddish-brown material After: wet, paste
10166813	LIME SLUDGE POND, RUN 1	Before: soft, moist, gray, multicolor After: dark gray, wetter, softer
10167013	LIME SLUDGE POND, RUN 9	Before: soft, moist, gray, multicolor After: dark gray, wetter, softer
10167213	LIME SLUDGE POND, RUN 13	Before: soft, moist, gray, multicolor After: dark gray, wetter, softer
10167413	LIME SLUDGE POND, RUN 14	Before: soft, moist, gray, multicolor After: dark gray, wetter, softer
10167613	LIME SLUDGE POND, RUN 15	Before: soft, moist, gray, multicolor After: dark gray, wetter, softer
10167813	LIME SLUDGE POND, RUN 16	Before: soft, clay-like, gray, multicolor After: darker gray, wetter, softer
10168213	SOUTH FIELD, RUN 2	Before: soft, moist, brown, mud-like After: soft, brown, wetter
10168413	SOUTH FIELD, RUN 1	Before: soft, brown, mud-like After: softer, grayer, wetter
10168613	SOUTH FIELD, RUN 3	Before: soft, brown, mud-like After: softer, grayer, wetter
10168813	SOUTH FIELD, RUN 4	Before: soft, brown, mud-like After: softer, grayer, wetter
10169013	SOUTH FIELD, RUN 5	Before: soft, brown, mud-like After: softer, brown
10169213	SOUTH FIELD, RUN 6	Before: soft, brown, moist After: softer, grayer
10169413	SOUTH FIELD, RUN 7	Before: soft, brown, moist, mud-like After: softer, browner
10169613	SOUTH FIELD, RUN 8	Before: soft, brown, moist, mud-like After: softer, browner
10169813	SOUTH FIELD, RUN 9	Before: soft, brown, moist, mud-like After: softer, browner
10310213	SOUTH FIELD, RUN 10	Before: soft, brown, mud-like After: softer, browner
10310413	SOUTH FIELD, RUN 11	Before: soft, brown, mud-like After: softer, browner
10310613	SOUTH FIELD, RUN 12	Before: soft, brown, mud-like After: softer, browner
10310813	SOUTH FIELD, RUN 10, DUP.	Before: soft, brown, mud-like After: softer, browner
10311013	SOUTH FIELD, RUN 3, DUP.	Before: soft, brown, mud-like After: softer, browner
10311213	SOUTH FIELD, RUN 6, DUP.	Before: soft, brown, mud-like After: softer, grayer
10311413	LIME SLUDGE POND, RUN 5, DUP.	Before: soft, clay-like, multi-hued After: softer, grayer
10311613	LIME SLUDGE POND, RUN 10, DUP.	Before: soft, clay-like, multi-hued After: softer, grayer
10311813	LIME SLUDGE POND, RUN 16, DUP.	Before: soft, clay-like, multi-hued After: softer, grayer
10312013	SOLID WASTER LANDFILL, RUN 3, DUP.	Recovery % = 80 Before: brownish-red lumps of ashed waste After: mud-like
10312213	SOLID WASTE LANDFILL, RUN 7, DUP.	Recovery % = 80 Before: brownish-red lumps of ashed waste After: mud-like, wet, soupy
10312413	SOLID WASTE LANDFILL, RUN 12, DUP.	Recovery % = 80 Before: brownish-red lumps of ashed waste After: mud-like, pasty, brownish

3527

TREATABILITY SAMPLE #	COMMENT	GENERAL DESCRIPTION OF WASTE(before and after mixing)
10312613	RAW MATERIALS, RUN 1	Before: fine, powdery play sand After: sandy, gray mixture
10312813	RAW MATERIALS, RUN 2	Before: fine, powdery play sand After: grayer, sandy mixture
10313023	RAW MATERIALS, RUN 3	Before: fine, powdery play sand After: sandy, gray mixture
10313213	RAW MATERIALS, RUN 4	Before: fine, powdery play sand After: sandy, gray mixture
10313413	RAW MATERIALS, RUN 5	Before: fine, powdery play sand After: sandy, gray mixture
10313613	RAW MATERIALS, RUN 6	Before: fine, powdery play sand After: sandy, gray mixture
10313813	RAW MATERIALS, RUN 7	Before: fine, powdery play sand After: sandy, gray mixture
10371213	LIME SLUDGE POND, RUN 3 (STAGE II)	Before: moist, grayish clay w/dark burnt orange and white clumps After: smooth gray cement w/gloss
10371413	LIME SLUDGE POND, RUN 2 (STAGE II)	Before: moist, grayish clay w/dk burnt orange & white clumps After: thick, glossy, semi-smooth homog
10371613	LIME SLUDGE POND, RUN 1 (STAGE II)	Before: moist, grayish clay w/dark burnt orange & white clumps After: not reported
10371813	LIME SLUDGE POND, RUN 4 (STAGE II)	Before: moist, grayish clay w/dk burnt orange & white clumps After: smooth paste texture, grayish
10372013	LIME SLUDGE POND, RUN 5 (STAGE II)	Before: moist, grayish clay w/dk burnt orange & white clumps After: very wet, gray, smooth paste
10372213	LIME SLUDGE POND, RUN 6 (STAGE II)	Before: moist, grayish clay w/dk burnt orange & white clumps After: thick smooth paste which crumbld
10372413	LIME SLUDGE POND, RUN 7 (STAGE II)	Before: moist, grayish clay w/dk burnt orange & white clumps After: not reported
10372613	LIME SLUDGE POND, RUN 8 (STAGE II)	Before: moist, grayish clay w/dk burnt orange & white clumps After: thick but smooth & packable
10372813	LIME SLUDGE POND, RUN 9 (STAGE II)	Before: moist, grayish clay w/dk burnt orange & white clumps After: very thick, light gloss
10373013	LIME SLUDGE POND, RUN 7, DUP. (STAGE II)	Before: soft, streaky, multi-color After: gray, soft mixture
10373213	LIME SLUDGE POND, RUN 3, DUP. (STAGE II)	Before: soft, streaky, multi-color After: soft, gray mixture
10373401	LIME SLUDGE POND, RUN 1 (LONG-TERM)	Before: soft, streaky, multi-color After: soft, grayish mixture
10373402	LIME SLUDGE POND, RUN 1 (LONG-TERM)	Before: soft, streaky, multi-color After: soft, grayish mixture
10373601	LIME SLUDGE POND, RUN 2 (LONG-TERM)	Before: soft, streaky, multi-color After: soft, grayish mixture
10373602	LIME SLUDGE POND, RUN 2 (LONG-TERM)	Before: soft, streaky, multi-color After: soft, grayish mixture
10373801	LIME SLUDGE POND, RUN 3 (LONG-TERM)	Before: soft, streaky, multi-color After: soft, grayish mixture
10373802	LIME SLUDGE POND, RUN 3 (LONG-TERM)	Before: soft, streaky, multi-color After: soft, grayish mixture

OU-2
TDL ANALYTICAL INFORMATION (PART 1 OF 3)

07/07/92

TREATABILITY SAMPLE #	COMMENT	pH OF WASTE	Eh OF WASTE (mV)	pH OF FLYASH	Eh OF FLYASH (mV)	pH OF MIXTURE	Eh OF MIXTURE (mV)	WASTE MOISTURE CONTENT	FLYASH MOISTURE CONTENT	MIXTURE MOISTURE CONTENT	TEMP RISE (C)	TIME BETWEEN MIX & TEMP. MEASUR.(MIN.)	CRUSHED MOISTURE CONTENT	SHEAR STRENGTH (t/sq.ft.)	POCKET PENET. (t/sq.ft.)
10162413	SOLID WASTE LANDFILL, RUN 1	8.7	175	7.1	375	12.0	-45	0.37	-9.99	-9.99	0.0	-99.99	23.5	0.0	>700.0
10162513	SOLID WASTE LANDFILL, RUN 2	8.7	175	7.1	375	11.8	-21	0.37	-9.99	-9.99	0.5	-99.99	22.2	0.0	>700.0
10162613	SOLID WASTE LANDFILL, RUN 3	8.7	175	7.1	375	11.8	-12	0.37	-9.99	-9.99	1.0	-99.99	22.8	0.0	>700.0
10162713	SOLID WASTE LANDFILL, RUN 4	8.7	175	7.1	375	11.9	-30	0.37	-9.99	-9.99	1.0	-99.99	22.7	0.0	>700.0
10162813	SOLID WASTE LANDFILL, RUN 5	8.7	175	7.1	375	12.1	-27	0.37	-9.99	-9.99	0.0	4.0	21.8	0.0	>700.0
10162913	SOLID WASTE LANDFILL, RUN 6	8.7	175	7.1	375	11.4	0	0.37	-9.99	-9.99	0.5	1.0	16.8	0.0	>700.0
10163001	SOLID WASTE LANDFILL, RUN 7, REPEAT	8.7	175	7.1	375	11.2	-21	0.37	-9.99	-9.99	0.0	0.5	18.7	0.1	>700.0
10163013	SOLID WASTE LANDFILL, RUN 7	8.7	175	7.1	375	11.2	-21	0.37	-9.99	-9.99	0.0	0.5	18.7	0.1	>700.0
10163213	SOLID WASTE LANDFILL, RUN 8	9.5	120	7.1	375	11.2	0	0.37	-9.99	-9.99	0.5	1.0	15.0	0.3	>700.0
10163413	SOLID WASTE LANDFILL, RUN 9	9.5	120	7.1	375	11.7	0	0.37	-9.99	-9.99	1.0	1.0	16.5	0.0	>700.0
10163613	SOLID WASTE LANDFILL, RUN 10	8.8	138	7.1	375	11.9	12	0.37	-9.99	-9.99	0.5	6.0	20.8	0.0	>700.0
10164213	LIME SLUDGE POND, WRONG MIXTURE	8.3	150	7.1	375	11.9	-35	40.30	-9.99	-9.99	1.0	1.0	-9.99	0.1	>700.0
10164413	LIME SLUDGE POND, RUN 2	8.8	138	7.4	420	11.7	30	40.30	-9.99	-9.99	2.0	1.0	31.4	0.2	>700.0
10164613	LIME SLUDGE POND, RUN 3	8.3	150	7.1	375	12.1	33	40.30	-9.99	-9.99	0.0	1.0	32.7	0.1	>4.5
10164813	LIME SLUDGE POND, RUN 4	8.3	150	7.1	375	11.6	-15	40.30	-9.99	-9.99	0.0	1.0	34.7	0.0	>4.5
10165013	LIME SLUDGE POND, RUN 5	8.9	132	7.1	375	11.9	-77	40.30	-9.99	-9.99	0.5	1.0	40.7	0.0	>4.5
10165213	LIME SLUDGE POND, RUN 6	8.9	132	7.1	375	11.7	-27	40.30	-9.99	-9.99	0.0	1.0	33.8	0.1	>4.5
10165413	LIME SLUDGE POND, RUN 7	8.9	132	7.1	375	12.3	12	40.30	-9.99	-9.99	0.0	1.0	32.1	0.0	>4.5
10165613	LIME SLUDGE POND, RUN 8	8.9	132	7.1	375	11.9	20	40.30	-9.99	-9.99	1.0	1.0	28.7	0.0	>4.5
10165813	LIME SLUDGE POND, RUN 10	8.6	132	7.4	335	11.4	200	40.30	-9.99	-9.99	1.0	1.0	41.5	0.0	>4.5
10166013	LIME SLUDGE POND, RUN 11	8.6	132	7.4	335	11.8	120	40.30	-9.99	-9.99	0.0	1.0	42.3	0.0	>4.5
10166213	LIME SLUDGE POND, RUN 12	8.6	132	7.4	335	11.8	10	40.30	-9.99	-9.99	0.0	1.0	41.7	0.1	>4.5
10166413	SOLID WASTE LANDFILL, RUN 11	8.8	138	7.4	355	11.7	48	0.37	-9.99	-9.99	0.0	1.0	18.0	0.0	-99.9
10166613	SOLID WASTE LANDFILL, RUN 12	8.8	138	7.4	355	11.7	18	0.37	-9.99	-9.99	0.0	1.0	22.0	0.0	-99.9
10166813	LIME SLUDGE POND, RUN 1	8.6	132	7.4	390	11.4	30	40.30	-9.99	-9.99	1.0	1.0	38.5	0.0	-99.9
10167013	LIME SLUDGE POND, RUN 9	8.6	132	7.4	390	12.1	-12	40.30	-9.99	-9.99	1.0	1.0	30.8	0.0	-99.9
10167213	LIME SLUDGE POND, RUN 13	8.6	132	7.4	390	11.4	-30	40.30	-9.99	-9.99	0.0	1.0	31.3	0.0	-99.9
10167413	LIME SLUDGE POND, RUN 14	8.6	132	7.4	390	11.8	-8	40.30	-9.99	-9.99	1.0	2.0	32.3	0.0	-99.9
10167613	LIME SLUDGE POND, RUN 15	8.6	132	7.4	390	11.5	10	40.30	-9.99	-9.99	1.0	1.0	36.2	0.0	-99.9
10167813	LIME SLUDGE POND, RUN 16	9.0	140	8.8	180	12.0	-44	40.30	-9.99	-9.99	1.0	1.0	34.6	0.1	>4.5
10168213	SOUTH FIELD, RUN 2	7.7	130	8.8	180	11.6	-15	13.10	-9.99	-9.99	1.0	1.0	26.2	0.2	>4.5
10168413	SOUTH FIELD, RUN 1	7.9	183	7.7	210	11.5	31	13.10	-9.99	22.1	2.0	0.0	28.9	0.0	>4.5
10168613	SOUTH FIELD, RUN 3	7.9	183	7.7	210	12.4	5	13.10	-9.99	32.9	5.0	1.0	27.4	0.2	>4.5
10168813	SOUTH FIELD, RUN 4	7.6	237	7.7	210	11.3	70	13.10	-9.99	28.9	1.0	1.0	29.2	0.1	>4.5
10169013	SOUTH FIELD, RUN 5	7.6	237	7.7	210	11.6	-4	13.10	-9.99	38.0	1.0	1.0	26.8	0.1	>4.5
10169213	SOUTH FIELD, RUN 6	7.6	237	7.7	210	11.8	20	13.10	-9.99	30.2	0.5	1.0	25.3	0.2	>4.5
10169413	SOUTH FIELD, RUN 7	7.6	237	7.7	210	12.0	10	13.10	-9.99	33.9	1.5	1.0	28.3	0.0	>4.5
10169613	SOUTH FIELD, RUN 8	7.6	237	7.7	210	11.7	-10	13.10	-9.99	32.0	1.0	1.0	26.1	0.2	>4.5
10169813	SOUTH FIELD, RUN 9	7.6	237	7.7	210	11.9	10	13.10	-9.99	31.9	1.0	1.0	24.5	0.1	>4.5
10310213	SOUTH FIELD, RUN 10	7.3	255	7.8	308	11.5	60	13.10	-9.99	36.0	0.5	1.0	30.2	0.1	>4.5
10310413	SOUTH FIELD, RUN 11	7.3	255	8.8	308	11.8	60	13.10	-9.99	34.3	1.0	1.0	29.8	0.1	>4.5
10310613	SOUTH FIELD, RUN 12	7.3	255	7.8	308	11.9	10	13.10	-9.99	36.7	0.5	1.0	30.6	0.0	>4.5
10310813	SOUTH FIELD, RUN 10, DUP.	7.3	255	7.8	308	11.9	30	13.10	-9.99	35.8	1.0	1.0	29.2	0.1	>4.5
10311013	SOUTH FIELD, RUN 3, DUP.	7.7	248	7.4	292	12.1	0	13.10	-9.99	36.2	1.0	2.0	29.5	0.1	>4.5
10311213	SOUTH FIELD, RUN 6, DUP.	7.7	248	7.4	292	12.0	10	13.10	-9.99	34.4	2.0	1.0	26.0	0.1	>4.5
10311413	LIME SLUDGE POND, RUN 5, DUP.	8.5	135	7.4	292	12.3	-12	40.30	-9.99	41.9	0.5	1.0	34.5	0.0	>4.5
10311613	LIME SLUDGE POND, RUN 10, DUP.	8.5	135	7.4	292	11.9	-15	40.30	-9.99	43.8	0.0	2.0	35.8	0.0	>4.5
10311813	LIME SLUDGE POND, RUN 16, DUP.	8.1	182	7.7	215	12.1	-10	40.30	-9.99	44.1	1.0	1.0	37.7	0.1	>4.5
10312013	SOLID WASTE LANDFILL, RUN 3, DUP.	8.8	145	7.7	215	11.6	15	0.37	-9.99	29.9	1.5	1.0	24.9	0.0	>4.5
10312213	SOLID WASTE LANDFILL, RUN 7, DUP.	8.8	145	7.7	215	11.9	5	0.37	-9.99	28.9	2.0	2.0	20.3	0.0	>4.5

TREATABILITY SAMPLE #	COMMENT	pH OF WASTE	Eh OF WASTE (mV)	pH OF FLYASH	Eh OF FLYASH (mV)	pH OF MIXTURE	Eh OF MIXTURE (mV)	WASTE MOISTURE CONTENT	FLYASH MOISTURE CONTENT	MIXTURE MOISTURE CONTENT	TEMP RISE (C)	TIME BETWEEN MIX & TEMP. MEASUR.(MIN.)	CRUSHED MOISTURE CONTENT	SHEAR STRENGTH (t/sq.ft.)	POCKET PENET. (t/sq.ft.
10312413	SOLID WASTE LANDFILL, RUN 12, DUP.	8.8	145	7.7	215	11.7	99	0.37	-9.99	29.4	3.0	1.0	24.3	0.0	>4.5
10312613	RAW MATERIALS, RUN 1	8.6	174	-9.99	-9999	11.6	60	-9.99	-9.99	19.3	0.0	2.0	11.8	0.0	>4.5
10312813	RAW MATERIALS, RUN 2	8.6	174	-9.99	-9999	11.6	-30	-9.99	-9.99	20.2	0.5	1.0	16.4	0.0	>4.5
10313023	RAW MATERIALS, RUN 3	8.6	174	-9.99	-9999	11.7	-49	-9.99	-9.99	19.2	0.5	1.0	18.7	0.0	>4.5
10313213	RAW MATERIALS, RUN 4	8.6	174	-9.99	-9999	11.6	-29	-9.99	-9.99	22.6	0.5	1.0	11.7	0.1	>4.5
10313413	RAW MATERIALS, RUN 5	8.9	150	-9.99	-9999	11.6	46	-9.99	-9.99	19.8	1.0	2.0	13.3	0.1	>4.5
10313613	RAW MATERIALS, RUN 6	8.9	150	-9.99	-9999	11.9	-20	-9.99	-9.99	22.9	1.0	1.0	15.9	0.2	>4.5
10313813	RAW MATERIALS, RUN 7	8.9	150	-9.99	-9999	11.7	-27	-9.99	-9.99	20.5	1.5	1.0	13.5	0.2	>4.5
10371213	LIME SLUDGE POND, RUN 3 (STAGE II)	8.8	231	-9.99	-9999	12.2	45	40.30	-9.99	38.8	0.0	-99.99	30.3	0.1	-99.9
10371413	LIME SLUDGE POND, RUN 2 (STAGE II)	8.8	231	-9.99	-9999	12.1	55	40.30	-9.99	32.7	0.0	-99.99	23.6	0.1	-99.9
10371613	LIME SLUDGE POND, RUN 1 (STAGE II)	8.8	231	-9.99	-9999	12.2	43	40.30	-9.99	34.6	0.0	-99.99	26.3	0.1	-99.9
10371813	LIME SLUDGE POND, RUN 4 (STAGE II)	8.8	231	-9.99	-9999	12.2	45	40.30	-9.99	32.9	0.0	1.0	26.6	0.1	-99.9
10372013	LIME SLUDGE POND, RUN 5 (STAGE II)	8.8	231	-9.99	-9999	12.2	48	40.30	-9.99	32.8	0.0	1.0	26.7	0.0	-99.9
10372213	LIME SLUDGE POND, RUN 6 (STAGE II)	8.8	231	-9.99	-9999	12.3	19	40.30	-9.99	33.9	0.0	1.0	29.2	0.1	-99.9
10372413	LIME SLUDGE POND, RUN 7 (STAGE II)	8.8	231	-9.99	-9999	12.1	89	40.30	-9.99	31.2	0.0	1.0	32.4	-9.99	-99.9
10372613	LIME SLUDGE POND, RUN 8 (STAGE II)	8.8	231	-9.99	-9999	12.4	18	40.30	-9.99	27.0	0.0	-99.99	28.7	0.2	-99.9
10372813	LIME SLUDGE POND, RUN 9 (STAGE II)	8.8	231	-9.99	-9999	12.2	47	40.30	-9.99	29.2	0.0	-99.99	27.4	1.4	-99.9
10373013	LIME SLUDGE POND, RUN 7, DUP. (STAGE II)	8.9	167	-9.99	-9999	12.1	28	40.30	-9.99	34.1	0.0	1.0	29.3	0.0	>4.5
10373213	LIME SLUDGE POND, RUN 3, DUP. (STAGE II)	8.9	167	-9.99	-9999	12.5	50	40.30	-9.99	36.7	0.0	1.0	31.6	0.0	>4.5
10373401	LIME SLUDGE POND, RUN 1 (LONG-TERM)	8.9	167	7.8	190	12.2	-40	40.30	-9.99	44.9	0.0	3.0	42.0	0.0	>4.5
10373402	LIME SLUDGE POND, RUN 1 (LONG-TERM)	8.9	167	7.8	190	12.2	-40	40.30	-9.99	44.9	0.0	3.0	40.0	0.0	>4.5
10373601	LIME SLUDGE POND, RUN 2 (LONG-TERM)	8.9	167	7.8	190	12.2	-30	40.30	-9.99	42.3	0.0	1.0	35.1	0.0	>4.5
10373602	LIME SLUDGE POND, RUN 2 (LONG-TERM)	8.9	167	7.8	190	12.2	-30	40.30	-9.99	42.3	0.0	1.0	34.2	0.0	>4.5
10373801	LIME SLUDGE POND, RUN 3 (LONG-TERM)	8.8	182	7.4	230	12.1	11	40.30	-9.99	38.0	0.0	1.0	38.3	0.0	-99.9
10373802	LIME SLUDGE POND, RUN 3 (LONG-TERM)	8.8	182	7.4	230	12.1	11	40.30	-9.99	38.0	0.0	1.0	38.0	0.0	-99.9

OU-2
TDL ANALYTICAL INFORMATION (PART 2 OF 3)

07/07/92

TREATABILITY SAMPLE #	GROSS ALPHA (dpm)	GROSS BETA (dpm)	GROSS ALPHA (pCi/l)	GROSS BETA (pCi/l)	TOTAL URANIUM (ppm)	UCS (psi)	BULKING FACTOR(%)	BULK DENSITY(g/cc)	PERMEABILITY	pH OF MTCLP DETER. TEST	pH OF MTCLP	TYPE (1/2)
10162413	0.0	0.6	0.0	67.6	0.0000	380	158.5	1.8	0.0	2.6	11.05	1
10162513	0.0	0.0	0.0	0.0	0.0000	446	136.6	1.8	3.6 E-4	2.6	10.85	1
10162613	2.7	5.1	304.0	574.3	0.0000	454	151.5	1.8	2.6 E-8	2.7	10.80	1
10162713	0.0	0.6	0.0	67.6	0.0000	397	117.9	1.8	0.00	2.4	11.15	1
10162813	0.0	0.0	0.0	0.0	0.0000	> 480	107.2	1.8	2.5 E-8	3.9	11.05	1
10162913	0.0	2.9	0.0	326.5	0.0000	450	156.0	1.8	0.00	3.6	11.60	1
10163001	-9999.9	-9999.9	0.0	0.0	-999.9999	> 480	167.9	1.8	0.00	0.0	0.00	
10163013	0.0	3.4	0.0	382.8	0.0000	385	166.0	1.8	<9.1 E-10	4.3	11.70	1
10163213	0.0	1.2	0.0	135.1	0.0000	474	120.5	1.9	1.1 E-10	3.6	11.90	1
10163413	0.0	1.2	0.0	135.1	0.0000	> 480	128.0	1.9	8.1 E-10	3.6	11.80	1
10163613	0.0	0.0	0.0	0.0	0.0000	220	98.9	1.8	0.00	3.0	10.80	1
10164213	0.0	0.0	0.0	0.0	0.0228	244	73.6	1.6	0.00	8.5	7.60	2
10164413	0.0	1.1	0.0	123.9	0.0232	251	71.4	1.6	0.00	8.9	7.40	2
10164613	0.0	1.8	0.0	202.7	0.0985	231	93.2	1.5	0.00	6.8	7.40	2
10164813	0.0	0.6	0.0	67.6	0.0358	195	68.6	1.5	0.00	8.3	8.40	2
10165013	0.0	0.0	0.0	0.0	0.0000	120	59.1	1.5	0.00	8.2	9.40	2
10165213	0.0	1.1	0.0	123.9	0.0000	313	107.0	1.5	0.00	9.0	7.10	2
10165413	0.0	2.3	0.0	259.0	0.0000	381	96.9	1.6	8.9 E-8	9.2	11.30	2
10165613	4.6	0.0	518.0	0.0	0.0341	> 480	87.5	1.6	1.0 E-7	11.5	11.50	2
10165813	0.0	1.2	0.0	135.1	0.0312	104	59.2	1.5	0.00	7.0	9.00	2
10166013	4.6	1.2	518.0	135.1	0.0292	94	49.6	1.4	0.00	7.0	7.20	2
10166213	0.0	0.0	0.0	0.0	0.0228	87	66.4	1.4	0.00	6.4	6.60	2
10166413	4.0	0.0	450.4	0.0	0.0000	383	95.5	1.8	0.00	2.7	10.90	1
10166613	0.0	2.2	0.0	247.7	0.0000	304	102.0	1.8	0.00	3.5	11.10	1
10166813	1.7	0.0	191.4	0.0	0.0000	192	95.0	1.5	0.00	5.1	8.30	2
10167013	1.5	4.9	168.9	551.7	0.0000	407	68.3	1.6	6.4 E-8	11.2	11.60	2
10167213	0.0	4.9	0.0	551.7	0.0000	466	110.3	1.6	0.00	8.0	11.00	2
10167413	0.0	0.0	0.0	0.0	0.0000	314	99.1	1.6	0.00	8.5	11.10	2
10167613	0.0	0.6	0.0	67.6	0.0000	166	46.3	1.5	0.00	8.4	10.60	2
10167813	1.9	0.0	213.9	0.0	0.0000	194	71.8	1.5	6.5 E-8	7.1	7.80	2
10168213	2.6	0.0	292.8	0.0	0.0000	296	154.0	1.6	1.5 E-7	2.5	11.40	1
10168413	0.0	2.3	0.0	259.0	0.0000	238	170.0	1.6	0.00	4.1	11.40	1
10168613	1.4	0.0	157.6	0.0	0.0000	249	168.9	1.6	0.00	3.1	11.30	1
10168813	0.0	1.7	0.0	191.4	0.0000	209	144.9	1.7	4.7 E-8	2.6	11.60	1
10169013	0.0	0.0	0.0	0.0	0.0000	354	112.9	1.7	0.00	3.0	11.60	1
10169213	0.0	0.0	0.0	0.0	0.0000	469	194.4	1.7	1.5 E-8	3.2	10.90	2
10169413	0.0	0.0	0.0	0.0	0.0000	220	174.9	1.6	0.00	2.8	11.60	1
10169613	0.0	0.0	0.0	0.0	0.0000	> 480	173.9	1.6	9.4 E-8	4.8	9.40	2
10169813	1.6	1.2	180.2	135.1	0.0000	> 480	150.6	1.7	7.2 E-8	5.2	11.40	2
10310213	2.1	5.9	236.5	664.3	0.1095	219	157.2	1.6	0.00	3.3	11.30	1
10310413	1.4	8.4	157.6	945.8	0.1097	237	150.5	1.6	6.7 E-8	3.2	11.30	1
10310613	4.5	1.7	506.7	191.4	1.0447	158	168.4	1.6	0.00	3.5	11.30	1
10310813	1.9	3.5	213.9	394.1	0.3464	176	159.9	1.6	0.00	8.7	6.90	2
10311013	0.0	3.8	0.0	427.9	0.2652	281	165.8	1.6	0.00	4.0	11.50	1
10311213	0.0	0.6	0.0	67.6	0.5118	> 480	192.6	1.7	<8.3 E-10	9.8	10.95	2
10311413	0.0	3.0	0.0	337.8	0.3142	189	53.1	1.5	0.00	9.2	9.75	2
10311613	3.2	5.1	360.3	574.3	0.2001	116	53.1	1.5	0.00	8.4	7.05	2
10311813	1.7	1.7	191.4	191.4	0.1081	185	77.9	1.5	1.7 E-8	10.4	7.95	2
10312013	0.0	0.0	0.0	0.0	0.2281	> 480	157.1	1.7	4.2 E-8	4.5	11.05	1
10312213	6.3	5.1	709.4	574.3	0.9679	> 480	166.3	1.8	1.3 E-7	9.9	9.75	2

TREATABILITY SAMPLE #	GROSS ALPHA (dpm)	GROSS BETA (dpm)	GROSS ALPHA (pCi/l)	GROSS BETA (pCi/l)	TOTAL URANIUM (ppm)	UCS (psi)	BULKING FACTOR(%)	BULK DENSITY(g/cc)	PERMEABILITY	pH OF MTCLP DETER. TEST	pH OF MTCLP	TYPE (1/2)
10312413	5.8	3.4	653.1	382.8	0.0710	329	106.5	1.8	0.00	4.3	10.65	1
10312613	-9999.9	-9999.9	0.0	0.0	-999.9999	> 480	29.6	2.0	0.00	-9.99	-9.99	
10312813	-9999.9	-9999.9	0.0	0.0	-999.9999	101	21.8	1.9	0.00	-9.99	-9.99	
10313023	-9999.9	-9999.9	0.0	0.0	-999.9999	0	40.5	1.8	0.00	-9.99	-9.99	
10313213	-9999.9	-9999.9	0.0	0.0	-999.9999	> 480	12.3	2.0	0.00	-9.99	-9.99	
10313413	-9999.9	-9999.9	0.0	0.0	-999.9999	> 480	37.9	2.0	0.00	-9.99	-9.99	
10313613	-9999.9	-9999.9	0.0	0.0	-999.9999	391	36.1	1.9	0.00	-9.99	-9.99	
10313813	-9999.9	-9999.9	0.0	0.0	-999.9999	> 480	42.1	1.9	0.00	-9.99	-9.99	
10371213	6.4	0.4	720.6	45.0	0.0000	> 480	85.1	1.6	0.00	12.3	12.00	2
10371413	0.0	4.8	0.0	540.5	0.0000	> 480	46.8	1.7	0.00	12.3	12.20	2
10371613	0.0	1.2	0.0	135.1	0.0000	> 480	68.3	1.7	0.00	12.3	12.30	2
10371813	0.0	0.4	0.0	45.0	0.0000	> 480	39.5	1.7	3.7 E-8	12.3	12.00	2
10372013	3.1	1.6	349.1	180.2	0.0000	> 480	23.7	1.7	8.5 E-9	12.2	12.15	2
10372213	0.0	1.6	0.0	180.2	0.0000	> 480	35.2	1.7	0.00	12.0	11.95	2
10372413	0.0	0.0	0.0	0.0	0.0000	> 480	45.8	1.6	0.00	12.2	11.80	2
10372613	0.0	0.0	0.0	0.0	0.0000	> 480	22.4	1.7	0.00	12.0	11.85	2
10372813	1.5	3.9	168.9	439.1	0.0000	> 480	30.8	1.7	0.00	12.1	12.00	2
10373013	0.0	0.0	0.0	0.0	0.0000	> 480	48.3	1.6	0.00	12.2	11.95	2
10373213	0.0	0.4	0.0	45.0	0.0000	> 480	89.5	1.6	0.00	12.2	12.20	2
10373401	-9999.9	-9999.9	0.0	0.0	0.0000	100	48.9	1.5	0.00	11.1	7.45	2
10373402	-9999.9	-9999.9	0.0	0.0	-999.9999	148	52.2	1.4	0.00	-9.99	-9.99	
10373601	-9999.9	-9999.9	0.0	0.0	0.0000	335	98.1	1.5	0.00	12.0	11.85	2
10373602	-9999.9	-9999.9	0.0	0.0	-999.9999	> 480	99.4	1.5	0.00	-9.99	-9.99	
10373801	-9999.9	-9999.9	0.0	0.0	0.0141	211	95.9	1.5	0.00	11.3	11.40	2
10373802	-9999.9	-9999.9	0.0	0.0	-999.9999	333	96.2	1.5	0.00	-9.99	-9.99	

OU-2
TDL INFORMATION (PART 3 OF 3)

07/07/92

TREATABILITY SAMPLE #	COMMENT	DESCRIPTION
10162413	SOLID WASTE LANDFILL, RUN 1	
10162513	SOLID WASTE LANDFILL, RUN 2	
10162613	SOLID WASTE LANDFILL, RUN 3	
10162713	SOLID WASTE LANDFILL, RUN 4	
10162813	SOLID WASTE LANDFILL, RUN 5	
10162913	SOLID WASTE LANDFILL, RUN 6	
10163001	SOLID WASTE LANDFILL, RUN 7, REPEAT	
10163013	SOLID WASTE LANDFILL, RUN 7	
10163213	SOLID WASTE LANDFILL, RUN 8	
10163413	SOLID WASTE LANDFILL, RUN 9	
10163613	SOLID WASTE LANDFILL, RUN 10	
10164213	LIME SLUDGE POND, WRONG MIXTURE	
10164413	LIME SLUDGE POND, RUN 2	
10164613	LIME SLUDGE POND, RUN 3	
10164813	LIME SLUDGE POND, RUN 4	
10165013	LIME SLUDGE POND, RUN 5	
10165213	LIME SLUDGE POND, RUN 6	
10165413	LIME SLUDGE POND, RUN 7	
10165613	LIME SLUDGE POND, RUN 8	
10165813	LIME SLUDGE POND, RUN 10	
10166013	LIME SLUDGE POND, RUN 11	
10166213	LIME SLUDGE POND, RUN 12	
10166413	SOLID WASTE LANDFILL, RUN 11	
10166613	SOLID WASTE LANDFILL, RUN 12	
10166813	LIME SLUDGE POND, RUN 1	
10167013	LIME SLUDGE POND, RUN 9	
10167213	LIME SLUDGE POND, RUN 13	
10167413	LIME SLUDGE POND, RUN 14	
10167613	LIME SLUDGE POND, RUN 15	
10167813	LIME SLUDGE POND, RUN 16	
10168213	SOUTH FIELD, RUN 2	
10168413	SOUTH FIELD, RUN 1	
10168613	SOUTH FIELD, RUN 3	
10168813	SOUTH FIELD, RUN 4	
10169013	SOUTH FIELD, RUN 5	
10169213	SOUTH FIELD, RUN 6	
10169413	SOUTH FIELD, RUN 7	
10169613	SOUTH FIELD, RUN 8	
10169813	SOUTH FIELD, RUN 9	
10310213	SOUTH FIELD, RUN 10	
10310413	SOUTH FIELD, RUN 11	
10310613	SOUTH FIELD, RUN 12	
10310813	SOUTH FIELD, RUN 10, DUP.	
10311013	SOUTH FIELD, RUN 3, DUP.	
10311213	SOUTH FIELD, RUN 6, DUP.	
10311413	LIME SLUDGE POND, RUN 5, DUP.	
10311613	LIME SLUDGE POND, RUN 10, DUP.	
10311813	LIME SLUDGE POND, RUN 16, DUP.	
10312013	SOLID WASTE LANDFILL, RUN 3, DUP.	
10312213	SOLID WASTE LANDFILL, RUN 7, DUP.	
10312413	SOLID WASTE LANDFILL, RUN 12, DUP.	

TREATABILITY SAMPLE #	COMMENT	DESCRIPTION
10312613	RAW MATERIALS, RUN 1	
10312813	RAW MATERIALS, RUN 2	
10313023	RAW MATERIALS, RUN 3	
10313213	RAW MATERIALS, RUN 4	
10313413	RAW MATERIALS, RUN 5	
10313613	RAW MATERIALS, RUN 6	
10313813	RAW MATERIALS, RUN 7	
10371213	LIME SLUDGE POND, RUN 3 (STAGE II)	
10371413	LIME SLUDGE POND, RUN 2 (STAGE II)	
10371613	LIME SLUDGE POND, RUN 1 (STAGE II)	
10371813	LIME SLUDGE POND, RUN 4 (STAGE II)	
10372013	LIME SLUDGE POND, RUN 5 (STAGE II)	
10372213	LIME SLUDGE POND, RUN 6 (STAGE II)	
10372413	LIME SLUDGE POND, RUN 7 (STAGE II)	
10372613	LIME SLUDGE POND, RUN 8 (STAGE II)	
10372813	LIME SLUDGE POND, RUN 9 (STAGE II)	
10373013	LIME SLUDGE POND, RUN 7, DUP. (STAGE II)	
10373213	LIME SLUDGE POND, RUN 3, DUP. (STAGE II)	
10373401	LIME SLUDGE POND, RUN 1 (LONG-TERM)	
10373402	LIME SLUDGE POND, RUN 1 (LONG-TERM)	
10373601	LIME SLUDGE POND, RUN 2 (LONG-TERM)	
10373602	LIME SLUDGE POND, RUN 2 (LONG-TERM)	
10373801	LIME SLUDGE POND, RUN 3 (LONG-TERM)	
10373802	LIME SLUDGE POND, RUN 3 (LONG-TERM)	

APPENDIX C

APPENDIX C

MTCLP AND TCLP TREATABILITY RESULTS

APPENDIX C - TABLE OF CONTENTS

Table C-1 Laboratory Qualifiers

Table C-2 Contract Detection Limits

Table C-3 MTCLP Inorganic Results

Table C-4 Inorganic TCLP Results

Table C-5 Radiological TCLP Results

Table C-6 Volatile Organic TCLP Results

Table C-7 Semivolatile Organic TCLP Results

Table C-8 Summary Statistical Analysis-Solid Waste Landfill-Chemical Constituents-Raw Data

Table C-9 Summary Statistical Analysis-Lime Sludge Pond-Chemical Constituents-Raw Data

Table C-10 Summary Statistical Analysis-South Field-Chemical Constituents-Raw Data

Table C-11 Summary Statistical Analysis-Solid Waste Landfill-Radiological Constituents-Raw Data

Table C-12 Summary Statistical Analysis-Lime Sludge Pond-Radiological Constituents-Raw Data

Table C-13 Summary Statistical Analysis-South Field-Radiological Constituent-Raw Data

Table C-14 Summary Statistical Analysis-Solid Waste Landfill-Chemical Constituents-Spike Corrected Data

Table C-15 Summary Statistical Analysis-Lime Sludge Pond-Chemical Constituent-Spike Corrected Data

Table C-16 Summary Statistical Analysis-South Field-Chemical Constituents-Spike Corrected Data

Table C-17 Summary Statistical Analysis-Solid Waste Landfill-Chemical Constituents-Spike and Dilution Corrected Data

Table C-18 Summary Statistical Analysis-Lime Sludge Pond-Chemical Constituents-Spike and Dilution Corrected Data

Table C-19 Summary Statistical Analysis-South Field-Chemical Constituents-Spike and Dilution Data

TABLE C-1. Laboratory Qualifiers Used with Treatability Samples

Organic Qualifiers

U = Indicates compound was analyzed for but not detected.

J = Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B = This flag is used when the analyte is found in the associated blank as well as the sample. It indicates possible/probable blank contamination.

E = This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis. If one or more compounds had a response greater than full scale, the sample or extract was diluted and reanalyzed. The diluted sample is identified by a "D" suffix appended to the sample number.

D = This flag is used for all compounds identified in the analysis at a secondary dilution factor.

NA = Analysis not performed for this analyte.

TABLE C-1. Laboratory Qualifiers (Continued)

Inorganic Qualifiers

Concentration Qualifiers

B = Reported value was obtained from a reading that was less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit.

U = Indicates compound was analyzed for but not detected.

Quality Qualifiers

E = The reported value is estimated because of the presence of interference.

M = Duplicate injection precision not met.

N = Spiked sample recovery not within control limits.

W = Post-digestion spike for furnace AA analysis is not out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

G = Native analyte > 4 times spike added, therefore acceptance criteria do not apply.

X = Detection limit is higher than normal due to sample matrix interferences.

* = Duplicate analysis not within control limits.

+ = Correlation coefficient for the MSA is less than 0.955.

Table C-2. TREATABILITY TCLP EXTRACT ANALYSES COMPOUNDS WITH CONTRACT DETECTION LIMITS*

Source: USEPA Contract Laboratory Program, Statement of Work, Rev. 7/87.

ELEMENTS	Symbol	(µg/L)	RADIONUCLIDES	LDL**	Units
Aluminum	Al	60	Cesium-137	<20	(pCi/L)
Antimony	Sb	30	Lead-210	<3.0	(pCi/L)
Arsenic	As	2	Plutonium-238	<1.0	(pCi/L)
Barium	Ba	2	Plutonium-239/240	<1.0	(pCi/L)
Beryllium	Be	2	Radium-226	<1.0	(pCi/L)
Boron	B	50	Radium-228	<3.0	(pCi/L)
Cadmium	Cd	2	Ruthenium-106	<150	(pCi/L)
Calcium	Ca	20	Strontium-90	<5.0	(pCi/L)
Chromium	Cr	10	Thorium-Total	<1.0	(µg/L)
Cobalt	Co	10	Uranium-Total	<1.0	(µg/L)
Copper	Cu	10	Gross Alpha	<3.0	(pCi/L)
Iron	Fe	10	Gross Beta	<4.0	(pCi/L)
Lead	Pb	2			
Magnesium	Mg	50			
Manganese	Mn	20			
Mercury	Hg	0.2			
Molybdenum	Mo	10			
Nickel	Ni	20			
Potassium	K	100			
Selenium	Se	2			
Silicon	Si	25			
Silver	Ag	10			
Sodium	Na	100			
Thallium	Tl	20			
Vanadium	V	10			
Zinc	Zn	5			
Cyanide	CN	10			

* Specific quantitation limits are highly matrix and volume dependent. The quantitation limits listed here are provided for guidance and may not always be achievable.

** LLD - Lower level detection limits.

Table C-2 cont. TREATABILITY TCLP EXTRACT ANALYSES COMPOUNDS WITH CONTRACT DETECTION LIMITS*

Source: USEPA Contract Laboratory Program, Statement of Work, Rev. 7/87.

VOLATILES		SEMIVOLATILES				PESTICIDES/PCBs	
Compound	(µg/L)	Compound	(µg/L)	Compound	(µg/L)	Compound	(µg/L)
Chloromethane	10	Phenol	10	Acenaphthene	10	alpha-BHC	0.05
Bromomethane	10	bis(2-Chloroehtyl) ether	10	2,4-Dinitrophenol	50	Beta-BHC	0.05
Vinyl Chloride	10	2-Chlorophenol	10	4-Nitrophenol	50	delta-BHC	0.05
Chloroethane	10	1,3-Dichlorobenzene	10	Dibenzofuran	10	gamma-BHC (Lindane)	0.05
Methylene Chloride	5	1,4-Dichlorobenzene	10	2,4-Dinitrotoluene	10	Heptachlor	0.05
Acetone	10	Benzyl alcohol	10	Diethylphthalate	10	Aldrin	0.05
Carbon Dislfide	5	1,2-Dichlorobenzene	10	4-Chlorophenyl-phenyl ether	10	Hepachlor epoxide	0.05
1,1-Dichloroethene	5	2-Methylphenol	10	Fluorene	10	Endosulfan I	0.05
1,1-Dichloroethane	5	bis(2-Chloroisopropyl) ether	10	4-Nitroaniline	50	Dieldrin	0.1
1,2-Dichloroethene (total)	5	4-Methylphenol	10	4,6-Dinitro-2-methylphenol	50	4,4'-DDE	0.1
Chloroform	5	N-Nitroso-di-n-dipropylamine	10	N-nitrosodiphenylamine	10	Endrin	0.1
1,2-Dichloroethane	5	Hexachloroethane	10	4-Bromophenyl-phenylether	10	Endosulfan II	0.1
2-Butanone	10	Nitrobenzene	10	Hexachlorobenzene	10	4,4'-DDT	0.1
1,1,1-Trichloroethane	5	Isophorone	10	Pentachlorophenol	50	Methoxychlor	0.5
CarbonTetrachloride	5	2-Nitrophenol	10	Phenanthrene	10	Endrin ketone	0.1
Vinyl Acetate	10	2,4-Dimethylphenol	10	Anthracene	10	alpha-Chlordane	0.5
Bromodichloromethane	5	Benzoic acid	50	Di-n-butylphthalate	10	gamma-Chlordane	0.5
1,2-Dichloropropane	5	bis(2-Chloroethoxy) methane	10	Fluoranthene	10	Toxaphene	1
cis-1,3-Dichloropropene	5	2,4-Dichlorophenol	10	Pyrene	10	Aroclor-1016	0.5
Trichloroethene	5	1,2,4-Trichlorobenzene	10	Butylbenzylphthalate	10	Aroclor-1221	0.5
Dibromochloromethane	5	Naphthalene	10	3,3'-Dichlorobenzidine	20	Aroclor-1232	0.5
1,1,2-Trichloroethane	5	4-Chloroaniline	10	Benzo(a)anthracene	10	Aroclor-1242	0.5
Benzene	5	Hexachlorobutadiene	10	Chrysene	10	Aroclor-1248	0.5
trans-1,3-Dichloropropene	5	4-Chloro-3-methylphenol	10	bis(2-Ethylhexyl)phthalate	10	Aroclor-1254	1
Bromoform	5	2-Methylnaphthalene	10	Di-n-octylphthalate	10	Aroclor-1260	1
4-Methyl-2-pentanone	10	Hexachlorocyclopentadiene	10	Benzo(b)fluoranthene	10		
2-Hexanone	10	2,4,6-Trichlorophenol	10	Benzo(k)fluoranthene	10		
Tetrachloroethene	5	2,4,5-Trichlorophenol	50	Benzo(a)pyrene	10		
Toluene	5	2-Chloronaphthalene	10	Indeno(1,2,3-cd)pyrene	10		
1,1,2,2-Tetrachloroethane	5	2-Nitroaniline	50	Dibenz(a,h)anthracene	10		
Chlorobenzene	5	Dimethylphthalate	10	Benzo(g,h,i)perylene	10		
Ethyl Benzene	5	Acenaphthylene	10				
Styrene	5	2,6-Dinitrotoluene	10				
Xylenes (Total)	5	3-Nitroaniline	50				

* Specific quantitation limits are highly matrix and volume dependent. The quantitation limits listed here are provided for guidance and may not always be achievable.

Table C–3. Fernald Environmental Management Project OU2 MTCLP Results

		Solid Waste Landfill								
	FEMP Sample No.	75201	75201	75201	75201	75201	75201	75201	75201	75201
	Treat. Sample No.	10162413	10162513	10162613	10312013	10162713	10162813	10162913	10163013	10312213
	Sample ID/Run No.	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D
Raw Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	245	U	U B	U B	243	U B	503	331	364
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U B	U	U	U	U	U	U	U	U
	Cr (µg/L)	68.1	50.0	45.2	42.0	53.2	87.0	54.6	54.3	87.0
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	1.00	0.31	4.70	U
	Gross Alpha (pCi/L)	U	U	304	U	U	U	U	U	709.4
	Gross Beta (pCi/L)	67.6	U	574.3	U	67.6	U	326.5	382.8	574.3
	Total Uranium (µg/L)	U	U	U	228.1	U	U	U	U	967.9
Matrix Spike Corrected Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	274	U	U	U	272	U	563	370	407
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	135	99	90	83	106	173	109	108	173
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	1.01	0.31	4.73	U
Dilution Correction Factors:		0.5405	0.5556	0.5263	0.5263	0.6250	0.6452	0.4918	0.4878	0.4878
Spike and Dilution Corrected Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	507	U	U	U	435	U	1144	759	835
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	250	179	171	159	169	268	221	221	355
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	1.56	0.63	9.69	U

Table C–3. Fernald Environmental Management Project OU2 MTCLP Results

		Solid Waste Landfill					
	FEMP Sample No. Treat. Sample No. Sample ID/Run No.	75201 10163213 Run 8	75201 10163413 Run 9	75201 10163613 Run 10	75203 10166413 Run 11	75203 10166613 Run 12	75201 10312413 Run 12D
Raw Data	As (µg/L)	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U
	Ba (µg/L)	450	301	U B	U B	U B	U B
	Cd (µg/L)	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U
	Cr (µg/L)	35.2	56.4	68.2	79.7	83.5	67.6
	Se (µg/L)	U	U	U	U	U	U
	Hg (µg/L)	U	0.23	U	U	U	U
	Gross Alpha (pCi/L)	U	U	U	450.4	U	653.1
	Gross Beta (pCi/L)	135.1	135.1	U	U	247.7	382.8
	Total Uranium (µg/L)	U	U	U	U	U	71
Matrix Spike Corrected Data	As (µg/L)	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U
	Ba (µg/L)	503	337	U	U	U	U
	Cd (µg/L)	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U
	Cr (µg/L)	70	112	136	158	166	134
	Se (µg/L)	U	U	U	U	U	U
	Hg (µg/L)	U	0.23	U	U	U	U
Dilution Correction Factors:		0.5607	0.5556	0.6803	0.6757	0.6667	0.6667
Spike and Dilution Corrected Data	As (µg/L)	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U
	Ba (µg/L)	898	606	U	U	U	U
	Cd (µg/L)	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U
	Cr (µg/L)	125	202	199	235	249	202
	Se (µg/L)	U	U	U	U	U	U
	Hg (µg/L)	U	0.42	U	U	U	U

Table C–3. Fernald Environmental Management Project OU2 MTCLP Results

		Lime Sludge Pond, Stage I								
	FEMP Sample No.	75202	75202	75202	75202	75202	75202	75202	75202	75202
	Treat. Sample No.	10166813	10164413	10164613	10164813	10165013	10311413	10165213	10165413	10165613
	Sample ID/Run No.	Run 1	Run 2	Run 3	Run 4	Run 5	Run 5D	Run 6	Run 7	Run 8
Raw Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	455	369	437	268	292	340	404	564	458
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	64.3	17.8	19.0	35.6	50.5	42.1	75.2	53.1	70.6
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U
	Gross Alpha (pCi/L)	191.4	U	U	U	U	U	U	U	518
	Gross Beta (pCi/L)	U	123.9	202.7	67.6	U	337.8	123.9	259	U
	Total Uranium (µg/L)	U	23.2	98.5	35.8	U	314.2	U	U	34.1
Matrix Spike Corrected Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	551	447	529	324	354	412	489	683	554
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	67	19	20	37	53	44	79	56	74
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U
Dilution Correction Factors:		0.5405	0.5556	0.5263	0.6250	0.6452	0.6452	0.4762	0.4878	0.5405
Spike and Dilution Corrected Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	1019	804	1005	519	548	638	1027	1400	1026
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	124	34	38	60	82	68	165	114	137
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U

Table C–3. Fernald Environmental Management Project OU2 MTCLP Results

		Lime Sludge Pond, Stage I									
	FEMP Sample No.	75202	75202	75202	75202	75202	75202	75202	75204	75205	75202
	Treat. Sample No.	10167013	10165813	10311613	10166013	10166213	10167213	10167413	10167613	10167813	10311813
	Sample ID/Run No.	Run 9	Run 10	Run 10D	Run 11	Run 12	Run 13	Run 14	Run 15	Run 16	Run 16D
Raw Data	As (µg/L)	U	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	30.3	U	U	U	U	31.0	U	U	U	U
	Ba (µg/L)	756	487	399	441	457	527	727	368	335	341
	Cd (µg/L)	U	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	72.1	29.2	74.5	20.9	33.7	74.4	62.8	55.8	73.4	59.9
	Se (µg/L)	U	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U	U
	Gross Alpha (pCi/L)	168.9	U	360.3	518	U	U	U	U	213.9	191.4
	Gross Beta (pCi/L)	551.7	135.1	574.3	135.1	U	551.7	U	67.6	U	191.4
	Total Uranium (µg/L)	U	31.2	200.1	29.2	22.8	U	U	U	U	108.1
Matrix Spike Corrected Data	As (µg/L)	U	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	30.3	U	U	U	U	31.0	U	U	U	U
	Ba (µg/L)	915	590	483	534	553	638	880	446	406	413
	Cd (µg/L)	U	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	75	31	78	22	35	78	66	58	77	63
	Se (µg/L)	U	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U	U
Dilution Correction Factors:		0.5556	0.6623	0.6623	0.6757	0.6494	0.4762	0.4878	0.6667	0.6061	0.6061
Spike and Dilution Corrected Data	As (µg/L)	U	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	54.6	U	U	U	U	65.2	U	U	U	U
	Ba (µg/L)	1647	890	729	790	852	1340	1804	668	669	681
	Cd (µg/L)	U	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	136	46	118	32	54	163	135	88	127	103
	Se (µg/L)	U	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U	U

Table C–3. Fernald Environmental Management Project OU2 MTCLP Results

		Lime Sludge Pond, Stage II								
	FEMP Sample No.	67431	67431	67431	67431	67431	67431	67431	67431	67431
	Treat. Sample No.	10371613	10371413	10371213	10373213	10371813	10372013	10372213	10372413	10373013
	Sample ID/Run No.	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D
Raw Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	872	698	745	781	669	716	736	847	831
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	U	55.0	66.0	64.0	66.0	54.0	57.0	56.0	62.0
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U
	Gross Alpha (pCi/L)	U	U	720.6	U	U	349.1	U	U	U
	Gross Beta (pCi/L)	135.1	540.5	45	45	45	180.2	180.2	U	U
	Total Uranium (µg/L)	U	U	U	U	U	U	U	U	U
Matrix Spike Corrected Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	1056	845	902	946	810	867	891	1025	1006
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	U	58	69	67	69	56	60	59	65
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U
Dilution Correction Factors:		0.5403	0.5553	0.5263	0.5257	0.6250	0.6447	0.6058	0.6222	0.6224
Spike and Dilution Corrected Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	1954	1522	1714	1799	1296	1345	1471	1648	1616
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	U	104	131	127	110	88	98	94	104
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U

Table C–3. Fernald Environmental Management Project OU2 MTCLP Results

		Lime Sludge Pond, Stage II	
	FEMP Sample No.	67431	67431
	Treat. Sample No.	10372613	10372813
	Sample ID/Run No.	Run 8	Run 9
Raw Data	As (µg/L)	U	U
	Ag (µg/L)	U	U
	Ba (µg/L)	697	915
	Cd (µg/L)	U	U
	Pb (µg/L)	U	U
	Cr (µg/L)	69.0	58.0
	Se (µg/L)	U	U
	Hg (µg/L)	U	U
	Gross Alpha (pCi/L)	U	168.9
	Gross Beta (pCi/L)	U	439.1
	Total Uranium (µg/L)	U	U
Matrix Spike Corrected Data	As (µg/L)	U	U
	Ag (µg/L)	U	U
	Ba (µg/L)	844	1108
	Cd (µg/L)	U	U
	Pb (µg/L)	U	U
	Cr (µg/L)	72	61
	Se (µg/L)	U	U
	Hg (µg/L)	U	U
Dilution Correction Factors:		0.6449	0.6061
Spike and Dilution Corrected Data	As (µg/L)	U	U
	Ag (µg/L)	U	U
	Ba (µg/L)	1308	1828
	Cd (µg/L)	U	U
	Pb (µg/L)	U	U
	Cr (µg/L)	112	100
	Se (µg/L)	U	U
	Hg (µg/L)	U	U

Table C–3. Fernald Environmental Management Project OU2 MTCLP Results

		South Field								
	FEMP Sample No.	75206	75206	75206	75208	75206	75206	75206	75208	75206
	Treat. Sample No.	10168413	10168213	10168613	10311013	10168813	10169013	10169213	10311213	10169413
	Sample ID/Run No.	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 6D	Run 7
Raw Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	412	255	330	274	480	261	421	538	286
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	27.4	17.0	22.5	15.6	23.2	15.7	41.8	63.9	19.1
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U
	Gross Alpha (pCi/L)	U	292.8	157.6	U	U	U	U	U	U
	Gross Beta (pCi/L)	259	U	U	427.9	191.4	U	U	67.6	U
	Total Uranium (µg/L)	U	U	U	265.2	U	U	U	511.8	U
Matrix Spike Corrected Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	412	255	330	274	480	261	421	539	286
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	31	19	25	17	26	18	47	71	21
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U
Dilution Correction Factors:		0.5405	0.5556	0.5263	0.5263	0.6250	0.6452	0.4762	0.4762	0.4878
Spike and Dilution Corrected Data	As (µg/L)	U	U	U	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U	U	U	U
	Ba (µg/L)	763	459	628	521	769	405	885	1131	587
	Cd (µg/L)	U	U	U	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U	U	U	U
	Cr (µg/L)	57	34	48	33	41	27	98	150	44
	Se (µg/L)	U	U	U	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U	U	U	U

Table C-3. Fernald Environmental Management Project OU2 MTCLP Results

		South Field					
	FEMP Sample No. Treat. Sample No. Sample ID/Run No.	75206 10169613 Run 8	75206 10169813 Run 9	75207 10310213 Run 10	75207 10310813 Run 10D	75207 10310413 Run 11	75207 10310613 Run 12
Raw Data	As (µg/L)	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U
	Ba (µg/L)	504	457	566	758	365	357
	Cd (µg/L)	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U
	Cr (µg/L)	58.0	38.7	28.9	14.3	13.9	12.1
	Se (µg/L)	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U
	Gross Alpha (pCi/L)	U	180.2	236.5	213.9	157.6	506.7
	Gross Beta (pCi/L)	U	135.1	664.3	394.1	945.8	191.4
	Total Uranium (µg/L)	U	U	109.5	346.4	109.7	1044.7
Matrix Spike Corrected Data	As (µg/L)	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U
	Ba (µg/L)	505	457	567	759	365	357
	Cd (µg/L)	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U
	Cr (µg/L)	65	43	32	16	16	14
	Se (µg/L)	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U
Dilution Correction Factors:		0.5405	0.5556	0.5525	0.5525	0.5618	0.5435
Spike and Dilution Corrected Data	As (µg/L)	U	U	U	U	U	U
	Ag (µg/L)	U	U	U	U	U	U
	Ba (µg/L)	933	823	1025	1373	650	658
	Cd (µg/L)	U	U	U	U	U	U
	Pb (µg/L)	U	U	U	U	U	U
	Cr (µg/L)	120	78	58	29	28	25
	Se (µg/L)	U	U	U	U	U	U
	Hg (µg/L)	U	U	U	U	U	U

295

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Reagents								Clean Sand													
FEMP Sample No.		none		none		none		none		75209		75209		75209		75209		75209		75209		75209	
Treat. Sample No.		10162301		10162302		10162306		10162307		10312613		10312813		10313013		10313213		10313413		10313613		10313813	
Sample ID/Run No.		PC Type I		PC Type II		Comm. Flyash		Attap. & Clino		Run 1		Run 2		Run 3		Run 4		Run 5		Run 6		Run 7	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Al	494		478		7510		517		1090		1330		690		783		823		522		803	
	Sb	114		102		38.8	B	225		84.1		110		107		85.9		85.1		94.3		84.3	
	As	U	WN	U	WN	55.4	SN	4.6	BWN	U	WN	U	N	U	WN	U		U	WN	U	WN	U	WN
	Ba	891		1180		754		657		941		673		596		614		855		515		800	
	Be	3.4	B	3.4	B	9.9		2.6	B	3.3	B	3.5	B	3.2	B	3.3	B	3.2	B	3.3	B	3.3	B
	Cd	U		U		5.5		84.6		U		U		U		U		U		U		U	
	Ca	373000		2680000		55300		862000		1960000		1830000		1780000		1980000		1990000		1990000		1910000	
	Cr	418		428		303		92		163		229		222		206		177		239		185	
	Co	22.8	B	20.1	B	31	B	30.5	B	14.3	B	22.4	B	20.3	B	12.8	B	13.5	B	15.5	B	15.4	B
	Cu	46.9		45.8		1460		36.7		44.5		46.7		39.9		43.7		41.3		39.7		37.8	
	Fe	99.6	B	97.6	B	857		136		96.2	B	575		220		80.7	B	86.1	B	96.1	B	79.1	B
	Pb	U	W	U	W	6.9		2.0	B	U		U		U		U		U		U		U	
	Mg	791	B	750	B	5800		412000		705	B	29100		32400		774	B	769	B	1920	B	764	B
	Mn	19.9		19.1		142		3170		18.1		85.1		80.7		17.7		17.5		18.0		17.1	
	Hg	U		U		U		U		U		U		U		U		U		U		U	
	Ni	29.3	B	26.5	B	73.9		75.6		U		72.9		73.5		U		20.6	B	U		U	
	K	348000		294000		22900		23300		64600		24700		26600		65600		55900		34000		53500	
	Se	U	W	U		U	W	U	W	U	W	U	W	U	W	U		U	W	U	W	U	W
	Ag	118		114		14.2		86.9		99.8		97.4		96.5		99.3		100		101		99.4	
	Na	51400		38000		2110000		196000		25200		60400		114000		83600		33900		51900		32400	
	Tl	U		U		8.9	B	U		U		U		U		U		U	W	U	W	U	W
	V	78.4		74.5		107		81.1		62.3		67.6		64.7		62.2		63.1		79.0		62.6	
	Zn	10.1	B	112		305		310		96.9		162		126		53.7		90.3		78.2		21.8	
	CN	U		4.7	B	2	B	U		U		U		U		U		U		U		U	
	Mo	76.6		80.6		182		58.3		22.7		27.4		29.3		26.7		22.0		28.9		23.9	
	B	770		782		1490		688		229		591		539		198		234		435		202	
	Si	673		666		5920		31900		2540		64200		56000		3190		3430		15800		3080	

See text for definition of qualifiers.

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Reagents								Clean Sand													
FEMP Sample No.		none		none		none		none		75209		75209		75209		75209		75209		75209		75209	
Treat. Sample No.		10162301		10162302		10162306		10162307		10312613		10312813		10313013		10313213		10313413		10313613		10313813	
Sample ID/Run No.		PC Type I		PC Type II		Comm. Flyash		Attap. & Clino		Run 1		Run 2		Run 3		Run 4		Run 5		Run 6		Run 7	
Element		Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Matrix Spike Corrected Data	Ba	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	
	Cd	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	
	Cr	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	
	Pb	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	
	Ag	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	
	As	N/A		N/A		N/A		N/A		U	WN	U	N	U	WN	U		U	WN	U	WN	U	WN
	Se	N/A		N/A		N/A		N/A		U	W	U	W	U	W	U		U	W	U	W	U	W
	Hg	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	
Dilution factors:		None		None		None		None		0.7377		0.8667		0.7317		0.8442		0.7143		0.7813		0.7143	
Matrix Spike and Dilution Corrected Data	Ba	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	
	Cd	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	
	Cr	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	
	Pb	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	
	Ag	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	
	As	N/A		N/A		N/A		N/A		U	WN	U	N	U	WN	U		U	WN	U	WN	U	WN
	Se	N/A		N/A		N/A		N/A		U	W	U	W	U	W	U		U	W	U	W	U	W
	Hg	N/A		N/A		N/A		N/A		U		U		U		U		U		U		U	

See text for definition of qualifiers.

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Solid Waste Landfill																			
FEMP Sample No.		75201		75201		75201		75201		75201		75201		75201		75201		75201		75201	
Treat. Sample No.		10162413		10162513		10162613		10312013		10162713		10162813		10162913		10163013		10312213		10163213	
Sample ID/Run No.		Run 1		Run 2		Run 3		Run 3D		Run 4		Run 5		Run 6		Run 7		Run 7D		Run 8	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Al	2170		1260		382		1790		397		444		1520		426		1220		513	
	Sb	U		31.7	B	55	B	31.6	B	113		78.2		34.1	B	135		43.6	B	92.7	
	As	U		2.1	BW	11.1	+	4.1	BWN	7.5	BW	4.5	BW	U	W	6.1	BWN	U	W	2.6	BWN
	Ba	485		441		456		199	B	580		439		687		560		507		498	
	Be	U		U		U		U		2.5	B	2.1	B	U		3.2	B	2.1	B	3.1	B
	Cd	U		U		U		U		U		U		U		U		U		U	
	Ca	442000		446000		747000		415000		1510000		1130000		820000		1880000		812000		1880000	
	Cr	93.7		90.4		112		95.7		157		156		117		152		133		195	
	Co	U		U		U		U		U		U		U		16.3	B	U		12.9	B
	Cu	23.9	B	23.4	B	34.4		22.0	B	39.9		32.2		30.0		38.1		30.6		35.1	
	Fe	49.2	B	40.4	B	75.1	B	59.1	B	98.2	B	82.5	B	65.3	B	99	B	71.7	B	89.6	B
	Pb	U		U		U		U		U		U		U		U		U		U	W
	Mg	379	B	442	B	2230	B	393	B	21700		3300	B	484	B	26800		495	B	2920	B
	Mn	10.2	B	9.1	B	11.6	B	9.5	B	16.1		13.3	B	12.3	B	17.9		12.5	B	17.0	
	Hg	U		U		U		U		U		U		U		U		U		U	
	Ni	U		U		U		U		20.2	B	U		U		29.7	B	U		22.8	B
	K	51100		49400		51200		57000		61400		58700		74800		68000		79100		72900	
	Se	U	N	U	WN	2.2	BWN	U		U	WN	U	N	U	WN	U	W	U	W	U	W
	Ag	57.4		59.2		71.4		57.6		90.7		81		73.5		101		77.2		100	
	Na	656000		U		U		NA		U		U		U		68300		NA		23200	
	Tl	U		U		U		U		U		U		U		U		U		U	
	V	40.0	B	48.4	B	90.3		48.8	B	98.1		83.3		44.1	B	110		45.0	B	91.2	
	Zn	128		7.1	B	135		19.1	B	120		117		143		99.9		76.4		U	
	CN	U	*	7.7	B*	U	*	2.6	B	U	*	2.1	B*	U	*	U		4.2	B	U	
	Mo	28.9		30.5		33.4		36.2		40.9		36.6		21.8		47.0		25.3		34.9	
	B	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
	Si	4540		9880		19100		NA		15600		16800		3880		18600		NA		13900	

See text for definition of qualifiers.

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Solid Waste Landfill																			
FEMP Sample No.		75201		75201		75201		75201		75201		75201		75201		75201		75201		75201	
Treat. Sample No.		10162413		10162513		10162613		10312013		10162713		10162813		10162913		10163013		10312213		10163213	
Sample ID/Run No.		Run 1		Run 2		Run 3		Run 3D		Run 4		Run 5		Run 6		Run 7		Run 7D		Run 8	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Matrix Spike Corrected Data	Ba	543		493		510		223	B	649		491		768		626		567		557	
	Cd	U		U		U		U		U		U		U		U		U		U	
	Cr	186		180		223		190		312		310		233		302		264		388	
	Pb	U		U		U		U		U		U		U		U		U		U	W
	Ag	293		302		364		294		463		413		375		515		394		510	
	As	U		2.0	BW	10.6	+	3.9	BWN	7.1	BW	4.3	BW	U	W	5.8	BWN	U	W	2.5	BWN
	Se	U	N	U	WN	2.07	BWN	U		U	WN	U	N	U	WN	U	W	U	W	U	W
	Hg	U		U		U		U		U		U		U		U		U		U	
Dilution factors:		0.5405		0.5556		0.5263		0.5263		0.6250		0.6452		0.4918		0.4878		0.4878		0.5607	
Matrix Spike and Dilution Corrected Data	Ba	1004		888		969		423	B	1038		761		1563		1284		1163		993	
	Cd	U		U		U		U		U		U		U		U		U		U	
	Cr	345		323		423		361		499		481		473		619		542		691	
	Pb	U		U		U		U		U		U		U		U		U		U	W
	Ag	542		544		692		558		740		641		763		1056		807		910	
	As	U		3.6	BW	20.1	+	7.4	BWN	11.4	BW	6.6	BW	U	W	11.9	BWN	U	W	4.4	BWN
	Se	U	N	U	WN	3.9	BWN	U		U	WN	U	N	U	WN	U	W	U	W	U	W
	Hg	U		U		U		U		U		U		U		U		U		U	

See text for definition of qualifiers.

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Solid Waste Landfill							
FEMP Sample No.		75201		75203		75203		75201	
Treat. Sample No.		10163413		10166413		10166613		10312413	
Sample ID/Run No.		Run 9		Run 11		Run 12		Run 12D	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Al	467		335		374		361	
	Sb	92		58.9	B	57.6	B	45.4	B
	As	2	WN	17.5	SN	16.2	+N	11	N
	Ba	484		398		417		161	B
	Be	3.2	B	2.4	B	2.4	B	2.1	B
	Cd	U		U		U		U	
	Ca	1860000		782000		752000		726000	
	Cr	215		132		143		145	
	Co	14.6	B	U		U		U	
	Cu	40.2		27.2		25.5		26.1	
	Fe	95.7	B	75.4	B*	68.1	B	67.1	B
	Pb	U		U		U		U	
	Mg	6530		3920	B	2540	B	1470	B
	Mn	17.4		12.4	B	12.0	B	12.0	B
	Hg	U		U		U		U	
	Ni	24.4	B	U		U		U	
	K	78500		44000		45400		42400	
	Se	U	W	U	WN	U	W	U	W
	Ag	101		74.9		74.0		72.5	
	Na	74700		U		U		NA	
	Tl	U		U		U		U	
	V	95.9		110		102		107	
	Zn	109		112		125		22.7	
	CN	U		U		U		3.5	B
	Mo	37.8		38.4		37.6		35.8	
	B	NA		NA		NA		NA	
	Si	16300		18900		16800		NA	

See text for definition of qualifiers.

300

3527

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Solid Waste Landfill							
FEMP Sample No.		75201		75203		75203		75201	
Treat. Sample No.		10163413		10166413		10166613		10312413	
Sample ID/Run No.		Run 9		Run 11		Run 12		Run 12D	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Matrix Spike Corrected Data	Ba	541		445		466		180	B
	Cd	U		U		U		U	
	Cr	427		262		284		288	
	Pb	U	U	U	U	U		U	
	Ag	515		382		378		370	
	As	1.9	WN	16.7	SN	15.4	+N	10.5	N
	Se	U	W	U	WN	U	W	U	W
	Hg	U		U		U		U	
Dilution factors:		0.5556		0.6757		0.6667		0.6667	
Matrix Spike and Dilution Corrected Data	Ba	974		659		700		270	B
	Cd	U		U		U		U	
	Cr	769		388		426		432	
	Pb	U	U	U	U	U		U	
	Ag	928		566		566		555	
	As	3.4	WN	24.7	SN	23.2	+N	15.7	N
	Se	U	W	U	WN	U	W	U	W
	Hg	U		U		U		U	

See text for definition of qualifiers.

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Lime Sludge Pond, Stage I																			
FEMP Sample No.		75202		75202		75202		75202		75202		75202		75202		75202		75202		75202	
Treat. Sample No.		10164413		10164613		10165013		10311413		10165213		10165413		10165613		10167013		10165813		10311613		10167213	
Sample ID/Run No.		Run 2		Run 3		Run 5		Run 5D		Run 6		Run 7		Run 8		Run 9		Run 10		Run 10D		Run 13	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Al	426		421		418		1060		410		641		849		760		430		1000		523	
	Sb	111		116		80.3		45.6	B	81.5		80.5		81.6		82.3		107		45.9	B	89.3	
	As	5.3	B	3.5	BWN	U	WN	U	N	4.6	BWN	U	WN	U	WN	U	WN	U	WN	U	W	U	WN
	Ba	430		447		560		715		606		482		816		777		746		363		687	
	Be	3.3	B	3.1	B	2.6	B	2.1	B	3	B	3.2	B	3.3	B	3.2	B	2.8	B	2.1	B	3.3	B
	Cd	11.1	B	U		U		U		U		U		U		U		U		U		U	
	Ca	1870000		1710000		1710000		818000		1860000		1890000		1950000		1830000		1750000		790000		1860000	
	Cr	137		136		166		101		174		187		206		184		154		140		185	
	Co	24.5	B	23.6	B	14.4	B	12	B	13.2	B	14	B	18.3	B	15.3	B	20.7	B	13.7	B	16.2	B
	Cu	60.8		48.7		69.4		86.2		42.3		41.1		61.7		50.4		54.2		89.1		43.0	
	Fe	93.7	B	93	B	87.4	B	73.1	B	85.2	B	83.3	B	91.1	B	91.9	B	94.3	B	71.7	B	91.7	B
	Pb	U		U	W	U		U		U		U	W	U		U		U		U		U	
	Mg	36200		46400		4150	BE	475	B	20500		859	B	812	B	814	B	48400	E	522	B	2730	B
	Mn	61.7		289		17.4		12.5	B	16.8		16.8		17.3		16.9		381		12.2	B	17.0	
	Hg	U		U		U		U		U		U		U		U		U		U		U	
	Ni	45.0		53.8		22.4	B	41.3		24.0	B	23.7	B	31.3	B	25.7	B	44.3		37.4	B	23.5	B
	K	50800		48900		53900		56800		60900		78300		66600		85500		41800		42200		73200	
	Se	U		U	W	U	W	U	W	U	W	U	W	U	W	U	W	U	W	U	W	U	W
	Ag	102		100		98.9		78.1		96.8		100		102		101		100		76.8		101	
	Na	90800		97800		114000		1220000		39300		90200		35600		107000		39000		600000		48200	
	Tl	U		U		U		U	W	U		U		U		U		U		U		U	
	V	78.1		71.8		72.5		43.6	B	81.3		67.3		68.0		65.5		67.5		50.1		82.4	
	Zn	12.0	B	13.5	B	115		80.6		102		U		105		89.1		135		17.1	B	128	
	CN	U		U		18.4		14.4		U		U		5.4	B	U		U		19.4		U	
	Mo	52.7		48.5		40.2		22.5		42.2		35.9		33.4		28.8		55.5		34.8		32.3	
	B	NA		NA		477		NA		NA		NA		NA		NA		724		NA		NA	
	Si	25100		33700		18200		NA		19100		5980		4540		4050		23700		NA		15400	

See text for definition of qualifiers.

302

3527

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Lime Sludge Pond, Stage I																					
FEMP Sample No.		75202		75202		75202		75202		75202		75202		75202		75202		75202		75202		75202	
Treat. Sample No.		10164413		10164613		10165013		10311413		10165213		10165413		10165613		10167013		10165813		10311613		10167213	
Sample ID/Run No.		Run 2		Run 3		Run 5		Run 5D		Run 6		Run 7		Run 8		Run 9		Run 10		Run 10D		Run 13	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Matrix Spike Corrected Data	Ba	521		541		678		866		734		584		988		941		903		439		832	
	Cd	11.0	B	U		U		U		U		U		U		U		U		U		U	
	Cr	143		142		174		106		182		196		215		192		161		146		194	
	Pb	U		U	W	U	U	U		U		U	W	U	U	U		U		U	U	U	
	Ag	102		100		99		78		97		100		102		101		100		77		101	
	As	4.7	B	3.1	BWN	U	WN	U	N	4.1	BWN	U	WN	U	WN	U	WN	U	WN	U	W	U	WN
	Se	U		U	W	U	W	U	W	U	W	U	W	U	W	U	W	U	W	U	W	U	W
	Hg	U		U		U		U		U		U		U		U		U		U		U	
Dilution factors:		0.5556		0.5263		0.6452		0.6452		0.4762		0.4878		0.5405		0.5556		0.6623		0.6623		0.4762	
Matrix Spike and Dilution Corrected Data	Ba	937		1028		1051		1342		1541		1196		1828		1693		1364		664		1747	
	Cd	19.8	B	U		U		U		U		U		U		U		U		U		U	
	Cr	258		270		269		164		382		401		399		346		243		221		406	
	Pb	U		U	W	U	U	U		U		U	W	U	U	U		U		U	U	U	
	Ag	184		190		153		121		203		205		189		182		151		116		212	
	As	8.4	B	5.9	BWN	U	WN	U	N	8.5	BWN	U	WN	U	WN	U	WN	U	WN	U	W	U	WN
	Se	U		U	W	U	W	U	W	U	W	U	W	U	W	U	W	U	W	U	W	U	W
	Hg	U		U		U		U		U		U		U		U		U		U		U	

See text for definition of qualifiers.

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Lime Sludge Pond, Stage I					
FEMP Sample No.		75202		75205		75202	
Treat. Sample No.		10167413		10167813		10311813	
Sample ID/Run No.		Run 14		Run 16		Run 16D	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Al	472		416		1110	
	Sb	89.1		101		39.1	B
	As	U		2.4	BWN	U	WN
	Ba	663		648		543	
	Be	3.1	B	2.7	B	U	
	Cd	U		U		U	
	Ca	1840000		1730000		757000	
	Cr	181		143		136	
	Co	15.3	B	22.7	B	11.6	B
	Cu	43.3		54.7		84.2	
	Fe	90.6	B	92.7	B	69.5	B
	Pb	U		U		U	
	Mg	4450	B	42700	E	492	B
	Mn	17.0		151		12.1	B
	Hg	U		U		U	
	Ni	24.3	B	45.6		34.9	B
	K	64600		52400		56500	
	Se	U		U	W	U	W
	Ag	100		98.8		74.6	
	Na	85500		116000		NA	
	Tl	U		U		U	
	V	81.0		67.4		44.9	B
	Zn	122		120		48.6	
	CN	3.5	B	13.8		3.2	B
	Mo	34.6		42.7		25.9	
	B	NA		596		NA	
	Si	16700		31200		NA	

See text for definition of qualifiers.

304

3527

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Lime Sludge Pond, Stage I					
FEMP Sample No.		75202		75205		75202	
Treat. Sample No.		10167413		10167813		10311813	
Sample ID/Run No.		Run 14		Run 16		Run 16D	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Matrix Spike Corrected Data	Ba	803		785		657	
	Cd	U		U		U	
	Cr	189		150		142	
	Pb	U		U		U	
	Ag	100		99		75	
	As	U		2.1	BWN	U	WN
	Se	U		U	W	U	W
	Hg	U		U		U	
Dilution factors:		0.4878		0.6061		0.6061	
Matrix Spike and Dilution Corrected Data	Ba	1645		1294		1085	
	Cd	U		U		U	
	Cr	388		247		235	
	Pb	U		U		U	
	Ag	205		163		123	
	As	U		3.5	BWN	U	WN
	Se	U		U	W	U	W
	Hg	U		U		U	

See text for definition of qualifiers.

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Lime Sludge Pond, Stage II																					
FEMP Sample No.		67431		67431		67431		67431		67431		67431		67431		67431		67431		67431		67431	
Treat. Sample No.		10371613		10371413		10371213		10373213		10371813		10372013		10372213		10372413		10373013		10372613		10372813	
Sample ID/Run No.		Run 1		Run 2		Run 3		Run 3D		Run 4		Run 5		Run 6		Run 7		Run 7D		Run 8		Run 9	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Al	891		959		1020		925		986		896		981		1070		1050		972		855	
	Sb	75		68.6		72.5		93.2		79.1		70.3		66.2		71.4		81.8		66.7		65.7	
	As	U		U		U		U	WN	U	W	U		U		U		9.3	BN	U		U	
	Ba	988		775		912		1140		1100		926		811		1120		835		923		766	
	Be	3	B	2.7	B	2.9	B	3	B	3	B	2.9	B	2.7	B	2.7	B	2.9	B	2.7	B	2.7	B
	Cd	U		U		U		U		U		U		U		U		U		U		U	
	Ca	2190000		1870000		1890000		2100000		2070000		1880000		1800000		1890000		1990000		1720000		1730000	
	Cr	144		142		151		152		142		138		142		140		154		146		150	
	Co	16.7	B	13.6	B	14	B	15.7	B	17	B	14.5	B	13.5	B	12.9	B	14.5	B	13.9	B	12.6	B
	Cu	52.3		46.6		43.2		49.2		61.4		62.3		52.3		46.7		49.5		51.6		53.0	
	Fe	90.3	B	82.6	B	80.6	B	86.2	B	85.5	B	90.2	B	79	B	78.2	B	81.8	B	79.7	B	81.8	B
	Pb	U	W	U	W	U	W	U	N	U	W	U	W	U	W	U	W	3.6	N	U	W	U	W
	Mg	688	B	669	B	677	B	689	B	676	B	671	B	675	B	666	B	908	B	691	B	690	B
	Mn	17.9		16.9		16.8		17.4		21.1		16.8		16.5		16.8		17.6		16.3		16.9	
	Hg	U		U		U		U		U		U		U		U		U		U		U	
	Ni	26.8	B	23.6	B	U		U		24.9	B	27.1	B	U		U		U		U		20.4	B
	K	95900		118000		85900		110000		75900		97500		82200		85200		80700		102000		99100	
	Se	U	W	U	W	U	W	U	WN*	U	W	U	W	U		U	W	12.6	SN*	U		U	
	Ag	109		103		104		107		106		103		102		103		105		101		100	
	Na	48600		112000		122000		121000		54100		129000		154000		61100		50700		147000		144000	
	Tl	U	N	U	N	U	N	U		U	N	U	N	U	N	U	N	12.9		U	N	U	N
	V	66.8		61.2		61.5		66.0		63.1		61.1		60.2		60.7		65.1		59.4		58.1	
	Zn	36.7		73.2		50.7		97.9		94.0		65.1		85.8		57.6		U		31.7		74.1	
	CN	2.4	B	U		3.2	B	U		U		4.6	B	4.1	B	3.6	B	U		3.6	B	5.9	B
	Mo	17.2		17.8		19.7		22.1		18.2		17.0		16.3		17.2		19.5		17.2		18.2	
	B	168		194		198		NA		204		189		181		212		NA		225		178	
	Si	1230		1280		1290		1020	E	926		1180		2010		1360		2000	E	2280		2540	

See text for definition of qualifiers.

306

3527

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		Lime Sludge Pond, Stage II																					
FEMP Sample No.		67431		67431		67431		67431		67431		67431		67431		67431		67431		67431		67431	
Treat. Sample No.		10371613		10371413		10371213		10373213		10371813		10372013		10372213		10372413		10373013		10372613		10372813	
Sample ID/Run No.		Run 1		Run 2		Run 3		Run 3D		Run 4		Run 5		Run 6		Run 7		Run 7D		Run 8		Run 9	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Matrix Spike Corrected Data	Ba	1196		938		1104		1380		1332		1121		982		1356		1011		1117		927	
	Cd	U		U		U		U		U		U		U		U		U		U		U	
	Cr	151		149		158		159		149		144		149		146		161		153		157	
	Pb	U	W	U	W	U	W	U	N	U	W	U	W	U	W	U	W	3.70	N	U	W	U	W
	Ag	109		103		104		107		106		103		102		103		105		101		100	
	As	U		U		U		U	WN	U	W	U		U		U		8.2	BN	U		U	
	Se	U	W	U	W	U	W	U	WN*	U	W	U	W	U		U	W	10.24	SN*	U		U	
	Hg	U		U		U		U		U		U		U		U		U		U		U	
Dilution factors:		0.5403		0.5553		0.5263		0.5257		0.6250		0.6447		0.6058		0.6222		0.6224		0.6449		0.6061	
Matrix Spike and Dilution Corrected Data	Ba	2214		1690		2098		2626		2131		1739		1621		2179		1624		1733		1530	
	Cd	U		U		U		U		U		U		U		U		U		U		U	
	Cr	279		268		300		302		238		224		245		235		259		237		259	
	Pb	U	W	U	W	U	W	U	N	U	W	U	W	U	W	U	W	6.0	N	U	W	U	W
	Ag	202		186		198		204		170		160		169		166		169		157		165	
	As	U		U		U		U	WN	U	W	U		U		U		13.2	BN	U		U	
	Se	U	W	U	W	U	W	U	WN*	U	W	U	W	U		U	W	16.5	SN*	U		U	
	Hg	U		U		U		U		U		U		U		U		U		U		U	

See text for definition of qualifiers.

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		South Field																			
FEMP Sample No.		75206		75206		75208		75206		75206		75208		75206		75206		75207		75207	
Treat. Sample No.		10168413		10168613		10311013		10169013		10169213		10311213		10169613		10169813		10310213		10310813	
Sample ID/Run No.		Run 1RE		Run 3		Run 3D		Run 5		Run 6		Run 6D		Run 8		Run 9		Run 10		Run 10D	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Al	1320		857		1050		1130		469		1150		1180		618		416		1460	
	Sb	39	B	50.6	B	31.3	B	46.4	B	87.6		45.4	B	49.6	B	77.9		89.9		38.2	B
	As	3.2	BW	4.6	B	3.9	BWM	2.3	B	3.8	BW	U	N	U		U	WN	9.4	B+N	2.5	BWN
	Ba	696		568		450		461		369		977		895		604		696		754	
	Be	2.1	B	2.3	B	U		2.2	B	3.1	B	2.2	B	2.3	B	2.8	B	2.7	B	U	
	Cd	U		U		U		U		U		U		U		U		U		U	
	Ca	727000		702000		646000		729000		1920000		840000		863000		1770000		1730000		802000	
	Cr	110		103		87.1		99.3		159		99.7		113		153		145		108	
	Co	10	B	11.7	B	U		12.6	B	18.3	B	U		U		16.2	B	16.6	B	U	
	Cu	73.0		65.6		85.0		76.4		66.7		47.5		59.0		88.3		104.0		83.3	
	Fe	68.3	B	67.3	B	65.8	B	69.2	B	86.6	B	75.5	B	68.9	B	88	B	115		68.2	B
	Pb	U		U		U	W	U		U	W	U		U		U		U		U	
	Mg	475	B	541	B	445	B	498	B	2890	B	470	B	476	B	1030	BE	18000	E	516	BE
	Mn	11.7	B	11.6	B	11.2	B	11.8	B	16.8		12.8	B	12.6	B	17.3		17.4		12.2	B
	Hg	U		U		U		U		U		U		U		U		U		U	
	Ni	21.5	B	24.7	B	U		31.6	B	31.7	B	U		U		32.8	B	33.7	B	23.8	B
	K	55400		54600		47400		44600		61700		72200		79900		64300		34100		39700	
	Se	U	W	U		U	W	U		U	W	U		U		U	W	U	W	U	W
	Ag	70.5		73.4		68.7		73.7		103		79.6		79.4		101		99.0		76.5	
	Na	U		U		NA		U		28700		NA		U		92500		22800		2110000	
	Tl	U		U		U		U		U		U		U		U		U		U	
	V	50.6		58.0		49.3	B	47.8	B	87.8		44.5	B	45.5	B	72.2		83.0		46.5	B
	Zn	98.4		93.1		37.5		72.8		U		27.9		90.5		97.6		114		141	
	CN	4.3	B	10.4		2.1	B	6.7	B	2.3	B	2	B	8.2	B	U		12.1		7.1	B
	Mo	35.1		34.0		30.1		25.0		35.1		17.9		17.2		29.0		37.4		28.4	
	B	284		325		NA		258		398		NA		169		393		559		225	
	Si	6730		10000		NA		7160		17100		NA		1570		11400		14000		4730	

See text for definition of qualifiers.

308

3527

Table C-4. Fernald Environmental Management Project OU2 Inorganic TCLP Results

		South Field																			
FEMP Sample No.		75206		75206		75208		75206		75206		75208		75206		75206		75207		75207	
Treat. Sample No.		10168413		10168613		10311013		10169013		10169213		10311213		10169613		10169813		10310213		10310813	
Sample ID/Run No.		Run 1RE		Run 3		Run 3D		Run 5		Run 6		Run 6D		Run 8		Run 9		Run 10		Run 10D	
	Element	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Matrix Spike Corrected Data	Ba	697		569		450		461		369		978		896		605		697		755	
	Cd	U		U		U		U		U		U		U		U		U		U	
	Cr	123		115		97		111		178		111		126		171		162		121	
	Pb	U		U		U	W	U		U	W	U	U	U		U	U	U		U	
	Ag	81		85		79		85		119		92		91		116		114		88	
	As	3.0	BW	4.4	B	3.7	BWM	2.2	B	3.6	BW	U	N	U		U	WN	8.9	B+N	2.4	BWN
	Se	U	W	U		U	W	U		U	W	U	U	U		U	W	U	W	U	W
	Hg	U		U		U		U		U		U		U		U		U		U	
Dilution factors:		0.5405		0.5263		0.5263		0.6452		0.4762		0.4762		0.5405		0.5556		0.5525		0.5525	
Matrix Spike and Dilution Corrected Data	Ba	1289		1080		856		715		776		2054		1657		1088		1261		1366	
	Cd	U		U		U		U		U		U		U		U		U		U	
	Cr	227		219		185		172		373		234		234		308		293		218	
	Pb	U		U		U	W	U		U	W	U	U	U		U	U	U		U	
	Ag	150		161		150		132		249		192		169		209		206		159	
	As	5.6	BW	8.3	B	7.0	BWM	3.4	B	7.6	BW	U	N	U		U	WN	16.1	B+N	4.3	BWN
	Se	U	W	U		U	W	U		U	W	U	U	U		U	W	U	W	U	W
	Hg	U		U		U		U		U		U		U		U		U		U	

See text for definition of qualifiers.

Table C-5. Fernald Environmental Management Project OU2 Radiological Results

		Reagents				Clean Sand						
	FEMP Sample No.	Attap. & Clinopt	Comm. Flyash	PC Type I	PC Type II	75209	75209	75209	75209	75209	75209	75209
	Treat. Sample No.	10162307	10162306	10162301	10162302	10312613	10312813	10313023	10313213	10313413	10313613	10313813
	Sample ID/Run No.	N/A	N/A	N/A	N/A	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7
	Radionuclide w/units	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.
Raw Data	Ru-106 (pCi/L)	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
	Cs-137 (pCi/L)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	Pb-210 (pCi/L)	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	3.57	3.09
	Pu-238 (pCi/L)	<1.0	<1.0	<1.0	<1.0	<1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Pu-239/240 (pCi/L)	<1.0	<1.0	<1.0	<1.0	<1.7	<1.0	1.28	<1.0	<1.0	<1.0	<1.0
	Ra-226 (pCi/L)	<1.0	<1.0	4.48	7.77	2.00	1.04	1.28	1.57	4.03	<1.0	1.88
	Ra-228 (pCi/L)	8.58	<5.9	<6.5	<9.4	<5.1	<4.4	<5.3	<5.5	<7.1	<6.6	<5.4
	Sr-90 (pCi/L)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.8	<5.0	5.43	<6.9
	Th-Total (μg/L)	<1.4	<5.2	<1.4	<4.7	8.19	13.1	<6.5	<4.5	<5.3	7.81	<6.6
	U-Total (μg/L)	4.32	8.04	<1.0	<1.0	<1.0	6.03	4.74	<1.0	<1.0	<1.0	<1.0
	Gross alpha (pCi/L)	77.3	<3.2	<6.3	<16	<45.4	<94.5	<17.8	<73.6	<7.2	<45.6	<17.9
	Gross beta (pCi/L)	<10	14.9	290	278	<42.9	<42.0	<40.0	<40.0	4.4	<40.2	64.6

See text for definition of qualifiers; NA = Not analyzed; * = Matrix interference; ** = Low yield caused by matrix interference, spikes and blanks were good.

Table C-5. Fernald Environmental Management Project OU2 Radiological Results

		Solid	Waste	Landfill									
	FEMP Sample No.	75201	75201	75201	75201	75201	75201	75201	75201	75201	75201	75201	75201
	Treat. Sample No.	10162413	10162513	10162613	10312013	10162713	10162813	10162913	10163013	10312213	10163213	10163413	10163613
	Sample ID/Run No.	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D	Run 8	Run 9	Run 10
	Radionuclide w/units	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.
Raw Data	Ru-106 (pCi/L)	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150	NA
	Cs-137 (pCi/L)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	NA
	Pb-210 (pCi/L)	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	NA
	Pu-238 (pCi/L)	<1.0	<1.5	<1.9	<1.0	<1.0	<1.0	<1.7	<1.0	<1.0	<1.0	<1.0	NA
	Pu-239/240 (pCi/L)	<1.0	<1.0	<1.0	2.09	<1.0	<1.0	<1.4	<1.0	<1.0	<1.0	1.32	NA
	Ra-226 (pCi/L)	<1.0	NA	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.67	1.01	1.99	NA
	Ra-228 (pCi/L)	<7.5	NA	14.3	41.3	<7.9	<5.8	<5.6	<7.6	<7.6	<8.8	<13	NA
	Sr-90 (pCi/L)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	NA
	Th-Total (μg/L)	<5.5	<2.0	<9.7	<7.8	<6.0	<7.2	<6.0	<8.8	9.42	<8.7	<7.2	NA
	U-Total (μg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NA
	Gross alpha (pCi/L)	<3.0	<8.4	<5.9	<90	<9.5	<11	<3.0	<46	<84	<18	<74	NA
	Gross beta (pCi/L)	66.9	39.4	37.1	55.2	48.6	<11	<4.0	58.2	83.4	93.5	46.4	NA

See text for definition of qualifiers; NA = Not analyzed; * = Matrix interference; ** = Low yield caused by matrix interference, spikes and blanks were good.

Table C-5. Fernald Environmental Management Project OU2 Radiological Results

		Solid	Waste	Landfill
	FEMP Sample No.	75203	75203	75201
	Treat. Sample No.	10166413	10166613	10312413
	Sample ID/Run No.	Run 11	Run 12	Run 12D
	Radionuclide w/units	Conc.	Conc.	Conc.
Raw Data	Ru-106 (pCi/L)	<150	<150	<150
	Cs-137 (pCi/L)	<20	<20	<20
	Pb-210 (pCi/L)	<3.0	<3.0	<3.0
	Pu-238 (pCi/L)	<1.0	<1.0	<1.0
	Pu-239/240 (pCi/L)	<1.0	<1.0	<1.0
	Ra-226 (pCi/L)	<1.0	3.47	<1.0
	Ra-228 (pCi/L)	<14	<14	5475
	Sr-90 (pCi/L)	<5.0	<5.0	<5.0
	Th-Total (μg/L)	<5.8	<3.1	<9.1
	U-Total (μg/L)	<1.0	<1.0	<1.0
	Gross alpha (pCi/L)	<83	<56	<18
	Gross beta (pCi/L)	68.2	61.6	62.7

See text for definition of qualifiers; NA = Not analyzed; • = Matrix interference; *• = Low yield caused by matrix interference, spikes and blanks were good.

Table C-5. Fernald Environmental Management Project OU2 Radiological Results

		Lime	Sludge	Pond	Stage I							
	FEMP Sample No.	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202
	Treat. Sample No.	10164413	10164613	10165013	10311413	10165213	10165413	10165613	10167013	10165813	10311613	10167213
	Sample ID/Run No.	Run 2	Run 3	Run 5	Run 5D	Run 6	Run 7	Run 8	Run 9	Run 10	Run 10D	Run 13
	Radionuclide w/units	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.
Raw Data	Ru-106 (pCi/L)	<150	<150	NA	<150	<150	<150	<150	<150	NA	<150	<150
	Cs-137 (pCi/L)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	Pb-210 (pCi/L)	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	NA	<3.0	<3.0	<3.0
	Pu-238 (pCi/L)	<1.0	<1.0	<1.0	1.27	<1.0	<1.0	<1.0	<3.5	<1.0	<1.0	<1.0
	Pu-239/240 (pCi/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.73	<1.0	<1.0	<1.0
	Ra-226 (pCi/L)	<1.0	2.02	2.97	2.55	1.92	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Ra-228 (pCi/L)	<8.5	<10	<10	<8.9	<8.5	<11	<7.7	<13	<11	<5.5	<8.5
	Sr-90 (pCi/L)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Th-Total (μg/L)	<48	<7.1	<3.0	<5.7	<5.7	<6.5	<6.2	20.2	<2.9	<1.0	<3.9
	U-Total (μg/L)	5.82	65.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Gross alpha (pCi/L)	<51	<59	<44	98.8	<107	<94	<30	<57	129	<47	<22
	Gross beta (pCi/L)	81.9	7.61	<43	48.9	51.5	71.5	78.2	<50	56.4	<41	85.1

See text for definition of qualifiers; NA = Not analyzed; • = Matrix interference; •• = Low yield caused by matrix interference, spikes and blanks were good.

Table C-5. Fernald Environmental Management Project OU2 Radiological Results

		Lime Sludge Pond, Stage I		
	FEMP Sample No.	75202	75205	75202
	Treat. Sample No.	10167413	10167813	10311813
	Sample ID/Run No.	Run 14	Run 16	Run 16D
	Radionuclide w/units	Conc.	Conc.	Conc.
Raw Data	Ru-106 (pCi/L)	<150	NA	<150
	Cs-137 (pCi/L)	<20	<20	<20
	Pb-210 (pCi/L)	<3.0	<3.0	<3.0
	Pu-238 (pCi/L)	<1.0	<1.0	<1.0
	Pu-239/240 (pCi/L)	<1.0	<1.0	1.55
	Ra-226 (pCi/L)	<1.0	1.13	2.34
	Ra-228 (pCi/L)	<8.4	<11	<6.1
	Sr-90 (pCi/L)	<5.0	<5.0	6.69
	Th-Total (μg/L)	<2.4	<2.6	NA
	U-Total (μg/L)	<1.0	20.1	<1.0
	Gross alpha (pCi/L)	<97	90.2	<17
	Gross beta (pCi/L)	61.4	<41	49.7

See text for definition of qualifiers; NA = Not analyzed; • = Matrix interference; •• = Low yield caused by matrix interference, spikes and blanks were good.

Table C-5. Fernald Environmental Management Project OU2 Radiological Results

		Lime	Sludge	Pond	Stage II					
	FEMP Sample No.	67431	67431	67431	67431	67431	67431	67431	67431	67431
	Treat. Sample No.	10371613	10371413	10371213	10371813	10372013	10372213	10372413	10372613	10372813
	Sample ID/Run No.	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9
	Radionuclide w/units	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.
Raw Data	Ru-106 (pCi/L)	<150	<150	<150	<150	<150	<150	<150	<150	<150
	Cs-137 (pCi/L)	<20	<20	<20	<20	<20	<20	<20	<20	<20
	Pb-210 (pCi/L)	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	Pu-238 (pCi/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Pu-239/240 (pCi/L)	1.72	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Ra-226 (pCi/L)	*	*	*	*	*	*	*	*	*
	Ra-228 (pCi/L)	*	*	*	*	*	*	*	*	*
	Sr-90 (pCi/L)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Th-Total (μg/L)	**	<16.8	**	<52.1	**	**	**	**	**
	U-Total (μg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	1.69	<1.0	<1.0	<1.0
	Gross alpha (pCi/L)	<52	<69	59.6	66.4	<101	<90	<19	<59	<19
	Gross beta (pCi/L)	85.2	81.8	71.7	76.8	59.5	62.2	75.5	98	105

See text for definition of qualifiers; NA = Not analyzed; * = Matrix interference; ** = Low yield caused by matrix interference, spikes and blanks were good.

Table C-5. Fernald Environmental Management Project OU2 Radiological Results

		South Field								
	FEMP Sample No.	75206	75208	75206	75206	75208	75206	75206	75207	75207
	Treat. Sample No.	10168613	10311013	10169013	10169213	10311213	10169613	10169813	10310213	10310813
	Sample ID/Run No.	Run 3	Run 3D	Run 5	Run 6	Run 6D	Run 8	Run 9	Run 10	Run 10D
	Radionuclide w/units	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.
Raw Data	Ru-106 (pCi/L)	NA	<150	NA	NA	<150	NA	NA	NA	NA
	Cs-137 (pCi/L)	<20	<20	<20	<20	<20	<20	<20	<20	<20
	Pb-210 (pCi/L)	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
	Pu-238 (pCi/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.5	<1.0	<1.5
	Pu-239/240 (pCi/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.3	<1.0	<1.0
	Ra-226 (pCi/L)	1.03	<1.0	<1.0	<1.0	2.98	1.78	1.28	1.79	1.28
	Ra-228 (pCi/L)	<8.2	<6.7	<8.4	<12	<6.0	<10	<13	<8.9	<8.4
	Sr-90 (pCi/L)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Th-Total (μg/L)	<3.0	<3.0	<1.0	<4.3	<4.8	<3.1	1.59	<3.8	<1.0
	U-Total (μg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Gross alpha (pCi/L)	<45	<42	<18	<74	<25	<48	<17	2890	<46
	Gross beta (pCi/L)	<40	63.9	39.7	<40	62.4	69.8	58.7	42.2	<36

3 pages

See text for definition of qualifiers; NA = Not analyzed; * = Matrix interference; ** = Low yield caused by matrix interference, spikes and blanks were good.

3527

Table C-6. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results

		Reagents								Clean Sand			
	FEMP Sample No.	N/A		N/A		N/A		N/A		75209		75209	
	Treat. Sample No.	10162301		10162302		10162306		10162307		10312813		10313213	
	Sample Identification/Run No.	PC Type I		PC Type II		Comm. Flyash		Attap. & Clinopt.		Run 2		Run 4	
	Compound Name	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q
Raw Data	Methylene Chloride	35	B	29	B	55	B	97	B	30	B	53	B
	Acetone	190	B	140	B	190	B	410	BEJ	190	B	270	BEJ
	1,1,1-Trichloroethane	U		U		U		U		U		7	
	4-Methyl-2-pentanone	18		11		18		12		12		12	
	2-Butanone	2	J	U		U		U		4	BJ	3	BJ
	2-Hexanone	1	J	U		U		U		U		U	
	Toluene	U		U		U		U		U		U	
	Chloroform	U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		3	J
	Carbon disulfide	U		U		U		U		U		U	
Spike Corrected Data	Methylene Chloride	N/A		N/A		N/A		N/A		30	B	53	B
	Acetone	N/A		N/A		N/A		N/A		190	B	270	BEJ
	1,1,1-Trichloroethane	N/A		N/A		N/A		N/A		U		7	
	4-Methyl-2-pentanone	N/A		N/A		N/A		N/A		12		12	
	2-Butanone	N/A		N/A		N/A		N/A		10.8	BJ	8.1	BJ
	2-Hexanone	N/A		N/A		N/A		N/A		U		U	
	Toluene	N/A		N/A		N/A		N/A		U		U	
	Chloroform	N/A		N/A		N/A		N/A		U		U	
	Vinyl acetate	N/A		N/A		N/A		N/A		U		U	
	1,1-Dichloroethane	N/A		N/A		N/A		N/A		U		3	J
	Carbon disulfide	N/A		N/A		N/A		N/A		U		U	
	Dilution Correction Factors:	N/A		N/A		N/A		N/A		0.8667		0.8442	
Spike and Dilution Corrected Data	Methylene Chloride	N/A		N/A		N/A		N/A		35	B	63	B
	Acetone	N/A		N/A		N/A		N/A		219	B	320	BEJ
	1,1,1-Trichloroethane	N/A		N/A		N/A		N/A		U		8.2923	
	4-Methyl-2-pentanone	N/A		N/A		N/A		N/A		13.8		14.2	
	2-Butanone	N/A		N/A		N/A		N/A		12.5	BJ	9.6	BJ
	2-Hexanone	N/A		N/A		N/A		N/A		U		U	
	Toluene	N/A		N/A		N/A		N/A		U		U	
	Chloroform	N/A		N/A		N/A		N/A		U		U	
	Vinyl acetate	N/A		N/A		N/A		N/A		U		U	
	1,1-Dichloroethane	N/A		N/A		N/A		N/A		U		3.55	J
	Carbon disulfide	N/A		N/A		N/A		N/A		U		U	

Notes: 2-Butanone is the only volatile organic compound for which there is a spike correction. See text for definition of qualifiers.

Table C-6. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results

		Solid Waste Landfill																	
	FEMP Sample No.	75201		75201		75201		75201		75201		75201		75201		75201		75201	
	Treat. Sample No.	10162413		10162413D		10162513D		10162513R		10162613		10162613D		10312013		10162713		10162713D		10162813	
	Sample Identification/Run No.	Run 1		Run 1		Run 2		Run 2		Run 3		Run 3		Run 3D		Run 4		Run 4		Run 5	
	Compound Name	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q
Raw Data	Methylene Chloride	210	E	200	D	240	D	250	E	220	E	330	D	28	B	160	B	230	D	180	B
	Acetone	77		73	D	280	D	250	E	160		660	D	150	B	210	E	260	D	130	
	1,1,1-Trichloroethane	U		U		U		U		U		U		8		U		U		U	
	4-Methyl-2-pentanone	2	J	2	DJ	U		U		U		U		16		1	J	U		2	J
	2-Butanone	U		U		U		U		U		U		2	J	U		U		U	
	2-Hexanone	U		U		U		U		U		U		2	J	U		U		3	J
	Toluene	U		U		U		U		1	J	U		U		1	J	U		U	
	Chloroform	U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		2	J	U		U		U	
	Carbon disulfide	U		U		U		U		U		U		U		U		U		U	
Spike Corrected Data	Methylene Chloride	210	BE	200	BD	240	BD	250	BE	220	BE	330	BD	28	B	160	B	230	BD	180	B
	Acetone	77		73	D	280	BD	250	BE	160		660	BD	150	B	210	E	260	BD	130	
	1,1,1-Trichloroethane	U		U		U		U		U		U		8		U		U		U	
	4-Methyl-2-pentanone	2	J	2	DJ	U		U		U		U		16		1	J	U		2	J
	2-Butanone	U		U		U		U		U		U		5.4	J	U		U		U	
	2-Hexanone	U		U		U		U		U		U		2	J	U		U		3	J
	Toluene	U		U		U		U		1	J	U		U		1	J	U		U	
	Chloroform	U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		2	J	U		U		U	
	Carbon disulfide	U		U		U		U		U		U		U		U		U		U	
	Dilution Correction Factors:	0.5405		0.5405		0.5556		0.5556		0.5263		0.5263		0.5263		0.6250		0.6250		0.6452	
Spike and Dilution Corrected Data	Methylene Chloride	389	BE	370	BD	432	BD	450	BE	418	BE	627	BD	53	B	256	B	368	BD	279	B
	Acetone	142		135	D	504	BD	450	BE	304		1254	BD	285	B	336	E	416	BD	202	
	1,1,1-Trichloroethane	U		U		U		U		U		U		15.2		U		U		U	
	4-Methyl-2-pentanone	3.7	J	3.7	DJ	U		U		U		U		30.4		1.6	J	U		3.1	J
	2-Butanone	U		U		U		U		U		U		10.3	J	U		U		U	
	2-Hexanone	U		U		U		U		U		U		3.80	J	U		U		4.65	J
	Toluene	U		U		U		U		1.90	J	U		U		1.60	J	U		U	
	Chloroform	U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		3.80	J	U		U		U	
	Carbon disulfide	U		U		U		U		U		U		U		U		U		U	

Notes: 2-Butanone is the only volatile organic compound for which there is a spike correction. See text for definition of qualifiers.

Table C-6. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results

		Solid Waste Landfill																					
	FEMP Sample No.	75201		75201		75201		75201		75201		75201		75201		75201		75203		75203		75201	
	Treat. Sample No.	10162913		10162913D		10163013		10312213		10163213		10163213		10163413		10163613		10166413		10166623		10312413	
	Sample Identification/Run No.	Run 6		Run 6		Run 7		Run 7D		Run 8		Run 8		Run 9		Run 10		Run 11		Run 12		Run 12D	
	Compound Name	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q
Raw Data	Methylene Chloride	260	E	220	D	33	B	31	B	35	B	68	B	88	B	160	B	98	B	620	BEJ	24	B
	Acetone	120	B	120	D	18	B	160	B	45	B	240	BEJ	340	BEJ	300	BEJ	90	B	430	BEJ	120	B
	1,1,1-Trichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	4-Methyl-2-pentanone	2	J	U		U		13		3	J	2	J	U		U		U		U		5	J
	2-Butanone	U		U		2	J	2	J	4	BJ	3	BJ	3	J	6	BJ	1	BJ	3	J	U	
	2-Hexanone	3	J	U		U		U		1	J	U		U		U		U		U		U	
	Toluene	U		U		U		U		U		U		U		U		U		U		U	
	Chloroform	U		U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	Carbon disulfide	U		U		U		U		U		U		U		U		U		U		U	
Spike Corrected Data	Methylene Chloride	260	BE	220	BD	33	B	31	B	35	B	68	B	88	B	160	B	98	B	620	BEJ	24	B
	Acetone	120	B	120	BD	18	B	160	B	45	B	240	BEJ	340	BEJ	300	BEJ	90	B	430	BEJ	120	B
	1,1,1-Trichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	4-Methyl-2-pentanone	2	J	U		U		13		3	J	2	J	U		U		U		U		5	J
	2-Butanone	U		U		5.4	J	5.4	J	10.8	BJ	8.1	BJ	8.1	J	16.2	BJ	2.7	BJ	8.1	J	U	
	2-Hexanone	3	J	U		U		U		1	J	U		U		U		U		U		U	
	Toluene	U		U		U		U		U		U		U		U		U		U		U	
	Chloroform	U		U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	Carbon disulfide	U		U		U		U		U		U		U		U		U		U		U	
	Dilution Correction Factors:	0.4918		0.4918		0.4878		0.4878		0.5607		0.5607		0.5556		0.6803		0.6757		0.6667		0.6667	
Spike and Dilution Corrected Data	Methylene Chloride	529	BE	447	BD	68	B	64	B	62	B	121	B	158	B	235	B	145	B	930	BEJ	36	B
	Acetone	244	B	244	BD	37	B	328	B	80	B	428	BEJ	612	BEJ	441	BEJ	133	B	645	BEJ	180	B
	1,1,1-Trichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	4-Methyl-2-pentanone	4.1	J	U		U		26.7		5.4	J	3.6	J	U		U		U		U		7.5	J
	2-Butanone	U		U		11.1	J	11.1	J	19.3	BJ	14.5	BJ	14.6	J	23.8	BJ	4.0	BJ	12.2	J	U	
	2-Hexanone	6.10	J	U		U		U		1.78	J	U		U		U		U		U		U	
	Toluene	U		U		U		U		U		U		U		U		U		U		U	
	Chloroform	U		U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	Carbon disulfide	U		U		U		U		U		U		U		U		U		U		U	

Notes: 2-Butanone is the only volatile organic compound for which there is a spike correction. See text for definition of qualifiers.

Table C-6. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results

		Lime Sludge Pond, Stage I										
	FEMP Sample No.	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202
	Treat. Sample No.	10164413	10164613	10165013	10311413	10165413	10165613	10167013	10165813	10311613	10167213	10167413
	Sample Identification/Run No.	Run 2	Run 3	Run 5	Run 5D	Run 7	Run 8	Run 9	Run 10	Run 10D	Run 13	Run 14
	Compound Name	(µg/L) Q	(µg/L) Q	(µg/L) Q	(µg/L) Q	(µg/L) Q	(µg/L) Q	(µg/L) Q	(µg/L) Q	(µg/L) Q	(µg/L) Q	(µg/L) Q
Raw Data	Methylene Chloride	160 B	87 B	140 B	67 B	80 B	88 B	120 B	51 B	26 B	97 B	98 B
	Acetone	240 BEJ	37 B	230 BEJ	170 B	140 B	340 BEJ	160 B	160 B	150 B	100 B	160 B
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	U	U	U	8 J	U	U	U	U	8 J	2 J	2 J
	2-Butanone	5 BJ	2 BJ	2 BJ	2 J	2 BJ	2 BJ	3 BJ	3 BJ	3 J	3 BJ	2 BJ
	2-Hexanone	U	U	U	U	U	U	U	U	U	U	U
	Toluene	U	U	3 J	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	3 J	U	U	U	U
	Vinyl acetate	U	U	U	U	U	1 J	U	U	U	U	U
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U	U
Spike Corrected Data	Methylene Chloride	160 B	87 B	140 B	67 B	80 B	88 B	120 B	51 B	26 B	97 B	98 B
	Acetone	240 BEJ	37 B	230 BEJ	170 B	140 B	340 BEJ	160 B	160 B	150 B	100 B	160 B
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	U	U	U	8 J	U	U	U	U	8 J	2 J	2 J
	2-Butanone	13.5 BJ	5.4 BJ	5.4 BJ	5.4 J	5.4 BJ	5.4 BJ	8.1 BJ	8.1 BJ	8.1 J	8.1 BJ	5.4 BJ
	2-Hexanone	U	U	U	U	U	U	U	U	U	U	U
	Toluene	U	U	3 J	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	3 J	U	U	U	U
	Vinyl acetate	U	U	U	U	U	1 J	U	U	U	U	U
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U	U
	Dilution Correction Factors:	0.5556	0.5263	0.6452	0.6452	0.4878	0.5405	0.5556	0.6623	0.6623	0.4762	0.4878
Spike and Dilution Corrected Data	Methylene Chloride	288 B	165 B	217 B	104 B	164 B	163 B	216 B	77 B	39 B	204 B	201 B
	Acetone	432 BEJ	70 B	357 BEJ	264 B	287 B	629 BEJ	288 B	242 B	226 B	210 B	328 B
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	U	U	U	12.4 J	U	U	U	U	12.1 J	4.2 J	4.1 J
	2-Butanone	24.3 BJ	10.3 BJ	8.4 BJ	8.4 J	11.1 BJ	10.0 BJ	14.6 BJ	12.2 BJ	12.2 J	17.0 BJ	11.1 BJ
	2-Hexanone	U	U	U	U	U	U	U	U	U	U	U
	Toluene	U	U	4.65 J	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	5.40 J	U	U	U	U
	Vinyl acetate	U	U	U	U	U	1.85 J	U	U	U	U	U
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U	U

Notes: 2-Butanone is the only volatile organic compound for which there is a spike correction. See text for definition of qualifiers.

Table C-6. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results

		Lime Sludge Pond, Stg I			
	FEMP Sample No.	75205		75202	
	Treat. Sample No.	10167813		10311813	
	Sample Identification/Run No.	Run 16		Run 16D	
	Compound Name	(µg/L)	Q	(µg/L)	Q
Raw Data	Methylene Chloride	67	B	31	B
	Acetone	300	BEJ	210	BEJ
	1,1,1-Trichloroethane	U		U	
	4-Methyl-2-pentanone	U		7	J
	2-Butanone	5	BJ	3	J
	2-Hexanone	U		U	
	Toluene	U		U	
	Chloroform	U		U	
	Vinyl acetate	U		U	
	1,1-Dichloroethane	U		U	
	Carbon disulfide	U		U	
Spike Corrected Data	Methylene Chloride	67	B	31	B
	Acetone	300	BEJ	210	BEJ
	1,1,1-Trichloroethane	U		U	
	4-Methyl-2-pentanone	U		7	J
	2-Butanone	13.5	BJ	8.1	J
	2-Hexanone	U		U	
	Toluene	U		U	
	Chloroform	U		U	
	Vinyl acetate	U		U	
	1,1-Dichloroethane	U		U	
	Carbon disulfide	U		U	
	Dilution Correction Factors:	0.6061		0.6061	
Spike and Dilution Corrected Data	Methylene Chloride	111	B	51	B
	Acetone	495	BEJ	347	BEJ
	1,1,1-Trichloroethane	U		U	
	4-Methyl-2-pentanone	U		11.5	J
	2-Butanone	22.3	BJ	13.4	J
	2-Hexanone	U		U	
	Toluene	U		U	
	Chloroform	U		U	
	Vinyl acetate	U		U	
	1,1-Dichloroethane	U		U	
	Carbon disulfide	U		U	

Notes: 2-Butanone is the only volatile organic compound for which there is a spike correction. See text for definition of qualifiers.

Table C-6. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results

		Lime Sludge Pond, Stage II																	
	FEMP Sample No.	67431		67431		67431		67431		67431		67431		67431		67431		67431	
	Treat. Sample No.	10371613		10371413		10371213		10373213		10371813		10372013		10372213		10372413		10373013		10372613		10372813	
	Sample Identification/Run No.	Run 1		Run 2		Run 3		Run 3D		Run 4		Run 5		Run 6		Run 7		Run 7D		Run 8		Run 9	
	Compound Name	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q
Raw Data	Methylene Chloride	52	B	74	B	54	B	52	B	55	B	30	B	30	B	31	B	36	B	31	B	38	B
	Acetone	120		190		170		760	BEJ	170		150	B	150	B	170	B	500	E	170	B	170	B
	1,1,1-Trichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	4-Methyl-2-pentanone	9	J	9	J	9	J	7	J	9	J	11	B	12	B	11	B	11	B	11	B	10	
	2-Butanone	7	J	6	J	7	J	9	J	9	J	8	J	7	J	7	J	1	BJ	6	J	7	BJ
	2-Hexanone	1	J	U		U		U		U		1	BJ	U		1	BJ	U		U		1	J
	Toluene	U		U		U		U		U		1	J	U		1	J	U		1	J	U	
	Chloroform	U		U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	Carbon disulfide	1	J	U		U		U		U		U		U		U		U		U		U	
Spike Corrected Data	Methylene Chloride	52	B	74	B	54	B	52	B	55	B	30	B	30	B	31	B	36	B	31	B	38	B
	Acetone	120		190		170		760	BEJ	170		150	B	150	B	170	B	500	E	170	B	170	B
	1,1,1-Trichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	4-Methyl-2-pentanone	9	J	9	J	9	J	7	J	9	J	11	B	12	B	11	B	11	B	11	B	10	
	2-Butanone	18.9	J	16.2	J	18.9	J	24.3	J	24.3	J	21.6	J	18.9	J	18.9	J	2.7	BJ	16.2	J	18.9	BJ
	2-Hexanone	1	J	U		U		U		U		1	BJ	U		1	BJ	U		U		1	J
	Toluene	U		U		U		U		U		1	J	U		1	J	U		1	J	U	
	Chloroform	U		U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	Carbon disulfide	1	J	U		U		U		U		U		U		U		U		U		U	
	Dilution Correction Factors:	0.5403		0.5553		0.5263		0.5257		0.6250		0.6447		0.6058		0.6222		0.6224		0.6449		0.6061	
Spike and Dilution Corrected Data	Methylene Chloride	96	B	133	B	103	B	99	B	88	B	47	B	50	B	50	B	58	B	48	B	63	B
	Acetone	222		342		323		1446	BEJ	272		233	B	248	B	273	B	803	E	264	B	280	B
	1,1,1-Trichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	4-Methyl-2-pentanone	16.7	J	16.2	J	17.1	J	13.3	J	14.4	J	17.1	B	19.8	B	17.7	B	17.7	B	17.1	B	16.5	
	2-Butanone	35.0	J	29.2	J	36.0	J	46.3	J	38.9	J	33.5	J	31.2	J	30.4	J	4.3	BJ	25.1	J	31.2	BJ
	2-Hexanone	1.85	J	U		U		U		U		1.55	BJ	U		1.61	BJ	U		U		1.65	J
	Toluene	U		U		U		U		U		1.55	J	U		1.61	J	U		1.55	J	U	
	Chloroform	U		U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		U		U		U		U		U	
	Carbon disulfide	1.85	J	U		U		U		U		U		U		U		U		U		U	

Notes: 2-Butanone is the only volatile organic compound for which there is a spike correction. See text for definition of qualifiers.

3527

Table C-6. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results

		South Field																			
	FEMP Sample No.	75206		75206		75206		75208		75206		75206		75206		75208		75206		75206	
	Treat. Sample No.	10168413		10168213		10168613		10311013		10168813		10169013		10169213		10311213		10169413		10169613	
	Sample Identification/Run No.	Run 1RE		Run 2		Run 3		Run 3D		Run 4		Run 5		Run 6		Run 6D		Run 7		Run 8	
	Compound Name	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q
Raw Data	Methylene Chloride	29	B	87	B	33	B	28	B	25	B	66	B	24	B	34	B	24	B	36	B
	Acetone	41	B	200	B	550	BEJ	150	B	80	B	3500	BEJ	24	B	200	B	350	BEJ	510	BEJ
	1,1,1-Trichloroethane	U		U		U		U		U		U		U		U		U		U	
	4-Methyl-2-pentanone	U		U		U		18		U		U		U		14		U		U	
	2-Butanone	2	J	3	BJ	2	J	3	J	2	J	8	J	1	J	2	J	3	J	3	J
	2-Hexanone	U		U		1	J	U		1	J	U		U		U		U		U	
	Toluene	U		U		U		U		U		U		U		U		U		U	
	Chloroform	U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		U		U		U		U	
	Carbon disulfide	U		U		U		U		U		U		U		U		U		U	
Spike Corrected Data	Methylene Chloride	29	B	87	B	33	B	28	B	25	B	66	B	24	B	34	B	24	B	36	B
	Acetone	41	B	200	B	550	BEJ	150	B	80	B	3500	BEJ	24	B	200	B	350	BEJ	510	BEJ
	1,1,1-Trichloroethane	U		U		U		U		U		U		U		U		U		U	
	4-Methyl-2-pentanone	U		U		U		18		U		U		U		14		U		U	
	2-Butanone	5.4	J	8.1	BJ	5.4	J	8.1	J	5.4	J	21.6	J	2.7	J	5.4	J	8.1	J	8.1	J
	2-Hexanone	U		U		1	J	U		1	J	U		U		U		U		U	
	Toluene	U		U		U		U		U		U		U		U		U		U	
	Chloroform	U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		U		U		U		U	
	Carbon disulfide	U		U		U		U		U		U		U		U		U		U	
	Dilution Correction Factors:	0.5405		0.5556		0.5263		0.5263		0.6250		0.6452		0.4762		0.4762		0.4878		0.5405	
Spike and Dilution Corrected Data	Methylene Chloride	54	B	157	B	63	B	53	B	40	B	102	B	50	B	71	B	49	B	67	B
	Acetone	76	B	360	B	1045	BEJ	285	B	128	B	5425	BEJ	50	B	420	B	718	BEJ	944	BEJ
	1,1,1-Trichloroethane	U		U		U		U		U		U		U		U		U		U	
	4-Methyl-2-pentanone	U		U		U		34.2		U		U		U		29.4		U		U	
	2-Butanone	10.0	J	14.6	BJ	10.3	J	15.4	J	8.6	J	33.5	J	5.7	J	11.4	J	16.6	J	15.0	J
	2-Hexanone	U		U		1.90	J	U		1.60	J	U		U		U		U		U	
	Toluene	U		U		U		U		U		U		U		U		U		U	
	Chloroform	U		U		U		U		U		U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U		U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U		U		U		U		U		U	
	Carbon disulfide	U		U		U		U		U		U		U		U		U		U	

Notes: 2-Butanone is the only volatile organic compound for which there is a spike correction. See text for definition of qualifiers.

Table C-6. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results

		South Field									
	FEMP Sample No.	75205		75207		75207		75207		75207	
	Treat. Sample No.	10169813		10310213		10310813		10310413		10310613	
	Sample Identification/Run No.	Run 9		Run 10		Run 10D		Run 11		Run 12	
	Compound Name	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q	(µg/L)	Q
Raw Data	Methylene Chloride	46	B	60	B	30	B	57	B	96	B
	Acetone	420	BEJ	340	BEJ	150	B	300	BEJ	410	BEJ
	1,1,1-Trichloroethane	U		U		U		U		U	
	4-Methyl-2-pentanone	U		U		U		U		U	
	2-Butanone	6	J	5	BJ	3	BJ	4	BJ	5	BJ
	2-Hexanone	U		U		U		U		U	
	Toluene	U		U		U		U		U	
	Chloroform	U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U	
	Carbon disulfide	U		U		U		U		U	
Spike Corrected Data	Methylene Chloride	46	B	60	B	30	B	57	B	96	B
	Acetone	420	BEJ	340	BEJ	150	B	300	BEJ	410	BEJ
	1,1,1-Trichloroethane	U		U		U		U		U	
	4-Methyl-2-pentanone	U		U		U		U		U	
	2-Butanone	16.2	J	13.5	BJ	8.1	BJ	10.8	BJ	13.5	BJ
	2-Hexanone	U		U		U		U		U	
	Toluene	U		U		U		U		U	
	Chloroform	U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U	
	Carbon disulfide	U		U		U		U		U	
	Dilution Correction Factors:	0.5556		0.5525		0.5525		0.5618		0.5435	
Spike and Dilution Corrected Data	Methylene Chloride	83	B	109	B	54	B	101	B	177	B
	Acetone	756	BEJ	615	BEJ	272	B	534	BEJ	754	BEJ
	1,1,1-Trichloroethane	U		U		U		U		U	
	4-Methyl-2-pentanone	U		U		U		U		U	
	2-Butanone	29.2	J	24.5	BJ	14.7	BJ	19.2	BJ	24.9	BJ
	2-Hexanone	U		U		U		U		U	
	Toluene	U		U		U		U		U	
	Chloroform	U		U		U		U		U	
	Vinyl acetate	U		U		U		U		U	
	1,1-Dichloroethane	U		U		U		U		U	
	Carbon disulfide	U		U		U		U		U	

Notes: 2-Butanone is the only volatile organic compound for which there is a spike correction. See text for definition of qualifiers.

Table C-7. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results

		Reagents														Clean Sand			
	FEMP Sample No.	N/A		N/A		N/A		N/A		N/A		N/A		N/A		75209		75209	
	Lab Sample No.	10162301		10162301RE		10162302		10162302RE		10162306		10162306RE		10162307		10312813		10313213	
	Sample Identification/Run No.	PC Type I		PC Type I		PC Type II		PC Type II		Comm. Flyash		Comm. Flyash		Attap. & Clinopt		Attap. & Clinopt		Run 2		Run 4	
	Compound Name	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Benzoic acid	U		U		U		U		U		U		U		U		U	
	Bis(2-ethylhexyl)Phthalate	U		U		U		U		U		U		U		U		U	
	2-Chlorophenol	U		U		U		U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U		U		U		U	
	Phenol	U		U		U		U		U		U		U		U		U	
	Dilution Correction Factors:	N/A		N/A		N/A		N/A		N/A		N/A		N/A		0.8667		0.8442	
Dilution Corrected Data	Benzoic acid	N/A		N/A		N/A		N/A		N/A		N/A		N/A		U		U	
	Bis(2-ethylhexyl)Phthalate	N/A		N/A		N/A		N/A		N/A		N/A		N/A		U		U	
	2-Chlorophenol	N/A		N/A		N/A		N/A		N/A		N/A		N/A		U		U	
	4-Chloro-3-methylphenol	N/A		N/A		N/A		N/A		N/A		N/A		N/A		U		U	
	Di-n-butylphthalate	N/A		N/A		N/A		N/A		N/A		N/A		N/A		U		U	
	Phenol	N/A		N/A		N/A		N/A		N/A		N/A		N/A		U		U	

See text for definition of qualifiers.

Table C-7. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results

		Solid Waste Landfill																					
	FEMP Sample No.	75201		75201		75201		75201		75201		75201		75201		75201		75201		75201		75201	
	Lab Sample No.	10162413		10162413RE		10162513		10162513RE		10162613		10162613RE		10312013		10162713		10162713RE		10162813		10162813RE	
	Sample Identification/Run No.	Run 1		Run 1		Run 2		Run 2		Run 3		Run 3		Run 3D		Run 4		Run 4		Run 5		Run 5	
	Compound Name	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Benzoic acid	10	J	U		U		U		U		U		U		U		10	J	U		U	
	Bis(2-ethylhexyl)Phthalate	U		U		9	J	U		U		5	J	U		U		10	J	U		U	
	2-Chlorophenol	U		U		U		U		U		U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U		U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U		U		420		U		U		U	
	Phenol	U		U		U		U		U		U		U		U		U		U		U	
	Dilution Correction Factors:	0.5405		0.5405		0.5556		0.5556		0.5263		0.5263		0.5263		0.6250		0.6250		0.6452		0.6452	
Dilution Corrected Data	Benzoic acid	18.5	J	U		U		U		U		U		U		U		16.0	J	U		U	
	Bis(2-ethylhexyl)Phthalate	U		U		16.2	J	U		U		9.5	J	U		U		16.0	J	U		U	
	2-Chlorophenol	U		U		U		U		U		U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U		U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U		U		672		U		U		U	
	Phenol	U		U		U		U		U		U		U		U		U		U		U	

See text for definition of qualifiers.

Table C-7. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results

		Solid Waste Landfill																			
	FEMP Sample No.	75201		75201		75201		75201		75201		75201		75201		75203		75203		75201	
	Lab Sample No.	10162913		10162913RE		10163013		10312213		10163213		10163413		10163613		10166413		10166613		10312413	
	Sample Identification/Run No.	Run 6		Run 6		Run 7		Run 7D		Run 8		Run 9		Run 10		Run 11		Run 12		Run 12D	
	Compound Name	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Benzoic acid	U		U		U		U		U		U		U		U		U		U	
	Bis(2-ethylhexyl)Phthalate	U		U		U		U		U		U		U		U		U		U	
	2-Chlorophenol	U		U		U		U		U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U		U		U		U		U	
	Phenol	U		U		U		U		5	J	U		U		U		U		U	
	Dilution Correction Factors:	0.4918		0.4918		0.4878		0.4878		0.5607		0.5556		0.6803		0.6757		0.6667		0.6667	
Dilution Corrected Data	Benzoic acid	U		U		U		U		U		U		U		U		U		U	
	Bis(2-ethylhexyl)Phthalate	U		U		U		U		U		U		U		U		U		U	
	2-Chlorophenol	U		U		U		U		U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U		U		U		U		U	
	Phenol	U		U		U		U		8.9	J	U		U		U		U		U	

See text for definition of qualifiers.

Table C-7. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results

		Lime Sludge Pond, Stage I																	
	FEMP Sample No.	75202		75202		75202		75202		75202		75202		75202		75202		75202	
	Lab Sample No.	10164413		10164613		10165013		10311413		10165213		10165413		10165613		10167013		10165813	
	Sample Identification/Run No.	Run 2		Run 3		Run 5		Run 5D		Run 6		Run 7		Run 8		Run 9		Run 10	
	Compound Name	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Benzoic acid	16	BJ	U		U		U		U		U		4	BJ	64	BJ	U	
	Bis(2-ethylhexyl)Phthalate	U		38	B	U		U		U		U		U		U		U	
	2-Chlorophenol	U		U		U		U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U		U		U		U	
	Phenol	U		U		U		U		U		U		U		U		U	
	Dilution Correction Factors:	0.5556		0.5263		0.6452		0.6452		0.4762		0.4878		0.5405		0.5556		0.6623	
Dilution Corrected Data	Benzoic acid	28.8	BJ	U		U		U		U		U		7.4	BJ	115	BJ	U	
	Bis(2-ethylhexyl)Phthalate	U		72.2	B	U		U		U		U		U		U		U	
	2-Chlorophenol	U		U		U		U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U		U		U		U	
	Phenol	U		U		U		U		U		U		U		U		U	

See text for definition of qualifiers.

Table C-7. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results

		Lime Sludge Pond, Stage I											
	FEMP Sample No.	75202		75202		75202		75202		75205		75202	
	Lab Sample No.	10311613		10311613RE		10167213		10167413		10167813		10311813	
	Sample Identification/Run No.	Run 10D		Run 10D		Run 13		Run 14		Run 16		Run 16D	
	Compound Name	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Benzoic acid	U		6	J	14	BJ	U		U		U	
	Bis(2-ethylhexyl)Phthalate	U		U		U		U		U		U	
	2-Chlorophenol	U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U	
	Phenol	5	J	U		U		U		U		4	J
	Dilution Correction Factors:	0.6623		0.6623		0.4762		0.4878		0.6061		0.6061	
Dilution Corrected Data	Benzoic acid	U		9.1	J	29.4	BJ	U		U		U	
	Bis(2-ethylhexyl)Phthalate	U		U		U		U		U		U	
	2-Chlorophenol	U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U	
	Phenol	7.6	J	U		U		U		U		6.6	J

See text for definition of qualifiers.

Table C-7. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results

		Lime Sludge Pond, Stage II																					
	FEMP Sample No.	67431		67431		67431		67431		67431		67431		67431		67431		67431		67431		67431	
	Lab Sample No.	10371613		10371413		10371213		10373213		10371813		10372013		10372213		10372413		10373013		10372613		10372813	
	Sample Identification/Run No.	Run 1		Run 2		Run 3		Run 3D		Run 4		Run 5		Run 6		Run 7		Run 7D		Run 8		Run 9	
	Compound Name	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Benzoic acid	U		5	J	7	J	7	J	9	J	U		U		15	J	9	J	U		9	J
	Bis(2-ethylhexyl)Phthalate	U		U		U		U		U		U		U		U		U		U		U	
	2-Chlorophenol	U		U		U		U		U		U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		5	J	U		U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U		U		U		U		U		U	
	Phenol	U		4	J	U		5	J	U		U		U		5	J	U		U		U	
	Dilution Correction Factors:	0.5403		0.5553		0.5263		0.5257		0.6250		0.6447		0.6058		0.6222		0.6224		0.6449		0.6061	
Dilution Corrected Data	Benzoic acid	U		9.0	J	13.3	J	13.3	J	14.4	J	U		U		24.1	J	14.5	J	U		14.8	J
	Bis(2-ethylhexyl)Phthalate	U		U		U		U		U		U		U		U		U		U		U	
	2-Chlorophenol	U		U		U		U		U		U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		9.5	J	U		U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U		U		U		U		U		U	
	Phenol	U		7.2	J	U		9.5	J	U		U		U		8.0	J	U		U		U	

See text for definition of qualifiers.

Table C-7. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results

		South Field																					
	FEMP Sample No.	75206		75206		75206		75208		75206		75206		75206		75208		75206		75206		75206	
	Lab Sample No.	10168413		10168213		10168613		10311013		10168813		10169013		10169213		10311213		10169413		10169613		10169813	
	Sample Identification/Run No.	Run 1RE		Run 2		Run 3		Run 3D		Run 4		Run 5		Run 6		Run 6D		Run 7		Run 8		Run 9	
	Compound Name	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Benzoic acid	6	J	8	J	6	J	U		9	J	U		U		U		U		U		U	
	Bis(2-ethylhexyl)Phthalate	U		U		U		U		U		U		U		U		U		U		U	
	2-Chlorophenol	U		5	J	U		U		U		U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U		U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U		U		U		U		U		U	
	Phenol	U		5	J	U		U		U		U		U		U		U		U		U	
	Dilution Correction Factors:	0.5405		0.5556		0.5263		0.5263		0.6250		0.6452		0.4762		0.4762		0.4878		0.5405		0.5556	
Dilution Corrected Data	Benzoic acid	11.1	J	14.4	J	11.4	J	U		14.4	J	U		U		U		U		U		U	
	Bis(2-ethylhexyl)Phthalate	U		U		U		U		U		U		U		U		U		U		U	
	2-Chlorophenol	U		9.0	J	U		U		U		U		U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U		U		U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U		U		U		U		U		U		U	
	Phenol	U		9.0	J	U		U		U		U		U		U		U		U		U	

See text for definition of qualifiers.

Table C-7. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results

		South Field									
	FEMP Sample No.	75207		75207		75207		75207		75207	
	Lab Sample No.	10310213		10310813		10310813R		10310413		10310613	
	Sample Identification/Run No.	Run 10		Run 10D		Run 10D		Run 11		Run 12	
	Compound Name	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q	Conc. (µg/L)	Q
Raw Data	Benzoic acid	U		U		U		U		U	
	Bis(2-ethylhexyl)Phthalate	U		U		U		U		U	
	2-Chlorophenol	U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U	
	Phenol	U		U		U		U		U	
	Dilution Correction Factors:	0.5525		0.5525		0.5525		0.5618		0.5435	
Dilution Corrected Data	Benzoic acid	U		U		U		U		U	
	Bis(2-ethylhexyl)Phthalate	U		U		U		U		U	
	2-Chlorophenol	U		U		U		U		U	
	4-Chloro-3-methylphenol	U		U		U		U		U	
	Di-n-butylphthalate	U		U		U		U		U	
	Phenol	U		U		U		U		U	

See text for definition of qualifiers.

TABLE C-8

SUMMARY STATISTICAL ANALYSIS-SOLID WASTE LANDFILL CHEMICAL CONSTITUENTS
(RAW DATA)

Chemical	Frequency of Detection	Range of Detection ($\mu g/L$)	Dist[a]	Mean[b] ($\mu g/L$)	Median ($\mu g/L$)	Lower 95% CI on Mean ($\mu g/L$)	Upper 95% CI on Mean ($\mu g/L$)	Coef. of Var. (%)
1,1,1-Trichloroethane	1 /1	8.000 - 8.000	[c]	[c]	8.000	8.000[c]	8.000[c]	NA
1,1-Dichloroethane	1 /1	2.000 - 2.000	[c]	[c]	2.000	2.000[c]	2.000[c]	NA
2-Butanone	6 /6	2.000 - 4.000	L[f]	2.570	2.500	2.018	3.273	30.619
2-Hexanone	4 /4	1.000 - 3.000	L[f]	2.060	2.500	1.119	3.790[d]	42.552
4-Methyl-2-pentanone	7 /7	1.000 - 16.000	L	5.571	2.000	1.203	28.241[d]	111.06
Acetone	15 /15	18.000 - 660.00	L[e]	209.53	160.00	127.89	415.69	72.669
Acetone[g]	14 /14	18.000 - 340.00	N	177.36	160.00	134.38	220.33	51.194
Aluminum	9 /9	382.00 - 1790.0	L	888.11	513.00	520.29	1587.5	62.613
Antimony	9 /9	31.600 - 113.00	L	63.544	55.000	42.756	97.725	48.800
Arsenic	5 /5	2.100 - 11.100	L[f]	5.032	4.500	2.752	9.201	59.868
Barium	9 /9	199.00 - 687.00	N	476.78	484.00	395.79	557.76	27.404
Benzoic acid	1 /15	10.000 - 10.000	L[f]	23.519	50.000	21.120	26.190[d]	16.137
Beryllium	5 /5	2.100 - 3.200	L[f]	2.557	2.500	2.107	3.104	20.352
Bis(2-ethylhexyl)Phthalate	3 /3	5.000 - 10.000	L[f]	7.663	9.000	4.083[d]	14.384[d]	33.072
Calcium	9 /9	415000 - 1.88E6	L	1.07E6	820000	670818	1.79E6	52.603
Chromium	9 /9	90.400 - 215.00	L	141.23	133.00	114.30	176.20	30.625
Cobalt	2 /2	12.900 - 14.600	[c]	[c]	13.750	12.900[c]	14.600[c]	8.742

TABLE C-8
(Continued)

Chemical	Frequency of Detection	Range of Detection ($\mu g/L$)	Dist[a]	Mean[b] ($\mu g/L$)	Median ($\mu g/L$)	Lower 95% CI on Mean ($\mu g/L$)	Upper 95% CI on Mean ($\mu g/L$)	Coef. of Var. (%)
Copper	9 /9	22.000 - 40.200	N	31.978	32.200	28.027	35.928	19.931
Cyanide	4 /4	2.100 - 7.700	L[f]	3.645	3.400	1.849[d]	7.185	60.975
Di-n-butylphthalate	1 /1	420.00 - 420.00	c	c	420.00	420.00[c]	420.00[c]	NA
Iron	9 /9	40.400 - 98.200	N	75.289	75.100	63.713	86.865	24.806
Magnesium	9 /9	393.00 - 21700	L	4277.1	2230.0	481.99	45886[d]	159.88
Manganese	9 /9	9.100 - 17.400	L	13.200	12.500	11.286	15.544	23.174
Methylene Chloride	15 /15	28.000 - 330.00	N	158.20	180.00	111.87	204.53	64.401
Molybdenum	8 /8	21.800 - 40.900	N	32.450	34.150	28.229	36.671	19.418
Nickel	3 /3	20.200 - 24.400	L[f]	22.399	22.800	19.062[d]	26.320[d]	9.435
Phenol	1 /15	5.000 - 5.000	L[f]	5.000	10.000	5.000[d]	5.000	0.000
Potassium	9 /9	49400 - 79100	L	64778	61400	57341	73471	18.015
Selenium	1 /1	2.200 - 2.200	c	c	2.200	2.200[c]	2.200[c]	NA
Silicon	7 /7	3880.0 - 19100	N	13637	15600	9842.3	17432	37.888
Silver	9 /9	57.600 -101.00	N	79.067	77.200	69.249	88.885	20.033
Sodium	2 /2	23200 - 74700	c	c	48950	23200[c]	74700[c]	74.394
Toluene	2 /15	1.000 - 1.000	L[f]	2.212	5.000	1.911	2.562[d]	22.948
Vanadium	9 /9	44.100 - 98.100	L[e]	71.678	83.300	54.968	95.267	33.763
Zinc	8 /9	7.100 - 143.00	N	81.011	109.00	45.785	116.24	70.151

TABLE C-8
(Continued)

NA - Not applicable.

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Distribution failed the Correlation Coefficient Test and therefore could not be definitively determined. It is treated as log-normal.

[f]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal

[g]Statistics for constituent with outliers rejected.

TABLE C-9

SUMMARY STATISTICAL ANALYSIS- LIME SLUDGE PONDS, CHEMICAL CONSTITUENTS (RAW DATA)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef. of Var. (%)
2-Butanone	14 /14	1.000 - 9.000	N	5.357	6.500	4.131	6.583	48.349
2-Hexanone	4 /4	1.000 - 1.000	L[f]	1.000	1.000	1.000	1.000	0.000
4-Chloro-3-methylphenol	1 /1	5.000 - 5.000	[c]	[c]	5.000	5.000[c]	5.000[c]	NA
4-Methyl-2-pentanone	12 /12	2.000 - 12.000	L[e]	9.250	9.500	7.068	13.168[d]	28.834
Acetone	14 /14	100.00 - 760.00	L[e]	237.14	170.00	165.01	325.65	76.825
Aluminum	14 /14	523.00 - 1070.0	L[e]	909.79	942.00	832.74	999.53	15.369
Antimony	14 /14	65.700 - 93.200	L	75.979	73.750	71.937	80.308	11.528
Arsenic	1 /1	9.300 - 9.300	[c]	[c]	9.300	9.300[c]	9.300[c]	NA
Barium	14 /14	687.00 - 1140.0	L	898.29	873.50	830.44	973.13	15.994
Benzoic acid	11 /14	4.000 - 64.000	L	16.357	10.000	9.943	26.316	95.153
Beryllium	14 /14	2.700 - 3.300	L	2.929	2.900	2.825	3.037	7.508
Boron	9 /9	168.00 - 225.00	L	194.33	194.00	183.30	206.22	9.144
Calcium	14 /14	1.72E6 - 2.19E6	L	1.91E6	1.89E6	1.85E6	1.98E6	7.118
Carbon disulfide	1 /1	1.000 - 1.000	[c]	[c]	1.000	1.000[c]	1.000[c]	NA
Chloroform	1 /1	3.000 - 3.000	[c]	[c]	3.000	3.000[c]	3.000[c]	NA
Chromium	14 /14	138.00 - 206.00	L[e]	155.43	148.00	146.35	165.13	13.369
Cobalt	14 /14	12.600 - 18.300	L	14.907	14.500	14.128	15.741	11.282
Copper	14 /14	43.000 - 62.300	L	51.657	51.000	48.736	54.801	12.250

TABLE C-9
(Continued)

Chemical	Frequency of Detection	Range of Detection ($\mu g/L$)	Dist[a]	Mean[b] ($\mu g/L$)	Median ($\mu g/L$)	Lower 95% CI on Mean ($\mu g/L$)	Upper 95% CI on Mean ($\mu g/L$)	Coef. of Var. (%)
Cyanide	8 /8	2.400 - 5.900	N	4.100	3.850	3.325	4.875	28.234
Iron	14 /14	78.200 - 91.900	L	85.043	84.050	82.594	87.587	6.035
Lead	1 /1	3.600 - 3.600	[c]	[c]	3.600	3.600[c]	3.600[c]	NA
Magnesium	14 /14	666.00 - 2730.0	L[e]	861.14	688.50	686.10	1032.6	63.041
Manganese	14 /14	16.300 - 21.100	L[e]	17.300	16.900	16.779	17.838	6.775
Methylene Chloride	14 /14	30.000 - 120.00	L	56.286	52.000	43.023	74.125	50.461
Molybdenum	14 /14	16.300 - 33.400	L[e]	21.064	18.200	18.582	23.864	28.077
Nickel	8 /8	20.400 - 31.300	L	25.413	25.300	23.290	27.783	12.607
Phenol	3 /14	4.000 - 5.000	L[f]	4.921	10.000	4.784	5.062[d]	5.423
Potassium	14 /14	66600 - 118000	L	89836	85700	82903	97527	16.153
Selenium	1 /1	12.600 - 12.600	[c]	[c]	12.600	12.600[c]	12.600[c]	NA
Silicon	14 /14	926.00 - 15400	L[e]	2936.1	1680.0	1605.5	4577.0	127.83
Silver	14 /14	100.00 - 109.00	L	103.36	103.00	102.11	104.62	2.506
Sodium	14 /14	35600 - 154000	N	95307	109500	74872	115743	45.302
Thallium	1 /1	12.900 - 12.900	[c]	[c]	12.900	12.900[c]	12.900[c]	NA
Toluene	3 /14	1.000 - 1.000	L[f]	2.054	5.000	1.708	2.471[d]	29.318
Vanadium	14 /14	58.100 - 82.400	L[e]	64.221	62.300	61.558	67.013	9.400
Vinyl acetate	1 /14	1.000 - 1.000	L[f]	4.457	10.000	3.636	5.463[d]	22.677
Zinc	13 /14	31.700 - 128.00	N	70.814	73.650	55.140	86.489	46.767

TABLE C-9
(Continued)

NA - Not applicable.

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Distribution failed the Correlation Coefficient Test and therefore could not be definitively determined. It is treated as log-normal.

[f]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal.

TABLE C-10

SUMMARY STATISTICAL ANALYSIS - SOUTH FIELD, CHEMICAL CONSTITUENTS (RAW DATA)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef of Var (%)
2-Butanone	4 /4	1.000 - 6.000	L[e]	2.449	2.500	1.013	5.920	72.008
4-Methyl-2-pentanone	1 /1	14.000 -14.000	[c]	[c]	14.000	14.000[c]	14.000[c]	NA
Acetone	4 /4	24.000 -510.00	L[e]	179.07	310.00	34.513	929.07[d]	75.979
Aluminum	4 /4	469.00 -1180.0	L[e]	791.93	884.00	461.04[d]	1360.3[d]	42.628
Antimony	4 /4	45.400 -87.600	L[e]	62.610	63.750	42.681[d]	91.844[d]	31.945
Arsenic	1 /1	3.800 - 3.800	[c]	[c]	3.800	3.800[c]	3.800[c]	NA
Barium	4 /4	369.00 -977.00	L[e]	664.42	749.50	393.88	1120.8[d]	39.185
Beryllium	4 /4	2.200 - 3.100	L[e]	2.574	2.550	2.127[d]	3.116[d]	16.318
Boron	3 /3	169.00 -398.00	L[e]	297.89	393.00	130.20[d]	681.53[d]	40.873
Calcium	4 /4	840000 -1.92E6	L[e]	1.25E6	1.32E6	740068[d]	2.12E6[d]	42.791
Chromium	4 /4	99.700 -159.00	L[e]	128.67	133.00	98.325[d]	168.37[d]	22.320
Cobalt	2 /2	16.200 -18.300	[c]	[c]	17.250	16.200[c]	18.300[c]	8.608
Copper	4 /4	47.500 -88.300	L[e]	63.739	62.850	47.013[d]	86.417	26.309
Cyanide	3 /3	2.000 - 8.200	L[e]	3.354	2.300	0.904[d]	12.437[d]	83.909
Iron	4 /4	68.900 -88.000	L[e]	79.349	81.050	69.179	91.015[d]	11.464
Magnesium	4 /4	470.00 -2890.0	L[e]	903.36	753.00	329.27[d]	2478.4	94.217
Manganese	4 /4	12.600 -17.300	L[e]	14.714	14.800	12.039[d]	17.984[d]	16.948

TABLE C-10
(Continued)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef of Var (%)
Methylene Chloride	4 /4	24.000 -46.000	L[e]	34.095	35.000	24.865	46.751[d]	25.767
Molybdenum	4 /4	17.200 -35.100	L[e]	23.660	23.450	15.595[d]	35.897[d]	35.237
Nickel	2 /2	31.700 -32.800	[c]	[c]	32.250	31.700[c]	32.800[c]	2.412
Potassium	4 /4	61700 - 79900	L[e]	69166	68250	60275[d]	79370	11.841
Silicon	3 /3	1570.0 - 17100	L[e]	6739.1	11400	781.65[d]	58102[d]	78.377
Silver	4 /4	79.400 -103.00	L[e]	90.048	90.300	76.005[d]	106.69[d]	14.343
Sodium	2 /2	28700 - 92500	[c]	[c]	60600	28700[c]	92500[c]	74.445
Vanadium	4 /4	44.500 -87.800	L[e]	59.855	58.850	40.160[d]	89.208[d]	33.906
Zinc	3 /4	27.900 -97.600	L[e]	28.016	59.200	3.746[d]	209.53[d]	85.638

NA - Not applicable

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal.

TABLE C-11

SUMMARY STATISTICAL ANALYSIS - SOLID WASTE LANDFILL, RADIOLOGICAL CONSTITUENTS (RAW DATA)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef of Var. (%)
Gross beta	8 /10	37.100 -93.500	L	46.930	47.500	15.014[c]	305.57[d]	61.863
Ra-228	2 /9	14.300 -41.300	L[d]	5.834	7.900	3.369[c]	10.100	134.50
Th-Total	1 /10	9.420 - 9.420	L[d]	3.630	7.500	2.627[c]	5.017	52.276
U-239/240	2 /10	1.320 - 2.090	L[d]	0.657	1.000	0.489[c]	0.884	70.074

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[d]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal

3411

TABLE C-12

SUMMARY STATISTICAL ANALYSIS - LIME SLUDGE PONDS RADIOLOGICAL CONSTITUENT (RAW DATA)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Meadian (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef of Var. (%)
Gross alpha	2 /12	59.600 -66.400	L[d]	26.123	58.000	18.116[d]	37.669	61.335
Gross beta	11 /12	59.500 -105.00	N	75.333	77.500	64.722	85.945	27.171
Th-Total[e]	1 /5	20.200 -20.200	L[d]	7.680	16.800	2.607[c]	22.626[c]	89.599
U-239/240	2 /12	1.720 - 4.730	L[d]	0.668	1.000	0.462[c]	0.966	129.93
U-Total[e]	1 /12	1.690 - 1.690	L[d]	0.553	1.000	0.461[c]	0.664	57.334

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[d]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal

[e]All Values for U-Total and Th-Total are reported in (µg/L).

342

3527

TABLE C-13

SUMMARY STATISTICAL ANALYSIS - SOUTH FIELD, RADIOLOGICAL CONSTITUENTS (RAW DATA)

Chemicals	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef of Var. (%)
Gross beta	3 /4	58.700 -69.800	L[d]	47.553	60.550	23.979[c]	94.301[c]	42.294
Th-Total	1 /4	1.590 - 1.590	L[d]	1.888	3.700	1.461[c]	2.441[c]	21.844

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[d]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It
is treated as log-normal.

TABLE C-14

SUMMARY STATISTICAL ANALYSIS SOLID WASTE LANDFILL, CHEMICAL CONSTITUENTS
(SPIKE CORRECTED DATA)

Chemical	Frequency of Detection	Range of Detection ($\mu g/L$)	Dist[a]	Mean[b] ($\mu g/L$)	Median ($\mu g/L$)	Lower 95 % CI on Mean ($\mu g/L$)	Upper 95% CI on Mean ($\mu g/L$)	Coef. of Var. (%)
1,1,1-Trichloroethane	1 /1	8.000 - 8.000	[c]	[c]	8.000	8.000c	8.000c	NA
1,1-Dichloroethane	1 /1	2.000 - 2.000	[c]	[c]	2.000	2.000c	2.000c	NA
2-Butanone	6 /6	5.400 -10.800	L[f]	6.938	6.750	5.448	8.837	30.619
2-Hexanone	4 /4	1.000 - 3.000	L[f]	2.060	2.500	1.119	3.790[d]	42.552
4-Methyl-2-pentanone	7 /7	1.000 - 16.000	L	5.571	2.000	1.203	28.241[d]	111.06
Acetone	15 /15	18.000 - 660.00	L[e]	209.53	160.00	127.89	415.69	72.669
Acetoneg	14 /14	18.000 - 340.00	N	177.36	160.00	134.38	220.33	51.194
Arsenic	5 /5	1.943 - 10.268	L[f]	4.655	4.163	2.545	8.512	59.868
Barium	9 /9	219.95 - 759.33	N	526.97	534.95	437.46	616.48	27.404
Chromium	9 /9	102.07 - 242.75	L	159.47	150.17	129.05	198.94	30.625
Methylene Chloride	15 /15	28.000 - 330.00	N	158.20	180.00	111.87	204.53	64.401
Selenium	1 /1	2.016 - 2.016	[c]	[c]	2.016	2.016c	2.016c	NA
Silver	9 /9	61.803 - 108.37	N	84.835	82.833	74.301	95.370	20.033
Toluene	2 /15	1.000 - 1.000	L[f]	2.212	5.000	1.911	2.562[d]	22.948

TABLE C14
(Continued)

NA - Not applicable.

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Distribution failed the Correlation Coefficient Test and therefore could not be definitively determined. It is treated as log-normal.

[f]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal.

[g]Statistics for constituent with outliers rejected.

TABLE C-15

SUMMARY STATISTICAL ANALYSIS- LIME SLUDGE PONDS, CHEMICAL CONSTITUENTS
(SPIKE CORRECTED DATA)

Chemical	Frequency of Detection	Range of Detection ($\mu g/L$)	Dist[a]	Mean[b] ($\mu g/L$)	Median ($\mu g/L$)	Lower 95% CI on Mean ($\mu g/L$)	Upper 95% CI on Mean ($\mu g/L$)	Coef. of Var. (%)
2-Butanone	14 /14	2.700 - 24.300	N	14.464	17.550	11.154	17.774	48.349
2-Hexanone	4 /4	1.000 - 1.000	L[f]	1.000	1.000	1.000	1.000	0.000
4-Methyl-2-pentanone	12 /12	2.000 - 12.000	L[e]	9.250	9.500	7.068	13.168[d]	28.834
Acetone	14 /14	100.00 - 760.00	L[e]	237.14	170.00	165.01	325.65	76.825
Arsenic	1 /1	8.230 - 8.230	[c]	[c]	8.230	8.230[c]	8.230[c]	NA
Barium	14 /14	831.72 - 1380.1	L	1087.5	1057.5	1005.4	1178.1	15.994
Carbon disulfide	1 /1	1.000 - 1.000	[c]	[c]	1.000	1.000[c]	1.000[c]	NA
Chloroform	1 /1	3.000 - 3.000	[c]	[c]	3.000	3.000[c]	3.000[c]	NA
Chromium	14 /14	144.35 - 215.48	L[e]	162.58	154.81	153.08	172.73	13.369
Lead	1 /1	3.704 - 3.704	[c]	[c]	3.704	3.704[c]	3.704[c]	NA
Methylene chloride	14 /14	30.000 - 120.00	L	56.286	52.000	43.023	74.125	50.461
Selenium	1 /1	10.244 - 10.244	[c]	[c]	10.244	10.244[c]	10.244[c]	NA
Silver	14 /14	100.10 - 109.11	L	103.46	103.10	102.22	104.72	2.506
Toluene	3 /14	1.000 - 1.000	L[f]	2.054	5.000	1.708	2.471[d]	29.318
Vinyl acetate	1 /14	1.000 - 1.000	L[f]	4.457	10.000	3.636	5.463[d]	22.677

TABLE C-15
(Continued)

NA - Not applicable.

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Distribution failed the Correlation Coefficient Test and therefore could not be definitively determined. It is treated as log-normal.

[f]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal.

TABLE C-16

SUMMARY STATISTICAL ANALYSIS - SOUTH FIELD, (SPIKE AND DILUTION CORRECTED DATA)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Meadian (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef of Var. (%)
2-Butanone	4 /4	2.700 -16.200	L[e]	6.614	6.750	2.736	15.984	72.008
4-Methyl-2-pentanone	1 /1	14.000 -14.000	[c]	[c]	14.000	14.000[d]	14.000[c]	NA
Acetone	4 /4	24.000 -510.00	L[e]	179.07	310.00	34.513	929.07[d]	75.979
Arsenic	1 /1	3.532 - 3.532	[c]	[c]	3.532	3.532[d]	3.532[c]	NA
Barium	4 /4	375.38 -993.90	L[e]	675.91	762.46	400.69	1140.2[d]	39.185
Chromium	4 /4	115.22 -183.74	L[e]	148.69	153.70	113.63[d]	194.57[d]	22.320
Methylene Chloride	4 /4	24.000 -46.000	L[e]	34.095	35.000	24.865	46.751[d]	25.767
Silver	4 /4	91.757 -119.03	L[e]	104.06	104.35	87.833[d]	123.29[d]	14.343

NA - Not Applicable

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal.

TABLE C-17

SUMMARY STATISTICAL ANALYSIS-SOLID WASTE LANDFILL, CHEMICAL CONSTITUENTS
(SPIKE AND DILUTION CORRECTED DATA)

Chemical	Frequency of Detection	Range of Detection ($\mu g/L$)	Dist[a]	Mean[b] ($\mu g/L$)	Median ($\mu g/L$)	Lower 95% CI on Mean ($\mu g/L$)	Upper 95% CI on Mean ($\mu g/L$)	Coef. of Var. (%)
1,1,1-Trichloroethane	1 /1	15.200 - 15.200	[c]	[c]	15.200	15.200[c]	15.200[c]	NA
1,1-Dichloroethane	1 /1	3.800 - 3.800	[c]	[c]	3.800	3.800[c]	3.800[c]	NA
2-Butanone	6 /6	10.300 - 19.300	L[e]	13.156	12.800	10.811	16.010	25.174
2-Hexanone	4 /4	1.780 - 6.100	L[e]	3.722	4.225	1.998	6.932[d]	44.212
4-Methyl-2-pentanone	7 /7	1.600 - 30.400	L	10.700	4.100	2.116	61.325[d]	114.89
Acetone	15 /15	37.000 - 1254.0	L	381.60	328.00	241.15	711.34	74.691
Acetone[f]	14 /14	37.000 - 612.00	N	319.29	316.00	244.81	393.76	49.281
Arsenic	5 /5	3.497 - 19.510	L[e]	8.116	7.206	4.405	14.952	64.809
Barium	9 /9	417.91 - 1544.0	N	963.10	962.92	776.47	1149.7	31.263
Benzoic acid	1 /15	16.000 - 16.000	L[e]	24.267	50.000	23.028	25.573[d]	9.524
Bis(2-ethylhexyl)phthalate	3 /3	9.500 - 16.200	L[e]	13.504	16.000	8.080[d]	22.567[d]	27.423
Chromium	9 /9	183.73 - 436.96	L	288.00	273.01	236.83	352.97	28.565
Di-n-butylphthalate	1 /1	672.00 - 672.00	[c]	[c]	672.00	672.00[c]	672.00[c]	NA
Methylene chloride	15 /15	53.000 - 627.00	N	288.80	279.00	201.21	376.39	66.690
Phenol	1 /15	8.900 - 8.900	L[e]	5.196	10.000	4.856[d]	5.560	19.144
Selenium	1 /1	3.831 - 3.831	[c]	[c]	3.831	3.831[c]	3.831[c]	NA

TABLE C-17
(Continued)

Chemical	Frequency of Detection	Range of Detection ($\mu g/L$)	Dist[a]	Mean[b] ($\mu g/L$)	Median ($\mu g/L$)	Lower 95% CI on Mean ($\mu g/L$)	Upper 95% CI on Mean ($\mu g/L$)	Coef. of Var. (%)
Silver	9 /9	114.33 - 195.06	N	153.81	155.71	135.84	171.79	18.854
Toluene	2 /15	1.600 - 1.900	L[e]	2.383	5.000	2.245	2.529[d]	11.247

NA - Not applicable.

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal

[f]Statistics for constituent with outliers rejected.

TABLE C-18

SUMMARY STATISTICAL ANALYSIS - LIME SLUDGE PONDS, CHEMICAL CONSTITUENTS (SKIKE, AND DILUTION CORRECTED DATA)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef. of Var. (%)
2-Butanone	14 /14	4.300 -38.900	N	24.764	29.800	19.430	30.098	45.508
2-Hexanone	4 /4	1.550 - 1.850	L[f]	1.661	1.630	1.519[d]	1.817	7.808
4-Chloro-3-methylphenol	1 /1	9.500 - 9.500	[c]	[c]	9.500	9.500[c]	9.500[c]	NA
4-Methyl-2-pentanone	12 /12	4.200 -19.800	L[e]	15.650	16.900	12.541	20.683[d]	25.285
Acetone	14 /14	210.00 -1446.0	L[e]	416.64	276.50	286.56	570.39	81.830
Arsenic	1 /1	13.223 -13.223	[c]	[c]	13.223	13.223[c]	13.223[c]	NA
Barium	14 /14	1530.0 -2625.5	L	1889.4	1742.7	1747.5	2044.6	16.442
Benzoic acid	10 /14	7.400 -115.00	L[e]	25.371	19.450	15.802	37.334	105.33
Benzoic acid[g]	9 /13	7.400 -29.400	N	18.477	14.800	14.886	22.068	39.314
Carbon disulfide	1 /1	1.850 - 1.850	[c]	[c]	1.850	1.850[c]	1.850[c]	NA
Chloroform	1 /1	5.400 - 5.400	[c]	[c]	5.400	5.400[c]	5.400[c]	NA
Chromium	14 /14	223.90 -406.38	L	285.50	263.18	259.05	314.94	20.839
Lead	1 /1	5.951 - 5.951	[c]	[c]	5.951	5.951[c]	5.951[c]	NA
Methylene Chloride	14 /14	47.000 -216.00	L	101.29	92.000	74.507	139.48	56.864
Phenol	3 /14	7.200 - 9.500	L[f]	5.556	10.000	5.015[d]	6.156	25.488
Selenium	1 /1	16.459 -16.459	[c]	[c]	16.459	16.459[c]	16.459[c]	NA
Silver	14 /14	156.77 -212.31	L	180.51	175.87	172.06	189.49	10.014

TABLE C-18
(Continued)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Median (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef. of Var. (%)
Toluene	3 /14	1.550 - 1.610	L[f]	2.263	5.000	2.060	2.485[d]	17.223
Vinyl acetate	1 /14	1.850 - 1.850	L[f]	4.657	10.000	4.107	25.281[d]	17.631

NA - Not applicable.

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Distribution failed the Correlation Coefficient Test and therefore could not be definitively determined. It is treated as log-normal.

[f]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal.

[g]Statistics for constituent with outliers rejected.

TABLE C-19

SUMMARY STATISTICAL ANALYSIS, SOUTH FIELD, CHEMICAL CONSTITUENTS (SPIKE AND DILUTION CORRECTED DATA)

Chemical	Frequency of Detection	Range of Detection (µg/L)	Dist[a]	Mean[b] (µg/L)	Meadian (µg/L)	Lower 95% CI on Mean (µg/L)	Upper 95% CI on Mean (µg/L)	Coef of Var. (%)
2-Butanone	4 /4	5.700 -29.200	L[e]	12.989	13.200	5.860	28.787	65.325
4-Methyl-2-pentanone	1 /1	29.400 -29.400	[c]	[c]	29.400	29.400[c]	29.400[c]	NA
Acetone	4 /4	50.000 -944.00	L[e]	349.89	588.00	72.191	1695.8[d]	72.521
Arsenic	1 /1	7.416 - 7.416	[c]	[c]	7.416	7.416[c]	7.416[c]	NA
Barium	4 /4	788.30 -2087.2	L[e]	1323.2	1395.2	793.55	2206.2[d]	41.016
Chromium	4 /4	241.58 -385.86	L[e]	291.07	280.11	222.51[d]	380.77	23.374
Methylene Chloride	4 /4	50.000 -83.000	L[e]	66.657	69.000	51.944	85.538[d]	20.144
Silver	4 /4	169.75 -249.96	L[e]	203.71	201.63	168.32[d]	246.54	16.429

NA - Not applicable

[a]Distribution: N = Normal; L = Lognormal.

[b]If the distribution is normal or if the distribution is log-normal, the number of detects ≥7, and frequency of detection ≥50%, an arithmetic mean is given. If the distribution is log-normal and either the number of detects <7 or the frequency of detection is <50%, a geometric mean is given.

[c]Not applicable if sample size ≤2.

[d]Note that the upper or lower 95% CI on the mean exceeds the maximum or minimum detected concentration.

[e]Data set contains fewer than seven observations or more than 50% nondetects, therefore the distribution could not be definitively determined. It is treated as log-normal.

APPENDIX D

APPENDIX D - TABLE OF CONTENTS

3527

Table D-1 Leachate Action Levels

Table D-2 Inorganic TCLP Comparison to Leachate Action Levels and TCLP Regulatory Levels

Table D-3 Comparison of Radiation Results to Leachate Action Levels

Table D-4 Comparison of Volatile Organic TCLP Results to Leachate Action Levels

Table D-5 Semivolatile Organic TCLP Results Compared to Leachate Action Levels

354

TABLE D-1
LEACHATE ACTION LEVELS

Site: Fernald Environmental Management Project
Location: Fernald, Ohio
Medium: Leachate

Transport Routes: Land Use: Resident Farmer
Leaching to Groundwater

Chemical	Risk-Based Action Levels[a]			ARAR-Based Action Levels[a]		Other Considerations	
	HI=0.20 RfD-Based Action Levels[b]	10-5 CSF-Based Action Levels[c]	10-6 CSF-Based Action Levels[c]	MCL-Based Limit[d]	TCLP Regulatory Limit[e]	Background Concentration[f]	Contract Required Detection Limit[g]
RADIONUCLIDES (pCi/L)							
Ac-227		70	7				
Cs-137		700	70	10200			102
Pb-210		40	4	100			
Np-237		90	9	100			1
Pa-231		200	20				
Pu-238		90	9	200			2
Pu-239		90	9	200			
Pu-240		90	9	200			
Pu-239/240		90	9	200			2
Ra-226		200	20	2000 (P)			5
Ra-228		200	20	2000 (P)		<3	5
Rn-220							
Rn-222		15000	1500	30000			
Sr-90		600	60	800			8
Tc-99		16000	1600	91400			914
Th-228		900	90	1400		<1	14

TABLE D-1
(Continued)

Chemical	Risk-Based Action Levels[a]			ARAR-Based Action Levels[a]		Other Considerations	
	HI=0.20 RfD-Based Action Levels[b]	10-5 CSF-Based Action Levels[c]	10-6 CSF-Based Action Levels[c]	MCL-Based Limit[d]	TCLP Regulatory Limit[e]	Background Concentration[f]	Contract Required Detection Limit[g]
Th-230		1200	120	1000		<1	10
Th-232		1300	130	200			2
U-234		1000	100			<1	
U-235		1000	100				
U-238		1000	100	700(P)		<1	
INORGANICS (mg/L)							
Aluminum						0.14	0.2
Antimony	0.3						0.06
Arsenic	0.7			5	5	0.39	0.01
Barium	40			200	100	1.0	0.2
Beryllium	4	0.01	0.001	0.1(P)		0.001	0.005
Boron	70						
Cadmium	0.4			0.5	1	0.003	0.005
Chromium	4			10	5	0.039	0.01
Cobalt	2						0.05
Copper							0.025
Iron						4.1	0.1
Lead	0.5			0.5	5	0.051	0.005

TABLE D-1
(Continued)

Chemical	Risk-Based Action Levels[a]			ARAR-Based Action Levels[a]		Other Considerations	
	HI=0.20 RfD-Based Action Levels[b]	10-5 CSF-Based Action Levels[c]	10-6 CSF-Based Action Levels[c]	MCL-Based Limit[d]	TCLP Regulatory Limit[e]	Background Concentration[f]	Contract Required Detection Limit[g]
Magnesium						47	5
Manganese	70					0.27	0.015
Mercury	0.2			0.2	0.2		0.0002
Molybdenum	3					0.014	
Nickel	20						0.04
Selenium	4			5	1		0.005
Silver	2			5	5		0.01
Thallium	0.1						0.01
Uranium	2			2			
Vanadium	5					0.02	0.05
Zinc	150					0.045	0.02
Cyanide	20			20(P)			0.01
ORGANICS (mg/L)							
1,1,2-Trichloro-1,2,2-trifluoroethane	2200						
1,1,2,2-Tetrachloroethane		0.2	0.02				0.005
1,1,1-Trichloroethane	70			20			0.005
1,1-Dichloroethane	70						0.005

TABLE D-1
(Continued)

Chemical	Risk-Based Action Levels[a]			ARAR-Based Action Levels[a]		Other Considerations	
	HI=0.20 RfD-Based Action Levels[b]	10-5 CSF-Base d Action Levels[c]	10-6 CSF-Base d Action Levels[c]	MCL-Based Limit[d]	TCLP Regulatory Limit[e]	Background Concentratio n[f]	Contract Required Detection Limit[g]
1,1-Dichloroethene	7	0.06	0.01	0.7	0.7		0.005
1,2-Dichloroethane		0.4	0.04	0.5	0.5		0.005
1,2-cis-Dichloroethene	7			7			
1,2-trans-Dichloroethene	20			10			0.005
2,4-Dimethylphenol	20						0.01
2-Butanone	40				200		0.01
2-Methylnaphthalene							0.01
2-Methylphenol							0.01
4-Methyl-2-pentanone	40						0.01
4-Methylphenol							0.01
Acenaphthene	40						0.01
Acetone	70						0.01
Anthracene	220						0.01
Aroclor-1242		0.005	0.0005	0.05			0.0005
Aroclor-1248		0.005	0.0005	0.05			0.0005
Aroclor-1254		0.005	0.0005	0.05			0.001
Aroclor-1260		0.005	0.0005	0.05			0.001
Benzene		1.30	0.13	0.5			0.005
Benzo(a)anthracene[h]							0.01
Benzo(a)pyrene		0.003	0.0003				0.01

TABLE D-1
(Continued)

Chemical	Risk-Based Action Levels[a]			ARAR-Based Action Levels[a]		Other Considerations	
	HI=0.20 RfD-Based Action Levels[b]	10-5 CSF-Based Action Levels[c]	10-6 CSF-Based Action Levels[c]	MCL-Based Limit[d]	TCLP Regulatory Limit[e]	Background Concentration[f]	Contract Required Detection Limit[g]
Benzo(b)fluoranthene[h]							0.01
Benzo(g,h,i)perylene[h]							0.01
Benzo(k)fluoranthene[h]							0.01
Benzoic Acid	3000						0.05
Benzyl Alcohol	220						0.01
Bis(2-ethylhexyl)phthalate	20	3	0.3			0.015	0.01
Butyl benzyl phthalate	150						0.01
Carbon Disulfide	70						0.005
Carbon Tetrachloride	0.5	0.3	0.03	0.5	0.5		0.005
Chlordane	0.04	0.03	0.003	0.2	0.03		0.0005
Chlorobenzene	20				100		0.005
Chloroethane							0.01
Chloroform	7	6	0.60	10	6		0.005
Chrysene[h]							0.01
DDT	0.4	0.1	0.01				0.0001
Di-n-butyl Phthalate	70						0.01
Di-n-octyl Phthalate	20						0.01
Dibenzo(a,h)anthracene[h]							0.01
Dibenzofuran							0.01

TABLE D-1
(Continued)

Chemical	Risk-Based Action Levels[a]			ARAR-Based Action Levels[a]		Other Considerations	
	HI=0.20 RfD-Based Action Levels[b]	10-5 CSF-Based Action Levels[c]	10-6 CSF-Based Action Levels[c]	MCL-Based Limit[d]	TCLP Regulatory Limit[e]	Background Concentration[f]	Contract Required Detection Limit[g]
Ethyl Parathion							0.0001
Ethylbenzene	7			70			0.005
Fluoranthene	30						0.01
Fluorene	30						0.01
beta-Hexachlorocyclohexane		0.02	0.002				0.00005
Indeno(1,2,3-cd)pyrene[h]							0.01
Methyl Parathion	2						
Methylene Chloride	40	5	0.5			0.018	0.005
N-nitrosodiphenylamine		7	0.7			0.013	0.01
Naphthalene	3						0.01
Pentachlorophenol	20	0.30	0.03	0.1	100		0.05
Phenanthrene							0.01
Phenol	440						0.01
Pyrene	20						0.01
Tetrachloroethene	7	0.7	0.07	0.5	0.7		0.005
Toluene	150			100			0.005
Trichloroethene		3	0.3	0.5	0.5		0.005
Vinyl Chloride		0.02	0.002	0.2	0.2		0.01
Xylenes (total)	1500			1000			0.005

TABLE D-1
(Continued)

(a) Leadchate action levels are developed based on the potential for chemicals in those zones to leach into the bedrock aquifer or a receiving surface water body, thus equating water in the shallow zones to "leachate." Leachate is regulated by the U.S. EPA under 40CFR261 with the use of the toxicity characteristic leaching procedure (TCLP). TCLP regulatory levels are based on the acceptable drinking water concentrations multiplied by a dilution attenuation factor (DAF), which accounts for the degree of attenuation and dilution that a compound is expected to undergo during transport to the drinking water aquifer or receiving stream (U.S. EPA 1986c; 51FR21650).

(b) Based on a Hazard Index-based groundwater preliminary remediation goal and a DAF of 100. Blank spaces in the table indicate information is not available to determine a value.

(c) Based on cancer risk-based groundwater preliminary remediation goal and a DAF of 100.

(d) Based on MCL times DAF of 100.

(e) From 40CFR261, 55FR11798.

(f) In most cases, concentrations represent upper 95% tolerance level from background concentrations found in the Shandon Flow at the FEMP. In cases where data were not available to calculate UTL, mean value is reported.

(g) From CLP Statement of Work, U.S. EPA OLM01.08.

(h) Risk-based level developed using cancer slope factor for benzo(a)pyrene.

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Reagents				Clean Sand						
FEMP Sample No.		none	none	none	none	75209	75209	75209	75209	75209	75209	75209
Treat. Sample No.		10162301	10162302	10162306	10162307	10312613	10312813	10313013	10313213	10313413	10313613	10313813
Sample ID/Run No.		PC Type I	PC Type II	Comm. Flyash	Attap. & Clinopt.	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7
Percent of Raw Data to HI=0.20 Leachate Action Levels	Al	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sb	38	34	13	75	28	37	36	29	28	31	28
	As	U	U	7.9	0.7	U	U	U	U	U	U	U
	Ba	2.4	3.2	2.0	1.8	2.5	1.8	1.6	1.7	2.3	1.4	2.2
	Be	0.09	0.09	0.25	0.07	0.08	0.09	0.08	0.08	0.08	0.08	0.08
	Cd	U	U	1	21	U	U	U	U	U	U	U
	Ca	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cr	11	12	8	2	4	6	6	6	5	6	5
	Co	1.2	1.1	1.6	1.6	0.8	1.2	1.1	0.7	0.7	0.8	0.8
	Cu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pb	U	U	1.4	0.4	U	U	U	U	U	U	U
	Mg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mn	0.03	0.03	0.19	4.34	0.02	0.12	0.11	0.02	0.02	0.02	0.02
	Hg	U	U	U	U	U	U	U	U	U	U	U
	Ni	0.2	0.2	0.5	0.5	U	0.5	0.5	U	0.1	U	U
	K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Se	U	U	U	U	U	U	U	U	U	U	U
	Ag	5.9	5.7	0.7	4.3	5.0	4.9	4.8	5.0	5.0	5.1	5.0
	Na	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tl	U	U	9	U	U	U	U	U	U	U	U
	V	1.6	1.5	2.1	1.6	1.2	1.4	1.3	1.2	1.3	1.6	1.3
	Zn	0.007	0.075	0.203	0.207	0.065	0.108	0.084	0.036	0.060	0.052	0.015
	CN	U	0.03	0.01	U	U	U	U	U	U	U	U
	Mo	2.6	2.7	6.1	1.9	0.8	0.9	1.0	0.9	0.7	1.0	0.8
	B	1.2	1.2	2.3	1.0	0.3	0.9	0.8	0.3	0.4	0.7	0.3
	Si	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent of Raw Data to E-5 Leachate Action Levels	Be	34	34	99	26	33	35	32	33	32	33	33
Percent of Raw Data to E-6 Leachate Action Levels	Be	340.000	340.000	990.000	260.000	330.000	350.000	320.000	330.000	320.000	330.000	330.000

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits Page 2

		Reagents				Clean Sand						
FEMP Sample No.		none	none	none	none	75209	75209	75209	75209	75209	75209	75209
Treat. Sample No.		10162301	10162302	10162306	10162307	10312613	10312813	10313013	10313213	10313413	10313613	10313813
Sample ID/Run No.		PC Type I	PC Type II	Comm. Flyash	Attap. & Clinopt.	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7
Percent of Raw Data to TC Regulatory Limit	Al	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	As	U	U	1.11	0.09	U	U	U	U	U	U	U
	Ba	0.9	1.2	0.8	0.7	0.9	0.7	0.6	0.6	0.9	0.5	0.8
	Be	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cd	U	U	0.6	8.5	U	U	U	U	U	U	U
	Ca	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cr	8	9	6	2	3	5	4	4	4	5	4
	Co	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pb	U	U	0.14	0.04	U	U	U	U	U	U	U
	Mg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Hg	U	U	U	U	U	U	U	U	U	U	U
	Ni	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Se	U	U	U	U	U	U	U	U	U	U	U
	Ag	2.4	2.3	0.3	1.7	2.0	1.9	1.9	2.0	2.0	2.0	2.0
	Na	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tl	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	V	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Zn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Si	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table D–2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Reagents				Clean Sand						
FEMP Sample No.		none	none	none	none	75209	75209	75209	75209	75209	75209	75209
Treat. Sample No.		10162301	10162302	10162306	10162307	10312613	10312813	10313013	10313213	10313413	10313613	10313813
Sample ID/Run No.		PC Type I	PC Type II	Comm. Flyash	Attap. & Clinopt.	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7
Percent of Matrix Spike Corrected Data to HI=0.20 Leachate Action Levels	Ba	U	U	U	U	U	U	U	U	U	U	U
	Cd	U	U	U	U	U	U	U	U	U	U	U
	Cr	U	U	U	U	U	U	U	U	U	U	U
	Pb	U	U	U	U	U	U	U	U	U	U	U
	Ag	U	U	U	U	U	U	U	U	U	U	U
	As	U	U	U	U	U	U	U	U	U	U	U
	Se	U	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Ba	U	U	U	U	U	U	U	U	U	U	U
	Cd	U	U	U	U	U	U	U	U	U	U	U
	Cr	U	U	U	U	U	U	U	U	U	U	U
	Pb	U	U	U	U	U	U	U	U	U	U	U
	Ag	U	U	U	U	U	U	U	U	U	U	U
	As	U	U	U	U	U	U	U	U	U	U	U
	Se	U	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike Corrected Data to TC Regulatory Limits	Ba	U	U	U	U	U	U	U	U	U	U	U
	Cd	U	U	U	U	U	U	U	U	U	U	U
	Cr	U	U	U	U	U	U	U	U	U	U	U
	Pb	U	U	U	U	U	U	U	U	U	U	U
	Ag	U	U	U	U	U	U	U	U	U	U	U
	As	U	U	U	U	U	U	U	U	U	U	U
	Se	U	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data TC Regulatory Limits	Ba	U	U	U	U	U	U	U	U	U	U	U
	Cd	U	U	U	U	U	U	U	U	U	U	U
	Cr	U	U	U	U	U	U	U	U	U	U	U
	Pb	U	U	U	U	U	U	U	U	U	U	U
	Ag	U	U	U	U	U	U	U	U	U	U	U
	As	U	U	U	U	U	U	U	U	U	U	U
	Se	U	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Solid Waste Landfill									
FEMP Sample No.		75201	75201	75201	75201	75201	75201	75201	75201	75201	75201
Treat. Sample No.		10162413	10162513	10162613	10312013	10162713	10162813	10162913	10163013	10312213	10163213
Sample ID/Run No.		Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D	Run 8
Percent of Raw Data to HI=0.20 Leachate Action Levels	Al	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sb	U	11	18	11	38	26	11	45	15	31
	As	U	0.3	1.6	0.6	1.1	0.6	U	0.9	U	0.4
	Ba	1.3	1.2	1.2	0.5	1.6	1.2	1.9	1.5	1.4	1.3
	Be	U	U	U	U	0.06	0.05	U	0.08	0.05	0.08
	Cd	U	U	U	U	U	U	U	U	U	U
	Ca	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cr	3	2	3	3	4	4	3	4	4	5
	Co	U	U	U	U	U	U	U	0.9	U	0.7
	Cu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pb	U	U	U	U	U	U	U	U	U	U
	Mg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mn	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02
	Hg	U	U	U	U	U	U	U	U	U	U
	Ni	U	U	U	U	0.1	U	U	0.2	U	0.2
	K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Se	U	U	0.06	U	U	U	U	U	U	U
	Ag	2.9	3.0	3.6	2.9	4.5	4.1	3.7	5.1	3.9	5.0
	Na	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tl	U	U	U	U	U	U	U	U	U	U
	V	0.8	1.0	1.8	1.0	2.0	1.7	0.9	2.2	0.9	1.8
	Zn	0.085	0.005	0.090	0.013	0.080	0.078	0.095	0.067	0.051	U
	CN	U	0.05	U	0.02	U	0.01	U	U	0.03	U
	Mo	1.0	1.0	1.1	1.2	1.4	1.2	0.7	1.6	0.8	1.2
	B	U	U	U	U	U	U	U	U	U	U
	Si	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent of Raw Data to E-5 Leachate Action Levels	Be	U	U	U	U	25	21	U	32	21	31
Percent of Raw Data to E-6 Leachate Action Levels	Be	U	U	U	U	250.000	210.000	U	320.000	210.000	310.000

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Solid Waste Landfill									
FEMP Sample No.		75201	75201	75201	75201	75201	75201	75201	75201	75201	75201
Treat. Sample No.		10162413	10162513	10162613	10312013	10162713	10162813	10162913	10163013	10312213	10163213
Sample ID/Run No.		Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D	Run 8
Percent of Raw Data to TC Regulatory Limit	Al	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	As	U	0.04	0.22	0.08	0.15	0.09	U	0.12	U	0.05
	Ba	0.5	0.4	0.5	0.2	0.6	0.4	0.7	0.6	0.5	0.5
	Be	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cd	U	U	U	U	U	U	U	U	U	U
	Ca	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cr	2	2	2	2	3	3	2	3	3	4
	Co	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pb	U	U	U	U	U	U	U	U	U	U
	Mg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Hg	U	U	U	U	U	U	U	U	U	U
	Ni	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Se	U	U	0.2	U	U	U	U	U	U	U
	Ag	1.1	1.2	1.4	1.2	1.8	1.6	1.5	2.0	1.5	2.0
	Na	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tl	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	V	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Zn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Si	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits Page 6

		Solid Waste Landfill									
FEMP Sample No.		75201	75201	75201	75201	75201	75201	75201	75201	75201	75201
Treat. Sample No.		10162413	10162513	10162613	10312013	10162713	10162813	10162913	10163013	10312213	10163213
Sample ID/Run No.		Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D	Run 8
Percent of Matrix Spike Corrected Data to HI=0.20 Leachate Action Levels	Ba	1.5	1.3	1.4	0.6	1.8	1.3	2.1	1.7	1.5	1.5
	Cd	U	U	U	U	U	U	U	U	U	U
	Cr	5	5	6	5	8	8	6	8	7	10
	Pb	U	U	U	U	U	U	U	U	U	U
	Ag	15	15	18	15	23	21	19	26	20	26
	As	U	0.3	1.5	0.6	1.0	0.6	U	0.8	U	0.4
	Se	U	U	0.05	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Ba	2.7	2.4	2.6	1.1	2.8	2.1	4.2	3.5	3.1	2.7
	Cd	U	U	U	U	U	U	U	U	U	U
	Cr	9	9	11	10	13	13	13	17	15	19
	Pb	U	U	U	U	U	U	U	U	U	U
	Ag	27	27	35	28	37	32	38	53	40	45
	As	U	0.5	2.9	1.1	1.6	0.9	U	1.7	U	0.6
	Se	U	U	0.10	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike Corrected Data to TC Regulatory Limits	Ba	0.5	0.5	0.5	0.2	0.6	0.5	0.8	0.6	0.6	0.6
	Cd	U	U	U	U	U	U	U	U	U	U
	Cr	4	4	4	4	6	6	5	6	5	8
	Pb	U	U	U	U	U	U	U	U	U	U
	Ag	6	6	7	6	9	8	8	10	8	10
	As	U	0.04	0.21	0.08	0.14	0.09	U	0.12	U	0.05
	Se	U	U	0.2	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data TC Regulatory Limits	Ba	1.0	0.9	1.0	0.4	1.0	0.8	1.6	1.3	1.2	1.0
	Cd	U	U	U	U	U	U	U	U	U	U
	Cr	7	6	8	7	10	10	9	12	11	14
	Pb	U	U	U	U	U	U	U	U	U	U
	Ag	11	11	14	11	15	13	15	21	16	18
	As	U	0.07	0.40	0.15	0.23	0.13	U	0.24	U	0.09
	Se	U	U	0.4	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U

3527

3682

Table D–2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Solid Waste Landfill			
FEMP Sample No.		75201	75203	75203	75201
Treat. Sample No.		10163413	10166413	10166613	10312413
Sample ID/Run No.		Run 9	Run 11	Run 12	Run 12D
Percent of Raw Data to HI=0.20 Leachate Action Levels	Al	N/A	N/A	N/A	N/A
	Sb	31	20	19	15
	As	0.3	2.5	2.3	1.6
	Ba	1.3	1.1	1.1	0.4
	Be	0.08	0.06	0.06	0.05
	Cd	U	U	U	U
	Ca	N/A	N/A	N/A	N/A
	Cr	6	4	4	4
	Co	0.8	U	U	U
	Cu	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A
	Pb	U	U	U	U
	Mg	N/A	N/A	N/A	N/A
	Mn	0.02	0.02	0.02	0.02
	Hg	U	U	U	U
	Ni	0.2	U	U	U
	K	N/A	N/A	N/A	N/A
	Se	U	U	U	U
	Ag	5.1	3.7	3.7	3.6
	Na	N/A	N/A	N/A	N/A
	Tl	U	U	U	U
	V	1.9	2.2	2.0	2.1
	Zn	0.073	0.075	0.083	0.015
	CN	U	U	U	0.02
	Mo	1.3	1.3	1.3	1.2
	B	U	U	U	U
	Si	N/A	N/A	N/A	N/A
Percent of Raw Data to E–5 Leachate Action Levels	Be	32	24	24	21
Percent of Raw Data to E–6 Leachate Action Levels	Be	320.000	240.000	240.000	210.000

368

Table D–2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Solid Waste Landfill			
FEMP Sample No.		75201	75203	75203	75201
Treat. Sample No.		10163413	10166413	10166613	10312413
Sample ID/Run No.		Run 9	Run 11	Run 12	Run 12D
Percent of Raw Data to TC Regulatory Limit	Al	N/A	N/A	N/A	N/A
	Sb	N/A	N/A	N/A	N/A
	As	0.04	0.35	0.32	0.22
	Ba	0.5	0.4	0.4	0.2
	Be	N/A	N/A	N/A	N/A
	Cd	U	U	U	U
	Ca	N/A	N/A	N/A	N/A
	Cr	4	3	3	3
	Co	N/A	N/A	N/A	N/A
	Cu	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A
	Pb	U	U	U	U
	Mg	N/A	N/A	N/A	N/A
	Mn	N/A	N/A	N/A	N/A
	Hg	U	U	U	U
	Ni	N/A	N/A	N/A	N/A
	K	N/A	N/A	N/A	N/A
	Se	U	U	U	U
	Ag	2.0	1.5	1.5	1.5
	Na	N/A	N/A	N/A	N/A
	Tl	N/A	N/A	N/A	N/A
	V	N/A	N/A	N/A	N/A
	Zn	N/A	N/A	N/A	N/A
	CN	N/A	N/A	N/A	N/A
	Mo	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A
	Si	N/A	N/A	N/A	N/A

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Solid Waste Landfill			
FEMP Sample No.		75201	75203	75203	75201
Treat. Sample No.		10163413	10166413	10166613	10312413
Sample ID/Run No.		Run 9	Run 11	Run 12	Run 12D
Percent of Matrix Spike Corrected Data to HI=0.20 Leachate Action Levels	Ba	1.5	1.2	1.3	0.5
	Cd	U	U	U	U
	Cr	12	7	8	8
	Pb	U	U	U	U
	Ag	26	19	19	18
	As	0.3	2.4	2.2	1.5
	Se	U	U	U	U
	Hg	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Ba	2.6	1.8	1.9	0.7
	Cd	U	U	U	U
	Cr	21	10	12	12
	Pb	U	U	U	U
	Ag	46	28	28	28
	As	0.5	3.5	3.3	2.2
	Se	U	U	U	U
	Hg	U	U	U	U
Percent of Matrix Spike Corrected Data to TC Regulatory Limits	Ba	0.5	0.4	0.5	0.2
	Cd	U	U	U	U
	Cr	9	5	6	6
	Pb	U	U	U	U
	Ag	10	8	8	7
	As	0.04	0.33	0.31	0.21
	Se	U	U	U	U
	Hg	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data TC Regulatory Limits	Ba	1.0	0.7	0.7	0.3
	Cd	U	U	U	U
	Cr	15	8	9	9
	Pb	U	U	U	U
	Ag	19	11	11	11
	As	0.07	0.49	0.46	0.31
	Se	U	U	U	U
	Hg	U	U	U	U

370

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Lime Sludge Pond, Stage I										
FEMP Sample No.		75202	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202
Treat. Sample No.		10164413	10164613	10165013	10311413	10165213	10165413	10165613	10167013	10165813	10311613	10167213
Sample ID/Run No.		Run 2	Run 3	Run 5	Run 5D	Run 6	Run 7	Run 8	Run 9	Run 10	Run 10D	Run 13
Percent of Raw Data to HI=0.20 Leachate Action Levels	Al	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sb	37	39	27	15	27	27	27	27	36	15	30
	As	0.8	0.5	U	U	0.7	U	U	U	U	U	U
	Ba	1.2	1.2	1.5	1.9	1.6	1.3	2.2	2.1	2.0	1.0	1.9
	Be	0.08	0.08	0.07	0.05	0.08	0.08	0.08	0.08	0.07	0.05	0.08
	Cd	3	U	U	U	U	U	U	U	U	U	U
	Ca	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cr	4	4	4	3	5	5	6	5	4	4	5
	Co	1.3	1.2	0.8	0.6	0.7	0.7	1.0	0.8	1.1	0.7	0.9
	Cu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pb	U	U	U	U	U	U	U	U	U	U	U
	Mg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mn	0.08	0.40	0.02	0.02	0.02	0.02	0.02	0.02	0.52	0.02	0.02
	Hg	U	U	U	U	U	U	U	U	U	U	U
	Ni	0.3	0.4	0.1	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.2
	K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Se	U	U	U	U	U	U	U	U	U	U	U
	Ag	5.1	5.0	4.9	3.9	4.8	5.0	5.1	5.1	5.0	3.8	5.1
	Na	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tl	U	U	U	U	U	U	U	U	U	U	U
	V	1.6	1.4	1.5	0.9	1.6	1.3	1.4	1.3	1.4	1.0	1.6
	Zn	0.008	0.009	0.077	0.054	0.068	U	0.070	0.059	0.090	0.011	0.085
	CN	U	U	0.12	0.10	U	U	0.04	U	U	0.13	U
	Mo	1.8	1.6	1.3	0.8	1.4	1.2	1.1	1.0	1.9	1.2	1.1
	B	U	U	0.7	U	U	U	U	U	1.1	U	U
	Si	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent of Raw Data to E-5 Leachate Action Levels	Be	33	31	26	21	30	32	33	32	28	21	33
Percent of Raw Data to E-6 Leachate Action Levels	Be	330.000	310.000	260.000	210.000	300.000	320.000	330.000	320.000	280.000	210.000	330.000

Table D–2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Lime Sludge Pond, Stage I										
FEMP Sample No.		75202	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202
Treat. Sample No.		10164413	10164613	10165013	10311413	10165213	10165413	10165613	10167013	10165813	10311613	10167213
Sample ID/Run No.		Run 2	Run 3	Run 5	Run 5D	Run 6	Run 7	Run 8	Run 9	Run 10	Run 10D	Run 13
Percent of Raw Data to TC Regulatory Limit	Al	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	As	0.11	0.07	U	U	0.09	U	U	U	U	U	U
	Ba	0.4	0.4	0.6	0.7	0.6	0.5	0.8	0.8	0.7	0.4	0.7
	Be	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cd	1.1	U	U	U	U	U	U	U	U	U	U
	Ca	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cr	3	3	3	2	3	4	4	4	3	3	4
	Co	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pb	U	U	U	U	U	U	U	U	U	U	U
	Mg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Hg	U	U	U	U	U	U	U	U	U	U	U
	Ni	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Se	U	U	U	U	U	U	U	U	U	U	U
	Ag	2.0	2.0	2.0	1.6	1.9	2.0	2.0	2.0	2.0	1.5	2.0
	Na	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tl	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	V	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Zn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Si	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Lime Sludge Pond, Stage I										
FEMP Sample No.		75202	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202
Treat. Sample No.		10164413	10164613	10165013	10311413	10165213	10165413	10165613	10167013	10165813	10311613	10167213
Sample ID/Run No.		Run 2	Run 3	Run 5	Run 5D	Run 6	Run 7	Run 8	Run 9	Run 10	Run 10D	Run 13
Percent of Matrix Spike Corrected Data to HI=0.20 Leachate Action Levels	Ba	1.4	1.5	1.8	2.3	2.0	1.6	2.7	2.5	2.4	1.2	2.2
	Cd	2.7	U	U	U	U	U	U	U	U	U	U
	Cr	4	4	5	3	5	5	6	5	4	4	5
	Pb	U	U	U	U	U	U	U	U	U	U	U
	Ag	5	5	5	4	5	5	5	5	5	4	5
	As	0.7	0.4	U	U	0.6	U	U	U	U	U	U
	Se	U	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Ba	2.5	2.8	2.8	3.6	4.2	3.2	4.9	4.6	3.7	1.8	4.7
	Cd	5	U	U	U	U	U	U	U	U	U	U
	Cr	7	7	7	4	10	11	11	9	7	6	11
	Pb	U	U	U	U	U	U	U	U	U	U	U
	Ag	9	10	8	6	10	10	9	9	8	6	11
	As	1.2	0.8	U	U	1.2	U	U	U	U	U	U
	Se	U	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike Corrected Data to TC Regulatory Limits	Ba	0.5	0.5	0.7	0.9	0.7	0.6	1.0	0.9	0.9	0.4	0.8
	Cd	1	U	U	U	U	U	U	U	U	U	U
	Cr	3	3	3	2	4	4	4	4	3	3	4
	Pb	U	U	U	U	U	U	U	U	U	U	U
	Ag	2	2	2	2	2	2	2	2	2	2	2
	As	0.09	0.06	U	U	0.08	U	U	U	U	U	U
	Se	U	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data TC Regulatory Limits	Ba	0.9	1.0	1.1	1.3	1.5	1.2	1.8	1.7	1.4	0.7	1.7
	Cd	2	U	U	U	U	U	U	U	U	U	U
	Cr	5	5	5	3	8	8	8	7	5	4	8
	Pb	U	U	U	U	U	U	U	U	U	U	U
	Ag	4	4	3	2	4	4	4	4	3	2	4
	As	0.17	0.12	U	U	0.17	U	U	U	U	U	U
	Se	U	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U

		Lime Sludge Pond, Stage I		
FEMP Sample No.		75202	75205	75202
Treat. Sample No.		10167413	10167813	10311813
Sample ID/Run No.		Run 14	Run 16	Run 16D
Percent of Raw Data to HI=0.20 Leachate Action Levels	Al	N/A	N/A	N/A
	Sb	30	34	13
	As	U	0.3	U
	Ba	1.8	1.8	1.5
	Be	0.08	0.07	U
	Cd	U	U	U
	Ca	N/A	N/A	N/A
	Cr	5	4	4
	Co	0.8	1.2	0.6
	Cu	N/A	N/A	N/A
	Fe	N/A	N/A	N/A
	Pb	U	U	U
	Mg	N/A	N/A	N/A
	Mn	0.02	0.21	0.02
	Hg	U	U	U
	Ni	0.2	0.3	0.2
	K	N/A	N/A	N/A
	Se	U	U	U
	Ag	5.0	4.9	3.7
	Na	N/A	N/A	N/A
	Tl	U	U	U
	V	1.6	1.3	0.9
	Zn	0.081	0.080	0.032
	CN	0.02	0.09	0.02
	Mo	1.2	1.4	0.9
	B	U	0.9	U
	Si	N/A	N/A	N/A
Percent of Raw Data to E-5 Leachate Action Levels	Be	31	27	U
Percent of Raw Data to E-6 Leachate Action Levels	Be	310.000	270.000	U

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Lime Sludge Pond, Stage I		
FEMP Sample No.		75202	75205	75202
Treat. Sample No.		10167413	10167813	10311813
Sample ID/Run No.		Run 14	Run 16	Run 16D
Percent of Raw Data to TC Regulatory Limit	Al	N/A	N/A	N/A
	Sb	N/A	N/A	N/A
	As	U	0.05	U
	Ba	0.7	0.6	0.5
	Be	N/A	N/A	N/A
	Cd	U	U	U
	Ca	N/A	N/A	N/A
	Cr	4	3	3
	Co	N/A	N/A	N/A
	Cu	N/A	N/A	N/A
	Fe	N/A	N/A	N/A
	Pb	U	U	U
	Mg	N/A	N/A	N/A
	Mn	N/A	N/A	N/A
	Hg	U	U	U
	Ni	N/A	N/A	N/A
	K	N/A	N/A	N/A
	Se	U	U	U
	Ag	2.0	2.0	1.5
	Na	N/A	N/A	N/A
	Tl	N/A	N/A	N/A
	V	N/A	N/A	N/A
	Zn	N/A	N/A	N/A
	CN	N/A	N/A	N/A
	Mo	N/A	N/A	N/A
	B	N/A	N/A	N/A
	Si	N/A	N/A	N/A

		Lime Sludge Pond, Stage I		
FEMP Sample No.		75202	75205	75202
Treat. Sample No.		10167413	10167813	10311813
Sample ID/Run No.		Run 14	Run 16	Run 16D
Percent of Matrix Spike Corrected Data to HI=0.20 Leachate Action Levels	Ba	2.2	2.1	1.8
	Cd	U	U	U
	Cr	5	4	4
	Pb	U	U	U
	Ag	5	5	4
	As	U	0.3	U
	Se	U	U	U
	Hg	U	U	U
Percent of Matrix Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Ba	4.4	3.5	2.9
	Cd	U	U	U
	Cr	10	7	6
	Pb	U	U	U
	Ag	10	8	6
	As	U	0.5	U
	Se	U	U	U
	Hg	U	U	U
Percent of Matrix Spike Corrected Data to TC Regulatory Limits	Ba	0.8	0.8	0.7
	Cd	U	U	U
	Cr	4	3	3
	Pb	U	U	U
	Ag	2	2	1
	As	U	0.04	U
	Se	U	U	U
	Hg	U	U	U
Percent of Matrix Spike and Dilution Corrected Data TC Regulatory Limits	Ba	1.6	1.3	1.1
	Cd	U	U	U
	Cr	8	5	5
	Pb	U	U	U
	Ag	4	3	2
	As	U	0.07	U
	Se	U	U	U
	Hg	U	U	U

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Lime Sludge Pond, Stage II										
FEMP Sample No.		67431	67431	67431	67431	67431	67431	67431	67431	67431	67431	67431
Treat. Sample No.		10371613	10371413	10371213	10373213	10371813	10372013	10372213	10372413	10373013	10372613	10372813
Sample ID/Run No.		Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D	Run 8	Run 9
Percent of Raw Data to HI=0.20 Leachate Action Levels	Al	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sb	25	23	24	31	26	23	22	24	27	22	22
	As	U	U	U	U	U	U	U	U	1.3	U	U
	Ba	2.7	2.1	2.5	3.1	3.0	2.5	2.2	3.0	2.3	2.5	2.1
	Be	0.08	0.07	0.07	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07
	Cd	U	U	U	U	U	U	U	U	U	U	U
	Ca	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cr	4	4	4	4	4	4	4	4	4	4	4
	Co	0.9	0.7	0.7	0.8	0.9	0.8	0.7	0.7	0.8	0.7	0.7
	Cu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pb	U	U	U	U	U	U	U	U	0.7	U	U
	Mg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mn	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02
	Hg	U	U	U	U	U	U	U	U	U	U	U
	Ni	0.2	0.2	U	U	0.2	0.2	U	U	U	U	0.1
	K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Se	U	U	U	U	U	U	U	U	0.32	U	U
	Ag	5.5	5.2	5.2	5.4	5.3	5.2	5.1	5.2	5.3	5.1	5.0
	Na	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tl	U	U	U	U	U	U	U	U	13	U	U
	V	1.3	1.2	1.2	1.3	1.3	1.2	1.2	1.2	1.3	1.2	1.2
	Zn	0.024	0.049	0.034	0.065	0.063	0.043	0.057	0.038	U	0.021	0.049
	CN	0.02	U	0.02	U	U	0.03	0.03	0.02	U	0.02	0.04
	Mo	0.6	0.6	0.7	0.7	0.6	0.6	0.5	0.6	0.7	0.6	0.6
	B	0.3	0.3	0.3	U	0.3	0.3	0.3	0.3	U	0.3	0.3
	Si	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent of Raw Data to E-5 Leachate Action Levels	Be	30	27	29	30	30	29	27	27	29	27	27
Percent of Raw Data to E-6 Leachate Action Levels	Be	300.000	270.000	290.000	300.000	300.000	290.000	270.000	270.000	290.000	270.000	270.000

3527

3477

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Lime Sludge Pond, Stage II										
FEMP Sample No.		67431	67431	67431	67431	67431	67431	67431	67431	67431	67431	67431
Treat. Sample No.		10371613	10371413	10371213	10373213	10371813	10372013	10372213	10372413	10373013	10372613	10372813
Sample ID/Run No.		Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D	Run 8	Run 9
Percent of Raw Data to TC Regulatory Limit	Al	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	As	U	U	U	U	U	U	U	U	0.19	U	U
	Ba	1.0	0.8	0.9	1.1	1.1	0.9	0.8	1.1	0.8	0.9	0.8
	Be	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cd	U	U	U	U	U	U	U	U	U	U	U
	Ca	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cr	3	3	3	3	3	3	3	3	3	3	3
	Co	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pb	U	U	U	U	U	U	U	U	0.07	U	U
	Mg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Hg	U	U	U	U	U	U	U	U	U	U	U
	Ni	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Se	U	U	U	U	U	U	U	U	1.3	U	U
	Ag	2.2	2.1	2.1	2.1	2.1	2.1	2.0	2.1	2.1	2.0	2.0
	Na	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tl	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	V	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Zn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Si	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		Lime Sludge Pond, Stage II										
FEMP Sample No.		67431	67431	67431	67431	67431	67431	67431	67431	67431	67431	67431
Treat. Sample No.		10371613	10371413	10371213	10373213	10371813	10372013	10372213	10372413	10373013	10372613	10372813
Sample ID/Run No.		Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D	Run 8	Run 9
Percent of Matrix Spike Corrected Data to HI=0.20 Leachate Action Levels	Ba	3.2	2.5	3.0	3.7	3.6	3.0	2.7	3.7	2.7	3.0	2.5
	Cd	U	U	U	U	U	U	U	U	U	U	U
	Cr	4	4	4	4	4	4	4	4	4	4	4
	Pb	U	U	U	U	U	U	U	U	0.7	U	U
	Ag	5	5	5	5	5	5	5	5	5	5	5
	As	U	U	U	U	U	U	U	U	1.2	U	U
	Se	U	U	U	U	U	U	U	U	0.26	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Ba	6.0	4.6	5.7	7.1	5.8	4.7	4.4	5.9	4.4	4.7	4.1
	Cd	U	U	U	U	U	U	U	U	U	U	U
	Cr	8	7	8	8	6	6	7	6	7	6	7
	Pb	U	U	U	U	U	U	U	U	1.2	U	U
	Ag	10	9	10	10	8	8	8	8	8	8	8
	As	U	U	U	U	U	U	U	U	1.9	U	U
	Se	U	U	U	U	U	U	U	U	0.41	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike Corrected Data to TC Regulatory Limits	Ba	1.2	0.9	1.1	1.4	1.3	1.1	1.0	1.4	1.0	1.1	0.9
	Cd	U	U	U	U	U	U	U	U	U	U	U
	Cr	3	3	3	3	3	3	3	3	3	3	3
	Pb	U	U	U	U	U	U	U	U	0.07	U	U
	Ag	2	2	2	2	2	2	2	2	2	2	2
	As	U	U	U	U	U	U	U	U	0.16	U	U
	Se	U	U	U	U	U	U	U	U	1.0	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data TC Regulatory Limits	Ba	2.2	1.7	2.1	2.6	2.1	1.7	1.6	2.2	1.6	1.7	1.5
	Cd	U	U	U	U	U	U	U	U	U	U	U
	Cr	6	5	6	6	5	4	5	5	5	5	5
	Pb	U	U	U	U	U	U	U	U	0.1	U	U
	Ag	4	4	4	4	3	3	3	3	3	3	3
	As	U	U	U	U	U	U	U	U	0.26	U	U
	Se	U	U	U	U	U	U	U	U	1.6	U	U
	Hg	U	U	U	U	U	U	U	U	U	U	U

Table D–2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		South Field									
FEMP Sample No.		75206	75206	75208	75206	75206	75208	75206	75206	75207	75207
Treat. Sample No.		10168413	10168613	10311013	10169013	10169213	10311213	10169613	10169813	10310213	10310813
Sample ID/Run No.		Run 1RE	Run 3	Run 3D	Run 5	Run 6	Run 6D	Run 8	Run 9	Run 10	Run 10D
Percent of Raw Data to HI=0.20 Leachate Action Levels	Al	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sb	13	17	10	15	29	15	17	26	30	13
	As	0.5	0.7	0.6	0.3	0.5	U	U	U	1.3	0.4
	Ba	1.9	1.5	1.2	1.2	1.0	2.6	2.4	1.6	1.9	2.0
	Be	0.05	0.06	U	0.06	0.08	0.06	0.06	0.07	0.07	U
	Cd	U	U	U	U	U	U	U	U	U	U
	Ca	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cr	3	3	2	3	4	3	3	4	4	3
	Co	0.5	0.6	U	0.7	1.0	U	U	0.9	0.9	U
	Cu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pb	U	U	U	U	U	U	U	U	U	U
	Mg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mn	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	Hg	U	U	U	U	U	U	U	U	U	U
	Ni	0.1	0.2	U	0.2	0.2	U	U	0.2	0.2	0.2
	K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Se	U	U	U	U	U	U	U	U	U	U
	Ag	3.5	3.7	3.4	3.7	5.2	4.0	4.0	5.1	5.0	3.8
	Na	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tl	U	U	U	U	U	U	U	U	U	U
	V	1.0	1.2	1.0	1.0	1.8	0.9	0.9	1.4	1.7	0.9
	Zn	0.066	0.062	0.025	0.049	U	0.019	0.060	0.065	0.076	0.094
	CN	0.03	0.07	0.01	0.04	0.02	0.01	0.05	U	0.08	0.05
	Mo	1.2	1.1	1.0	0.8	1.2	0.6	0.6	1.0	1.2	0.9
	B	0.4	0.5	U	0.4	0.6	U	0.3	0.6	0.8	0.3
	Si	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent of Raw Data to E–5 Leachate Action Levels	Be	21	23	U	22	31	22	23	28	27	U
Percent of Raw Data to E–6 Leachate Action Levels	Be	210.000	230.000	U	220.000	310.000	220.000	230.000	280.000	270.000	U

Table D-2. Fernald Environmental Management Project OU2 Inorganic TCLP Comparison to PRGs and TCLP Regulatory Limits

		South Field									
FEMP Sample No.		75206	75206	75208	75206	75206	75208	75206	75206	75207	75207
Treat. Sample No.		10168413	10168613	10311013	10169013	10169213	10311213	10169613	10169813	10310213	10310813
Sample ID/Run No.		Run 1RE	Run 3	Run 3D	Run 5	Run 6	Run 6D	Run 8	Run 9	Run 10	Run 10D
Percent of Raw Data to TC Regulatory Limit	Al	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sb	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	As	0.06	0.09	0.08	0.05	0.08	U	U	U	0.19	0.05
	Ba	0.7	0.6	0.5	0.5	0.4	1.0	0.9	0.6	0.7	0.8
	Be	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cd	U	U	U	U	U	U	U	U	U	U
	Ca	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cr	2	2	2	2	3	2	2	3	3	2
	Co	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Fe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Pb	U	U	U	U	U	U	U	U	U	U
	Mg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Hg	U	U	U	U	U	U	U	U	U	U
	Ni	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	K	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Se	U	U	U	U	U	U	U	U	U	U
	Ag	1.4	1.5	1.4	1.5	2.1	1.6	1.6	2.0	2.0	1.5
	Na	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tl	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	V	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Zn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Si	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

		South Field									
FEMP Sample No.		75206	75206	75208	75206	75206	75208	75206	75206	75207	75207
Treat. Sample No.		10168413	10168613	10311013	10169013	10169213	10311213	10169613	10169813	10310213	10310813
Sample ID/Run No.		Run 1RE	Run 3	Run 3D	Run 5	Run 6	Run 6D	Run 8	Run 9	Run 10	Run 10D
Percent of Matrix Spike Corrected Data to HI=0.20 Leachate Action Levels	Ba	1.9	1.5	1.2	1.2	1.0	2.6	2.4	1.6	1.9	2.0
	Cd	U	U	U	U	U	U	U	U	U	U
	Cr	3	3	3	3	5	3	3	5	4	3
	Pb	U	U	U	U	U	U	U	U	U	U
	Ag	4	4	4	4	6	5	5	6	6	4
	As	0.4	0.6	0.5	0.3	0.5	U	U	U	1.3	0.3
	Se	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Ba	3.5	2.9	2.3	1.9	2.1	5.6	4.5	2.9	3.4	3.7
	Cd	U	U	U	U	U	U	U	U	U	U
	Cr	6	6	5	5	10	6	6	8	8	6
	Pb	U	U	U	U	U	U	U	U	U	U
	Ag	8	8	8	7	12	10	8	10	10	8
	As	0.8	1.2	1.0	0.5	1.1	U	U	U	2.3	0.6
	Se	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike Corrected Data to TC Regulatory Limits	Ba	0.7	0.6	0.5	0.5	0.4	1.0	0.9	0.6	0.7	0.8
	Cd	U	U	U	U	U	U	U	U	U	U
	Cr	2	2	2	2	4	2	3	3	3	2
	Pb	U	U	U	U	U	U	U	U	U	U
	Ag	2	2	2	2	2	2	2	2	2	2
	As	0.06	0.09	0.07	0.04	0.07	U	U	U	0.18	0.05
	Se	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U
Percent of Matrix Spike and Dilution Corrected Data TC Regulatory Limits	Ba	1.3	1.1	0.9	0.7	0.8	2.1	1.7	1.1	1.3	1.4
	Cd	U	U	U	U	U	U	U	U	U	U
	Cr	5	4	4	3	7	5	5	6	6	4
	Pb	U	U	U	U	U	U	U	U	U	U
	Ag	3	3	3	3	5	4	3	4	4	3
	As	0.11	0.17	0.14	0.07	0.15	U	U	U	0.32	0.09
	Se	U	U	U	U	U	U	U	U	U	U
	Hg	U	U	U	U	U	U	U	U	U	U

Table D-3. Fernald Environmental Management Project OU2 Comparison of Radiological Results to Leachate Action Levels Page 1

		Reagents				Clean Sand						
FEMP Sample No.		Attap. & Clinopt.	Comm. Flyash	PC Type I	PC Type II	75209	75209	75209	75209	75209	75209	75209
Treat. Sample No.		10162307	10162306	10162301	10162302	10312613	10312813	10313023	10313213	10313413	10313613	10313813
Percent of Radiological Data to 10-5 Leachate Action Levels	Ru-106	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cs-137	U	U	U	U	U	U	U	U	U	U	U
	Pb-210	U	U	U	U	U	U	U	U	U	8.9	7.7
	Pu-238	U	U	U	U	U	U	U	U	U	U	U
	Pu-239/240	U	U	U	U	U	U	1.4	U	U	U	U
	Ra-226	U	U	2.2	3.9	1.0	0.5	0.6	0.8	2.0	U	0.9
	Ra-228	4.3	U	U	U	U	U	U	U	U	U	U
	Sr-90	U	U	U	U	U	U	U	U	U	0.9	U
	Th-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	U-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent of Radiological Data to 10-6 Leachate Action Levels	Ru-106	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cs-137	U	U	U	U	U	U	U	U	U	U	U
	Pb-210	U	U	U	U	U	U	U	U	U	89.3	77.3
	Pu-238	U	U	U	U	U	U	U	U	U	U	U
	Pu-239/240	U	U	U	U	U	U	14.2	U	U	U	U
	Ra-226	U	U	22.4	38.9	10.0	5.2	6.4	7.9	20.2	U	9.4
	Ra-228	42.9	U	U	U	U	U	U	U	U	U	U
	Sr-90	U	U	U	U	U	U	U	U	U	9.1	U
	Th-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	U-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table D–3. Fernald Environmental Management Project OU2 Comparison of Radiological Results to Leachate Action Levels Page 2

		Solid	Waste	Landfill									
FEMP Sample No.		75201	75201	75201	75201	75201	75201	75201	75201	75201	75201	75201	75201
Treat. Sample No.		10162413	10162513	10162613	10312013	10162713	10162813	10162913	10163013	10312213	10163213	10163413	10163613
Percent of Radiological Data to 10–5 Leachate Action Levels	Ru–106	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cs–137	U	U	U	U	U	U	U	U	U	U	U	U
	Pb–210	U	U	U	U	U	U	U	U	U	U	U	U
	Pu–238	U	U	U	U	U	U	U	U	U	U	U	U
	Pu–239/240	U	U	U	2.3	U	U	U	U	U	U	1.5	U
	Ra–226	U	U	U	U	U	U	U	U	0.8	0.5	1.0	U
	Ra–228	U	U	7.2	20.7	U	U	U	U	U	U	U	U
	Sr–90	U	U	U	U	U	U	U	U	U	U	U	U
	Th–Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	U–Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent of Radiological Data to 10–6 Leachate Action Levels	Ru–106	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cs–137	U	U	U	U	U	U	U	U	U	U	U	U
	Pb–210	U	U	U	U	U	U	U	U	U	U	U	U
	Pu–238	U	U	U	U	U	U	U	U	U	U	U	U
	Pu–239/240	U	U	U	23.2	U	U	U	U	U	U	14.7	U
	Ra–226	U	U	U	U	U	U	U	U	8.4	5.1	10.0	U
	Ra–228	U	U	71.5	206.5	U	U	U	U	U	U	U	U
	Sr–90	U	U	U	U	U	U	U	U	U	U	U	U
	Th–Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	U–Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table D-3. Fernald Environmental Management Project OU2 Comparison of Radiological Results to Leachate Action Levels Page 3

		Solid	Waste	Landfill
FEMP Sample No.		75203	75203	75201
Treat. Sample No.		10166413	10166613	10312413
Percent of Radiological Data to 10-5 Leachate Action Levels	Ru-106	N/A	N/A	N/A
	Cs-137	U	U	U
	Pb-210	U	U	U
	Pu-238	U	U	U
	Pu-239/240	U	U	U
	Ra-226	U	1.7	U
	Ra-228	U	U	2737.5
	Sr-90	U	U	U
	Th-Total	N/A	N/A	N/A
	U-Total	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A
Percent of Radiological Data to 10-6 Leachate Action Levels	Ru-106	N/A	N/A	N/A
	Cs-137	U	U	U
	Pb-210	U	U	U
	Pu-238	U	U	U
	Pu-239/240	U	U	U
	Ra-226	U	17.4	U
	Ra-228	U	U	27375.0
	Sr-90	U	U	U
	Th-Total	N/A	N/A	N/A
	U-Total	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A

Table D-3. Fernald Environmental Management Project OU2 Comparison of Radiological Results to Leachate Action Levels Page 4

		Lime	Sludge	Pond	Stage I							
FEMP Sample No.		75202	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202
Treat. Sample No.		10164413	10164613	10165013	10311413	10165213	10165413	10165613	10167013	10165813	10311613	10167213
Percent of Radiological Data to 10-5 Leachate Action Levels	Ru-106	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cs-137	U	U	U	U	U	U	U	U	U	U	U
	Pb-210	U	U	U	U	U	U	U	U	U	U	U
	Pu-238	U	U	U	1.4	U	U	U	U	U	U	U
	Pu-239/240	U	U	U	U	U	U	U	5.3	U	U	U
	Ra-226	U	1.0	1.5	1.3	1.0	U	U	U	U	U	U
	Ra-228	U	U	U	U	U	U	U	U	U	U	U
	Sr-90	U	U	U	U	U	U	U	U	U	U	U
	Th-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	U-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent of Radiological Data to 10-6 Leachate Action Levels	Ru-106	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cs-137	U	U	U	U	U	U	U	U	U	U	U
	Pb-210	U	U	U	U	U	U	U	U	U	U	U
	Pu-238	U	U	U	14.1	U	U	U	U	U	U	U
	Pu-239/240	U	U	U	U	U	U	U	52.6	U	U	U
	Ra-226	U	10.1	14.9	12.8	9.6	U	U	U	U	U	U
	Ra-228	U	U	U	U	U	U	U	U	U	U	U
	Sr-90	U	U	U	U	U	U	U	U	U	U	U
	Th-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	U-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table D-3. Fernald Environmental Management Project OU2 Comparison of Radiological Results to Leachate Action Levels Page 5

		Lime Sludge Pond, Stage I		
FEMP Sample No.		75202	75205	75202
Treat. Sample No.		10167413	10167813	10311813
Percent of Radiological Data to 10-5 Leachate Action Levels	Ru-106	N/A	N/A	N/A
	Cs-137	U	U	U
	Pb-210	U	U	U
	Pu-238	U	U	U
	Pu-239/240	U	U	1.7
	Ra-226	U	0.6	1.2
	Ra-228	U	U	U
	Sr-90	U	U	1.1
	Th-Total	N/A	N/A	N/A
	U-Total	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A
Percent of Radiological Data to 10-6 Leachate Action Levels	Ru-106	N/A	N/A	N/A
	Cs-137	U	U	U
	Pb-210	U	U	U
	Pu-238	U	U	U
	Pu-239/240	U	U	17.2
	Ra-226	U	5.7	11.7
	Ra-228	U	U	U
	Sr-90	U	U	11.2
	Th-Total	N/A	N/A	N/A
	U-Total	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A

387

3527

Table D–3. Fernald Environmental Management Project OU2 Comparison of Radiological Results to Leachate Action Levels Page 6

		Lime	Sludge	Pond	Stage II					
FEMP Sample No.		67431	67431	67431	67431	67431	67431	67431	67431	67431
Treat. Sample No.		10371613	10371413	10371213	10371813	10372013	10372213	10372413	10372613	10372813
Percent of Radiological Data to 10–5 Leachate Action Levels	Ru–106	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cs–137	U	U	U	U	U	U	U	U	U
	Pb–210	U	U	U	U	U	U	U	U	U
	Pu–238	U	U	U	U	U	U	U	U	U
	Pu–239/240	1.9	U	U	U	U	U	U	U	U
	Ra–226	U	U	U	U	U	U	U	U	U
	Ra–228	U	U	U	U	U	U	U	U	U
	Sr–90	U	U	U	U	U	U	U	U	U
	Th–Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	U–Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent of Radiological Data to 10–6 Leachate Action Levels	Ru–106	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cs–137	U	U	U	U	U	U	U	U	U
	Pb–210	U	U	U	U	U	U	U	U	U
	Pu–238	U	U	U	U	U	U	U	U	U
	Pu–239/240	19.1	U	U	U	U	U	U	U	U
	Ra–226	U	U	U	U	U	U	U	U	U
	Ra–228	U	U	U	U	U	U	U	U	U
	Sr–90	U	U	U	U	U	U	U	U	U
	Th–Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	U–Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table D-3. Fernald Environmental Management Project OU2 Comparison of Radiological Results to Leachate Action Levels Page 7

		South Field								
FEMP Sample No.		75206	75208	75206	75206	75208	75206	75206	75207	75207
Treat. Sample No.		10168613	10311013	10169013	10169213	10311213	10169613	10169813	10310213	10310813
Percent of Radiological Data to 10-5 Leachate Action Levels	Ru-106	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cs-137	U	U	U	U	U	U	U	U	U
	Pb-210	U	U	U	U	U	U	U	U	U
	Pu-238	U	U	U	U	U	U	U	U	U
	Pu-239/240	U	U	U	U	U	U	U	U	U
	Ra-226	0.5	U	U	U	1.5	0.9	0.6	0.9	0.6
	Ra-228	U	U	U	U	U	U	U	U	U
	Sr-90	U	U	U	U	U	U	U	U	U
	Th-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	U-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent of Radiological Data to 10-6 Leachate Action Levels	Ru-106	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cs-137	U	U	U	U	U	U	U	U	U
	Pb-210	U	U	U	U	U	U	U	U	U
	Pu-238	U	U	U	U	U	U	U	U	U
	Pu-239/240	U	U	U	U	U	U	U	U	U
	Ra-226	5.2	U	U	U	14.9	8.9	6.4	9.0	6.4
	Ra-228	U	U	U	U	U	U	U	U	U
	Sr-90	U	U	U	U	U	U	U	U	U
	Th-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	U-Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross alpha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gross beta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		Reagents				Clean Sand	
	FEMP Sample No.	**N/A**	**N/A**	**N/A**	**N/A**	**75209**	**75209**
	Treat. Sample No.	**10162301**	**10162302**	**10162306**	**10162307**	**10312813**	**10313213**
	Sample ID/Run No.	**PC Type I**	**PC Type II**	**Comm. Flyash**	**Attap. & Clinopt.**	**Run 2**	**Run 4**
Percent of Raw Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.08	0.07	0.13	0.22	0.07	0.12
	Acetone	0.3	0.2	0.3	0.6	0.3	0.4
	1,1,1-Trichloroethane	U	U	U	U	U	0.01
	4-Methyl-2-pentanone	0.05	0.03	0.05	0.03	0.03	0.03
	2-Butanone	0.01	U	U	U	0.01	0.01
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	0.004
	Carbon disulfide	U	U	U	U	U	U
Percent of Spike Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	N/A	N/A	N/A	N/A	0.07	0.12
	Acetone	N/A	N/A	N/A	N/A	0.3	0.4
	1,1,1-Trichloroethane	N/A	N/A	N/A	N/A	U	0.01
	4-Methyl-2-pentanone	N/A	N/A	N/A	N/A	0.032	0.032
	2-Butanone	N/A	N/A	N/A	N/A	0.029	0.022
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	N/A	N/A	N/A	N/A	U	U
	Chloroform	N/A	N/A	N/A	N/A	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	N/A	N/A	N/A	N/A	U	0.004
	Carbon disulfide	N/A	N/A	N/A	N/A	U	U
Percent of Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	N/A	N/A	N/A	N/A	0.08	0.14
	Acetone	N/A	N/A	N/A	N/A	0.30	0.44
	1,1,1-Trichloroethane	N/A	N/A	N/A	N/A	U	0.01
	4-Methyl-2-pentanone	N/A	N/A	N/A	N/A	0.04	0.04
	2-Butanone	N/A	N/A	N/A	N/A	0.03	0.03
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	N/A	N/A	N/A	N/A	U	U
	Chloroform	N/A	N/A	N/A	N/A	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	N/A	N/A	N/A	N/A	U	0.005
	Carbon disulfide	N/A	N/A	N/A	N/A	U	U

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		Reagents				Clean Sand	
	FEMP Sample No.	N/A	N/A	N/A	N/A	75209	75209
	Treat. Sample No.	10162301	10162302	10162306	10162307	10312813	10313213
	Sample ID/Run No.	PC Type I	PC Type II	Comm. Flyash	Attap. & Clinopt.	Run 2	Run 4
Percent of Raw Data to E-5 Leachate Action Levels	Methylene Chloride	0.7	0.6	1.1	1.9	0.6	1.1
	Chloroform	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Levels	Methylene Chloride	N/A	N/A	N/A	N/A	0.7	1.3
	Chloroform	N/A	N/A	N/A	N/A	U	U
Percent of Raw Data to E-6 Leachate Action Levels	Methylene Chloride	7	6	11	19	6	11
	Chloroform	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Levels	Methylene Chloride	N/A	N/A	N/A	N/A	7	13
	Chloroform	N/A	N/A	N/A	N/A	U	U
Percent of Raw Data to TC Reg Limits	2-Butanone	0.001	U	U	U	0.002	0.002
	Chloroform	U	U	U	U	U	U
Percent of Spike data to TC Reg Limits	2-Butanone	N/A	N/A	N/A	N/A	0.005	0.004
	Chloroform	N/A	N/A	N/A	N/A	U	U
Percent of Dilution data to TC Reg Limits	2-Butanone	N/A	N/A	N/A	N/A	0.006	0.005
	Chloroform	N/A	N/A	N/A	N/A	U	U

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		Solid Waste Landfill									
	FEMP Sample No.	75201	75201	75201	75201	75201	75201	75201	75201	75201	75201
	Treat. Sample No.	10162413	10162413DL	10162513DL	10162513RE	10162613	10162613DL	10312013	10162713	10162713DL	10162813
	Sample ID/Run No.	Run 1	Run 1	Run 2	Run 2	Run 3	Run 3	Run 3D	Run 4	Run 4	Run 5
Percent of Raw Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.48	0.45	0.55	0.57	0.50	0.75	0.06	0.36	0.52	0.41
	Acetone	0.1	0.1	0.4	0.3	0.2	0.9	0.2	0.3	0.4	0.2
	1,1,1-Trichloroethane	U	U	U	U	U	U	0.01	U	U	U
	4-Methyl-2-pentanone	0.01	0.01	U	U	U	U	0.04	0.00	U	0.01
	2-Butanone	U	U	U	U	U	U	0.01	U	U	U
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	0.0007	U	U	0.0007	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	0.003	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U
Percent of Spike Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.48	0.45	0.55	0.57	0.50	0.75	0.06	0.36	0.52	0.41
	Acetone	0.1	0.1	0.4	0.3	0.2	0.9	0.2	0.3	0.4	0.2
	1,1,1-Trichloroethane	U	U	U	U	U	U	0.01	U	U	U
	4-Methyl-2-pentanone	0.005	0.005	U	U	U	U	0.043	0.003	U	0.005
	2-Butanone	U	U	U	U	U	U	0.015	U	U	U
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	0.001	U	U	0.001	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	0.003	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U
Percent of Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.88	0.84	0.98	1.02	0.95	1.43	0.12	0.58	0.84	0.63
	Acetone	0.20	0.18	0.69	0.62	0.42	1.72	0.39	0.46	0.57	0.28
	1,1,1-Trichloroethane	U	U	U	U	U	U	0.02	U	U	U
	4-Methyl-2-pentanone	0.01	0.01	U	U	U	U	0.08	0.00	U	0.01
	2-Butanone	U	U	U	U	U	U	0.03	U	U	U
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	0.001	U	U	0.001	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	0.005	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		Solid Waste Landfill									
	FEMP Sample No.	75201	75201	75201	75201	75201	75201	75201	75201	75201	75201
	Treat. Sample No.	10162413	10162413DL	10162513DL	10162513RE	10162613	10162613DL	10312013	10162713	10162713DL	10162813
	Sample ID/Run No.	Run 1	Run 1	Run 2	Run 2	Run 3	Run 3	Run 3D	Run 4	Run 4	Run 5
Percent of Raw Data to E-5 Leachate Action Levels	Methylene Chloride	4.2	4.0	4.8	5.0	4.4	6.6	0.6	3.2	4.6	3.6
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Levels	Methylene Chloride	7.8	7.4	8.6	9.0	8.4	12.5	1.1	5.1	7.4	5.6
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to E-6 Leachate Action Levels	Methylene Chloride	42	40	48	50	44	66	6	32	46	36
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Levels	Methylene Chloride	78	74	86	90	84	125	11	51	74	56
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to TC Reg Limits	2-Butanone	U	U	U	U	U	U	0.001	U	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Spike data to TC Reg Limits	2-Butanone	U	U	U	U	U	U	0.003	U	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Dilution data to TC Reg Limits	2-Butanone	U	U	U	U	U	U	0.005	U	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		Solid Waste Landfill										
	FEMP Sample No.	75201	75201	75201	75201	75201	75201	75201	75201	75203	75203	75201
	Treat. Sample No.	10162913	10162913DL	10163013	10312213	10163213	10163213	10163413	10163613	10166413	10166623	10312413
	Sample ID/Run No.	Run 6	Run 6	Run 7	Run 7D	Run 8	Run 8	Run 9	Run 10	Run 11	Run 12	Run 12D
Percent of Raw Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.59	0.50	0.08	0.07	0.08	0.15	0.20	0.36	0.22	1.41	0.05
	Acetone	0.2	0.2	0.0	0.2	0.1	0.3	0.5	0.4	0.1	0.6	0.2
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	0.01	U	U	0.04	0.01	0.01	U	U	U	U	0.01
	2-Butanone	U	U	0.01	0.01	0.01	0.01	0.01	0.02	0.00	0.01	U
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U	U
Percent of Spike Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.59	0.50	0.08	0.07	0.08	0.15	0.20	0.36	0.22	1.41	0.05
	Acetone	0.2	0.2	0.02	0.2	0.1	0.3	0.5	0.4	0.1	0.6	0.2
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	0.005	U	U	0.035	0.008	0.005	U	U	U	U	0.014
	2-Butanone	U	U	0.015	0.015	0.029	0.022	0.022	0.044	0.007	0.022	U
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U	U
Percent of Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	1.20	1.02	0.15	0.14	0.14	0.28	0.36	0.53	0.33	2.11	0.08
	Acetone	0.33	0.33	0.05	0.45	0.11	0.59	0.84	0.60	0.18	0.88	0.25
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	0.01	U	U	0.07	0.01	0.01	U	U	U	U	0.02
	2-Butanone	U	U	0.03	0.03	0.05	0.04	0.04	0.06	0.01	0.03	U
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U	U

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		Solid Waste Landfill										
	FEMP Sample No.	75201	75201	75201	75201	75201	75201	75201	75201	75203	75203	75201
	Treat. Sample No.	10162913	10162913DL	10163013	10312213	10163213	10163213	10163413	10163613	10166413	10166623	10312413
	Sample ID/Run No.	Run 6	Run 6	Run 7	Run 7D	Run 8	Run 8	Run 9	Run 10	Run 11	Run 12	Run 12D
Percent of Raw Data to E-5 Leachate Action Levels	Methylene Chloride	5.2	4.4	0.7	0.6	0.7	1.4	1.8	3.2	2.0	12.4	0.5
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Levels	Methylene Chloride	10.6	8.9	1.4	1.3	1.2	2.4	3.2	4.7	2.9	18.6	0.7
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to E-6 Leachate Action Levels	Methylene Chloride	52	44	7	6	7	14	18	32	20	124	5
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Levels	Methylene Chloride	106	89	14	13	12	24	32	47	29	186	7
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to TC Reg Limits	2-Butanone	U	U	0.001	0.001	0.002	0.002	0.002	0.003	0.001	0.002	U
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Spike data to TC Reg Limits	2-Butanone	U	U	0.003	0.003	0.005	0.004	0.004	0.008	0.001	0.004	U
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Dilution data to TC Reg Limits	2-Butanone	U	U	0.006	0.006	0.010	0.007	0.007	0.012	0.002	0.006	U
	Chloroform	U	U	U	U	U	U	U	U	U	U	U

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		Lime Sludge Pond, Stage I												
	FEMP Sample No.	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202	75205	75202
	Treat. Sample No.	10164413	10164613	10165013	10311413	10165413	10165613	10167013	10165813	10311613	10167213	10167413	10167813	10311813
	Sample ID/Run No.	Run 2	Run 3	Run 5	Run 5D	Run 7	Run 8	Run 9	Run 10	Run 10D	Run 13	Run 14	Run 16	Run 16D
Percent of Raw Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.36	0.20	0.32	0.15	0.18	0.20	0.27	0.12	0.06	0.22	0.22	0.15	0.07
	Acetone	0.3	0.1	0.3	0.2	0.2	0.5	0.2	0.2	0.2	0.1	0.2	0.4	0.3
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	U	U	U	0.02	U	U	U	U	0.02	0.01	0.01	U	0.02
	2-Butanone	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	0.0020	U	U	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	0.04	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U	U	U	U
Percent of Spike Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.36	0.20	0.32	0.15	0.18	0.20	0.27	0.12	0.06	0.22	0.22	0.15	0.07
	Acetone	0.3	0.1	0.3	0.2	0.2	0.5	0.2	0.2	0.2	0.1	0.2	0.4	0.3
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	U	U	U	0.022	U	U	U	U	0.022	0.005	0.005	U	0.019
	2-Butanone	0.037	0.015	0.015	0.015	0.015	0.015	0.022	0.022	0.022	0.022	0.015	0.037	0.022
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	0.002	U	U	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	0.04	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U	U	U	U
Percent of Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.65	0.38	0.49	0.24	0.37	0.37	0.49	0.18	0.09	0.46	0.46	0.25	0.12
	Acetone	0.59	0.10	0.49	0.36	0.39	0.86	0.39	0.33	0.31	0.29	0.45	0.68	0.47
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	U	U	U	0.03	U	U	U	U	0.03	0.01	0.01	U	0.03
	2-Butanone	0.07	0.03	0.02	0.02	0.03	0.03	0.04	0.03	0.03	0.05	0.03	0.06	0.04
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	0.003	U	U	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	0.08	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U	U	U	U

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		Lime Sludge Pond, Stage I												
	FEMP Sample No.	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202	75202	75205	75202
	Treat. Sample No.	10164413	10164613	10165013	10311413	10165413	10165613	10167013	10165813	10311613	10167213	10167413	10167813	10311813
	Sample ID/Run No.	Run 2	Run 3	Run 5	Run 5D	Run 7	Run 8	Run 9	Run 10	Run 10D	Run 13	Run 14	Run 16	Run 16D
Percent of Raw Data to E-5 Leachate Action Levels	Methylene Chloride	3.2	1.7	2.8	1.3	1.6	1.8	2.4	1.0	0.5	1.9	2.0	1.3	0.6
	Chloroform	U	U	U	U	U	U	0.05	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Levels	Methylene Chloride	5.8	3.3	4.3	2.1	3.3	3.3	4.3	1.5	0.8	4.1	4.0	2.2	1.0
	Chloroform	U	U	U	U	U	U	0.09	U	U	U	U	U	U
Percent of Raw Data to E-6 Leachate Action Levels	Methylene Chloride	32	17	28	13	16	18	24	10	5	19	20	13	6
	Chloroform	U	U	U	U	U	U	0.50	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Levels	Methylene Chloride	58	33	43	21	33	33	43	15	8	41	40	22	10
	Chloroform	U	U	U	U	U	U	0.9	U	U	U	U	U	U
Percent of Raw Data to TC Reg Limits	2-Butanone	0.003	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.003	0.002
	Chloroform	U	U	U	U	U	U	0.05	U	U	U	U	U	U
Percent of Spike data to TC Reg Limits	2-Butanone	0.007	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.003	0.007	0.004
	Chloroform	U	U	U	U	U	U	0.05	U	U	U	U	U	U
Percent of Dilution data to TC Reg Limits	2-Butanone	0.012	0.005	0.004	0.004	0.006	0.005	0.007	0.006	0.006	0.009	0.006	0.011	0.007
	Chloroform	U	U	U	U	U	U	0.09	U	U	U	U	U	U

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		Lime Sludge Pond, Stage II										
	FEMP Sample No.	67431	67431	67431	67431	67431	67431	67431	67431	67431	67431	67431
	Treat. Sample No.	10371613	10371413	10371213	10373213	10371813	10372013	10372213	10372413	10373013	10372613	10372813
	Sample ID/Run No.	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D	Run 8	Run 9
Percent of Raw Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.12	0.17	0.12	0.12	0.13	0.07	0.07	0.07	0.08	0.07	0.09
	Acetone	0.2	0.3	0.2	1.0	0.2	0.2	0.2	0.2	0.7	0.2	0.2
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03
	2-Butanone	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.02	0.02
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	U	0.0007	U	0.0007	U	0.0007	U
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	0.001	U	U	U	U	U	U	U	U	U	U
Percent of Spike Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.12	0.17	0.12	0.12	0.13	0.07	0.07	0.07	0.08	0.07	0.09
	Acetone	0.2	0.3	0.2	1.0	0.2	0.2	0.2	0.2	0.7	0.2	0.2
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	0.024	0.024	0.024	0.019	0.024	0.030	0.032	0.030	0.030	0.030	0.027
	2-Butanone	0.051	0.044	0.051	0.066	0.066	0.058	0.051	0.051	0.007	0.044	0.051
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	U	0.001	U	0.001	U	0.001	U
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	0.001	U	U	U	U	U	U	U	U	U	U
Percent of Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.22	0.30	0.23	0.22	0.20	0.11	0.11	0.11	0.13	0.11	0.14
	Acetone	0.30	0.47	0.44	1.98	0.37	0.32	0.34	0.37	1.10	0.36	0.38
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	0.05	0.04	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.04
	2-Butanone	0.09	0.08	0.10	0.13	0.11	0.09	0.08	0.08	0.01	0.07	0.08
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	U	0.001	U	0.001	U	0.001	U
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	0.003	U	U	U	U	U	U	U	U	U	U

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		Lime Sludge Pond, Stage II										
	FEMP Sample No.	67431	67431	67431	67431	67431	67431	67431	67431	67431	67431	67431
	Treat. Sample No.	10371613	10371413	10371213	10373213	10371813	10372013	10372213	10372413	10373013	10372613	10372813
	Sample ID/Run No.	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D	Run 8	Run 9
Percent of Raw Data to E-5 Leachate Action Levels	Methylene Chloride	1.0	1.5	1.1	1.0	1.1	0.6	0.6	0.6	0.7	0.6	0.8
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Levels	Methylene Chloride	1.9	2.7	2.1	2.0	1.8	0.9	1.0	1.0	1.2	1.0	1.3
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to E-6 Leachate Action Levels	Methylene Chloride	10	15	11	10	11	6	6	6	7	6	8
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Levels	Methylene Chloride	19	27	21	20	18	9	10	10	12	10	13
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to TC Reg Limits	2-Butanone	0.004	0.003	0.004	0.005	0.005	0.004	0.004	0.004	0.001	0.003	0.004
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Spike data to TC Reg Limits	2-Butanone	0.009	0.008	0.009	0.012	0.012	0.011	0.009	0.009	0.001	0.008	0.009
	Chloroform	U	U	U	U	U	U	U	U	U	U	U
Percent of Dilution data to TC Reg Limits	2-Butanone	0.018	0.015	0.018	0.023	0.019	0.017	0.016	0.015	0.002	0.013	0.016
	Chloroform	U	U	U	U	U	U	U	U	U	U	U

399

3527

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		South Field									
	FEMP Sample No.	75206	75206	75206	75208	75206	75206	75206	75208	75206	75206
	Treat. Sample No.	10168413	10168213	10168613	10311013	10168813	10169013	10169213	10311213	10169413	10169613
	Sample ID/Run No.	Run 1RE	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 6D	Run 7	Run 8
Percent of Raw Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.07	0.20	0.08	0.06	0.06	0.15	0.05	0.08	0.05	0.08
	Acetone	0.1	0.3	0.8	0.2	0.1	4.8	0.0	0.3	0.5	0.7
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	U	U	U	0.05	U	U	U	0.04	U	U
	2-Butanone	0.01	0.01	0.01	0.01	0.01	0.02	0.00	0.01	0.01	0.01
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U
Percent of Spike Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.07	0.20	0.08	0.06	0.06	0.15	0.05	0.08	0.05	0.08
	Acetone	0.1	0.3	0.8	0.2	0.1	4.8	0.03	0.3	0.5	0.7
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	U	U	U	0.049	U	U	U	0.038	U	U
	2-Butanone	0.015	0.022	0.015	0.022	0.015	0.058	0.007	0.015	0.022	0.022
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U
Percent of Spike and Dilution Corrected Data to HI=0.20 Leachate Action Levels	Methylene Chloride	0.12	0.36	0.14	0.12	0.09	0.23	0.11	0.16	0.11	0.15
	Acetone	0.10	0.49	1.43	0.39	0.18	7.43	0.07	0.58	0.98	1.29
	1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U	U
	4-Methyl-2-pentanone	U	U	U	0.09	U	U	U	0.08	U	U
	2-Butanone	0.03	0.04	0.03	0.04	0.02	0.09	0.02	0.03	0.04	0.04
	2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Toluene	U	U	U	U	U	U	U	U	U	U
	Chloroform	U	U	U	U	U	U	U	U	U	U
	Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1,1-Dichloroethane	U	U	U	U	U	U	U	U	U	U
	Carbon disulfide	U	U	U	U	U	U	U	U	U	U

Table D-4. Fernald Environmental Management Project OU2 Volatile Organic TCLP Results Comparison to Leachate Action Levels

		South Field									
	FEMP Sample No.	75206	75206	75206	75208	75206	75206	75206	75208	75206	75206
	Treat. Sample No.	10168413	10168213	10168613	10311013	10168813	10169013	10169213	10311213	10169413	10169613
	Sample ID/Run No.	Run 1RE	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 6D	Run 7	Run 8
Percent of Raw Data to E-5 Leachate Action Levels	Methylene Chloride	0.6	1.7	0.7	0.6	0.5	1.3	0.5	0.7	0.5	0.7
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Levels	Methylene Chloride	1.1	3.1	1.3	1.1	0.8	2.0	1.0	1.4	1.0	1.3
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to E-6 Leachate Action Levels	Methylene Chloride	6	17	7	6	5	13	5	7	5	7
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Levels	Methylene Chloride	11	31	13	11	8	20	10	14	10	13
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to TC Reg Limits	2-Butanone	0.001	0.002	0.001	0.002	0.001	0.004	0.001	0.001	0.002	0.002
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Spike data to TC Reg Limits	2-Butanone	0.003	0.004	0.003	0.004	0.003	0.011	0.001	0.003	0.004	0.004
	Chloroform	U	U	U	U	U	U	U	U	U	U
Percent of Dilution data to TC Reg Limits	2-Butanone	0.005	0.007	0.005	0.008	0.004	0.017	0.003	0.006	0.008	0.007
	Chloroform	U	U	U	U	U	U	U	U	U	U

Table D-5. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results Compared to Leachate Action Levels

		Reagents								Clean Sand	
	FEMP Sample No.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	75209	75209
	Lab Sample No.	10162301	10162301RE	10162302	10162302RE	10162306	10162306RE	10162307	10162307RE	10312813	10313213
	Sample ID/Run No.	PC Type I	PC Type I	PC Type II	PC Type II	Comm. Flyash	Comm. Flyash	Attap. & Clinopt.	Attap. & Clinopt.	Run 2	Run 4
Percent of Raw Data to HI=0.20 Leachate Action Level	Benzoic acid	U	U	U	U	U	U	U	U	U	U
	Bis(2-ethylhexyl)Phthalate	U	U	U	U	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U	U	U	U	U
	Phenol	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Corrected Data to HI=0.20 Leachate Action Level	Benzoic acid	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	U	U
	Bis(2-ethylhexyl)Phthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	U	U
	Phenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	U	U
Percent of Raw Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	U	U
Percent of Raw Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	U	U

403

Table D-5. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results Compared to Leachate Action Levels

		Solid Waste Landfill										
	FEMP Sample No.	75201	75201	75201	75201	75201	75201	75201	75201	75201	75201	75201
	Lab Sample No.	10162413	10162413RE	10162513	10162513RE	10162613	10162613RE	10312013	10162713	10162713RE	10162813	10162813RE
	Sample ID/Run No.	Run 1	Run 1	Run 2	Run 2	Run 3	Run 3	Run 3D	Run 4	Run 4	Run 5	Run 5
Percent of Raw Data to HI=0.20 Leachate Action Level	Benzoic acid	0.0003	U	U	U	U	U	U	U	0.0003	U	U
	Bis(2-ethylhexyl)Phthalate	U	U	0.06	U	U	0.03	U	U	0.07	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U	U	0.6	U	U	U
	Phenol	U	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Corrected Data to HI=0.20 Leachate Action Level	Benzoic acid	0.001	U	U	U	U	U	U	U	0.001	U	U
	Bis(2-ethylhexyl)Phthalate	U	U	0.1	U	U	0.06	U	U	0.1	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U	U	0.9	U	U	U
	Phenol	U	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	0.3	U	U	0.2	U	U	0.4	U	U
Percent of Dilution Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	0.6	U	U	0.4	U	U	0.6	U	U
Percent of Raw Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	3.5	U	U	1.9	U	U	3.8	U	U
Percent of Dilution Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	6.2	U	U	3.7	U	U	6.2	U	U

Table D-5. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results Compared to Leachate Action Levels

		Solid Waste Landfill									
	FEMP Sample No.	75201	75201	75201	75201	75201	75201	75201	75203	75203	75201
	Lab Sample No.	10162913	10162913RE	10163013	10312213	10163213	10163413	10163613	10166413	10166613	10312413
	Sample ID/Run No.	Run 6	Run 6	Run 7	Run 7D	Run 8	Run 9	Run 10	Run 11	Run 12	Run 12D
Percent of Raw Data to HI=0.20 Leachate Action Level	Benzoic acid	U	U	U	U	U	U	U	U	U	U
	Bis(2-ethylhexyl)Phthalate	U	U	U	U	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U	U	U	U	U
	Phenol	U	U	U	U	0.001	U	U	U	U	U
Percent of Dilution Corrected Data to HI=0.20 Leachate Action Level	Benzoic acid	U	U	U	U	U	U	U	U	U	U
	Bis(2-ethylhexyl)Phthalate	U	U	U	U	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U	U	U	U	U
	Phenol	U	U	U	U	0.002	U	U	U	U	U
Percent of Raw Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U

Table D-5. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results Compared to Leachate Action Levels

		Lime Sludge Pond, Stage I								
	FEMP Sample No.	75202	75202	75202	75202	75202	75202	75202	75202	75202
	Lab Sample No.	10164413	10164613	10165013	10311413	10165213	10165413	10165613	10167013	10165813
	Sample ID/Run No.	Run 2	Run 3	Run 5	Run 5D	Run 6	Run 7	Run 8	Run 9	Run 10
Percent of Raw Data to HI=0.20 Leachate Action Level	Benzoic acid	0.001	U	U	U	U	U	0.0001	0.002	U
	Bis(2-ethylhexyl)Phthalate	U	0.3	U	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U	U	U	U
	Phenol	U	U	U	U	U	U	U	U	U
Percent of Dilution Corrected Data to HI=0.20 Leachate Action Level	Benzoic acid	0.001	U	U	U	U	U	0.0003	0.004	U
	Bis(2-ethylhexyl)Phthalate	U	0.5	U	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U	U	U	U
	Phenol	U	U	U	U	U	U	U	U	U
Percent of Raw Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	1.5	U	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	2.8	U	U	U	U	U	U	U
Percent of Raw Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	15	U	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	28	U	U	U	U	U	U	U

Table D-5. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results Compared to Leachate Action Levels

		Lime Sludge Pond, Stage I					
	FEMP Sample No.	75202	75202	75202	75202	75205	75202
	Lab Sample No.	10311613	10311613RE	10167213	10167413	10167813	10311813
	Sample ID/Run No.	Run 10D	Run 10D	Run 13	Run 14	Run 16	Run 16D
Percent of Raw Data to HI=0.20 Leachate Action Level	Benzoic acid	U	0.0002	0.0005	U	U	U
	Bis(2-ethylhexyl)Phthalate	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U
	Phenol	0.001	U	U	U	U	0.001
Percent of Dilution Corrected Data to HI=0.20 Leachate Action Level	Benzoic acid	U	0.0003	0.001	U	U	U
	Bis(2-ethylhexyl)Phthalate	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U
	Phenol	0.002	U	U	U	U	0.002
Percent of Raw Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U
Percent of Raw Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U

Table D-5. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results Compared to Leachate Action Levels

		Lime Sludge Pond, Stage II										
	FEMP Sample No.	67431	67431	67431	67431	67431	67431	67431	67431	67431	67431	67431
	Lab Sample No.	10371613	10371413	10371213	10373213	10371813	10372013	10372213	10372413	10373013	10372613	10372813
	Sample ID/Run No.	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 7	Run 7D	Run 8	Run 9
Percent of Raw Data to HI=0.20 Leachate Action Level	Benzoic acid	U	0.0002	0.0002	0.0002	0.0003	U	U	0.001	0.0003	U	0.0003
	Bis(2-ethylhexyl)Phthalate	U	U	U	U	U	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U	U	U	U	U	U
	Phenol	U	0.001	U	0.001	U	U	U	0.001	U	U	U
Percent of Dilution Corrected Data to HI=0.20 Leachate Action Level	Benzoic acid	U	0.0003	0.0005	0.0005	0.0005	U	U	0.001	0.0005	U	0.001
	Bis(2-ethylhexyl)Phthalate	U	U	U	U	U	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U	U	U	U	U	U
	Phenol	U	0.002	U	0.002	U	U	U	0.002	U	U	U
Percent of Raw Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U	U

Table D-5. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results Compared to Leachate Action Levels

		South Field									
	FEMP Sample No.	75206	75206	75206	75208	75206	75206	75206	75208	75206	75206
	Lab Sample No.	10168413	10168213	10168613	10311013	10168813	10169013	10169213	10311213	10169413	10169613
	Sample ID/Run No.	Run 1RE	Run 2	Run 3	Run 3D	Run 4	Run 5	Run 6	Run 6D	Run 7	Run 8
Percent of Raw Data to HI=0.20 Leachate Action Level	Benzoic acid	0.0002	0.0003	0.0002	U	0.0003	U	U	U	U	U
	Bis(2-ethylhexyl)Phthalate	U	U	U	U	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U	U	U	U	U
	Phenol	U	0.001	U	U	U	U	U	U	U	U
Percent of Dilution Corrected Data to HI=0.20 Leachate Action Level	Benzoic acid	0.0004	0.0005	0.0004	U	0.0005	U	U	U	U	U
	Bis(2-ethylhexyl)Phthalate	U	U	U	U	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U	U	U	U	U
	Phenol	U	0.002	U	U	U	U	U	U	U	U
Percent of Raw Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U
Percent of Raw Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U	U	U	U	U

Table D-5. Fernald Environmental Management Project OU2 Semivolatile Organic TCLP Results Compared to Leachate Action Levels

		South Field					
	FEMP Sample No.	75206	75207	75207	75207	75207	75207
	Lab Sample No.	10169813	10310213	10310813	10310813RE	10310413	10310613
	Sample ID/Run No.	Run 9	Run 10	Run 10D	Run 10D	Run 11	Run 12
Percent of Raw Data to HI=0.20 Leachate Action Level	Benzoic acid	U	U	U	U	U	U
	Bis(2-ethylhexyl)Phthalate	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U
	Phenol	U	U	U	U	U	U
Percent of Dilution Corrected Data to HI=0.20 Leachate Action Level	Benzoic acid	U	U	U	U	U	U
	Bis(2-ethylhexyl)Phthalate	U	U	U	U	U	U
	2-Chlorophenol	N/A	N/A	N/A	N/A	N/A	N/A
	4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A
	Di-n-butylphthalate	U	U	U	U	U	U
	Phenol	U	U	U	U	U	U
Percent of Raw Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U
Percent of Dilution Data to E-5 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U
Percent of Raw Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U
Percent of Dilution Data to E-6 Leachate Action Level	Bis(2-ethylhexyl)phthalate	U	U	U	U	U	U

APPENDIX E

APPENDIX E

OPERATING METHODS

Appendix E Table of Contents

Analytical Logbook Recording Procedures
Laboratory Notebook Recording Procedures
Standard Laboratory Sieves: Specification, Calibration, and Maintenance
Unconfined Compressive Strength
Calibration of Thermometers
Bulking Factor Procedure for Nonsludge Type Waste
Modified TCLP Leach Test Procedure
Waste and Reagent Mixing Procedure
Stabilization Waste Form Temperature Rise Generic Procedure
Permeability
Generic pH and Eh Procedures
Proposed Radon Emissions from Stabilized Soilds
Proposed Measurement of Radon Leaching in Water
Shear Strength
Generic Uranium by Ion Chromatography with Post-Column Reaction and Phosphorescence or Fluorescence Detection

International Technology Corporation

IT Analytical Services

Technology Development Laboratory Standard Operating Procedure

Title: Analytical Logbook Recording Procedures

Prepared by: Patti B. Carswell Date: 2/7/91

Reviewed by: Bruce F. Wagner Date: 2/7/91
Technical Specialist

Patti B Carswell Date: 2/7/91
Quality Control Coordinator

Janet M. Jones Date: 3-26-91
Director, Quality and Compliance, ITAS

Approved by: R S Miller Date: 6/7/91
Laboratory Director

Controlled Copy No: Uncontrolled

Key Words: Logbook, Notebook

Revision #	0					
Date	1-21-91					

Technology Development Laboratory
304 Directors Drive ▪ Knoxville, Tennessee 37923 ▪ (615) 690-3211 ▪ FAX (615) 694-9573
IT Corporation is a wholly owned Subsidiary of International Technology Corporation.

1.0 Purpose and Application

1.1 The purpose of this method is to describe the required methods of data entry in Technology Development Analytical Logbooks.

1.2 This procedure applies to analytical logbooks such as instrument injection logbooks, maintenance logbooks, and balance logs.

2.0 References

2.1 Writing the Laboratory Notebook, Howard M. Kanare, 1985.

3.0 Associated SOPs and Applicable Methods

3.1 ITAS SOP No. TDL1504, "Laboratory Notebook Recording Procedures."

4.0 Definitions

4.1 None

5.0 Procedure

5.1 Safety

5.1.1 All applicable safety and compliance guidelines set forth by IT Corporation and by federal, state, and local regulations must be followed during performance of this procedure. All work must be stopped in the event of a known or potential compromise to the health or safety of any ITAS Associate, and must be reported immediately to a laboratory supervisor.

5.1.2 All analytical logbooks must be kept free of chemical contamination while being used on benchtops, in field settings, etc.

5.2 Summary

5.2.1 All logbooks are the property of the International Technology Corporation (IT) Technology Development Laboratory (TDL). It is assigned to you so that you may keep a complete, careful, chronological record of your work. The work which you do and the data which you enter in this book are confidential; they must not be disclosed to unauthorized persons. The logbook's security and maintenance are your responsibility. In case of damage, loss, or

5.0 Procedure (continued)

disappearance, report the facts to your supervisor at once. When the logbook is filled, or upon termination of your employment, it must be returned to the laboratory quality/operation files.

5.3 Procedure

5.3.1 Briefly define in the front pages of the book what type of log is contained within. Definitions of column headings, references, and acceptance limits will be addressed on the first pages as well.

5.3.2 All entries are to be recorded directly into the logbook. Recording of original data on loose pieces of paper for later transcription into the logbook is to be avoided. Should loose paper be necessary for proper conduct of an experiment:

5.3.2.1 Write on the logbook page itself identification of what is affixed to that page

5.3.2.2 Firmly affix the loose paper with clear tape

5.3.2.3 Initial and date over the edge of the tape.

5.3.3 All entries must be made in black ink. Red ink is reserved for Quality Control (QC) checking purposes only. Erasures, blacking out, or use of correction fluid is not permitted. If a mistake is made, draw a single line through the erroneous material and make a corrected entry, initial, and date the correction.

5.3.4 It is necessary to fill each page and keep the sequence of entries in chronological order. Any unused section of a page will be cancelled with a diagonal line. Spaces intentionally left blank in tables or logs will contain horizontal lines.

5.3.5 When reference is made to samples, the TDL sample number will be used. Additional sample identification may be offered, but not to the exclusion of the TDL sample number.

5.3.6 Use a ruler to draw lines defining columns. Label columns including units when appropriate. Injection logs, balance logs, and other similar logs will include columns for the operators' initials and date.

5.3.7 Each entry in an analytical logbook is to be initialed and dated. The "Completed by" is signed by the last person to make entry on a given page and indicates that the page has been checked for completeness of entries.

6.0 Nonconformance and Corrective Action

6.1 A nonconformance is a deficiency in procedure sufficient to render the quality of an item unacceptable or indeterminate or any event which is beyond the limits documented and established for laboratory operation. A nonconformance may include data recording errors, transcription errors, and failure to document. A nonconformance memo associated with this procedure will be filed with the QC Coordinator.

7.0 Records Management

7.1 TDL Analytical Logbooks are the property of IT Corporation.

7.2 Document control of TDL Logbooks is handled by the QC Coordinator (QCC). The QCC will issue all notebooks. All completed logbooks will be returned to the QCC.

7.3 All returned Laboratory Logbooks are filed in TDL Central Files.

IT Analytical Services

Technology Development Laboratory Standard Operating Procedure

Title: Laboratory Notebook Recording Procedures

Prepared by: Patti B. Carswell Date: 2/7/91

Reviewed by: Bruce F. Wagner Date: 2/7/91
Technical Specialist

Patti B. Carswell Date: 2/7/91
Quality Control Coordinator

Janet M. Jones Date: 3-26-91
Director, Quality and Compliance, ITAS

Approved by: R. Miller Date: 3/27/91
Laboratory Director

Controlled Copy No: Uncontrolled

Key Words: NOTEBOOK

Revision #	0					
Date	1-21-91					

Technology Development Laboratory
304 Directors Drive ▪ Knoxville, Tennessee 37923 ▪ (615) 690-3211 ▪ FAX (615) 694-9573
IT Corporation is a wholly owned Subsidiary of International Technology Corporation.

1.0 Purpose and Application

1.1 The purpose of this method is to describe the required methods of data entry in Technology Development Laboratory notebooks.

1.2 This procedure applies to laboratory notebooks used for project-specific and non-project-specific documentation.

1.3 The purpose of each entry in your notebook is to provide a complete record of your work, one that would enable a co-worker to repeat, if necessary, exactly what you did and produce the same results, without having to ask any questions.

2.0 References

2.1 Writing the Laboratory Notebook, Howard M. Kanare, 1985.

3.0 Associated SOPs and Applicable Methods

3.1 ITAS SOP No. TDL1503, "Analytical Logbook Recording Procedures."

4.0 Definitions

4.1 None

5.0 Procedure

5.1 Safety

5.1.1 All applicable safety and compliance guidelines set forth by IT Corporation and by federal, state, and local regulations must be followed during performance of this procedure. All work must be stopped in the event of a known or potential compromise to the health or safety of any ITAS Associate, and must be reported immediately to a laboratory supervisor.

5.1.2 All laboratory notebooks must be kept free of chemical contamination while being used on benchtops, in field settings, etc.

5.2 Summary

5.2.1 All laboratory notebooks are the property of the International Technology Corporation (IT) Technology Development Laboratory (TDL). It is assigned to you so that you may keep a complete, careful, chronological record of your work. The work which you do and the data which you enter in the notebook are confidential; they must not be disclosed to unauthorized persons. The notebook's security and maintenance are your responsibility. In case of damage, loss, or disappearance, report the

5.0 Procedure (continued)

facts to your supervisor at once. When the notebook is filled or upon termination of your employment, it must be returned to the laboratory quality/operation files.

5.3 Procedure

5.3.1 All data is to be recorded directly into the notebook. Recording of original data on loose pieces of paper for later transcription into the logbook is to be avoided. Should loose paper be necessary for proper conduct of an experiment:

5.3.1.1 Write on the logbook page itself identification of what is affixed to that page.

5.3.1.2 Firmly affix the loose paper with clear tape

5.3.1.3 Initial and date over the edge of the tape.

5.3.2 All entries must be made in black ink. Red ink is reserved for Quality Control (QC) checking purposes only. Erasures, blacking out, or use of correction fluid is not permitted. If a mistake is made, draw a single line through the erroneous material and make a corrected entry, initial, and date the correction.

5.3.3 It is necessary to fill each page and keep the sequence of entries in chronological order. Several pages may be reserved for a particular experiment. However, if the continuity of pages for a particular experiment is broken for lack of reserved space, notations will be made on both sides of the break. The unused balance of a page will be cancelled by a diagonal line. Spaces intentionally left blank in tables or logs will contain horizontal lines.

5.3.4 Stock or standard solutions must reference:

5.3.4.1 Source
5.3.4.2 Lot number
5.3.4.3 Date received
5.3.4.4 Notebook and page numbers whenever available.

5.3.5 When reference is made to samples, the TDL sample number must be used. Additional sample identification may be offered, but not to the exclusion of the TDL sample number.

5.3.6 A co-worker performs a QC check on your calculations by recalculating 20 percent and verifying the formula used. Have him make a check in red ink beside each answer which was recalculated and sign and date

5.0 Procedure (continued)

calculations that lead to the generation of a result which is reported to the client either verbally or in writing. Any values which have not had a 20 percent QC check (one of every five calculations has been checked) are considered "preliminary" and will be marked as such on any material leaving the TDL lab. If an error is found during the 20 percent check, then a 100 percent QC check will be performed.

5.3.7 If one of your co-workers has witnessed an experiment you have conducted, to an extent that enables him to state of his own knowledge what you did and what results you secured, have him sign and date the notebook page(s) as "Witnessed and understood by." If the experiment seems to you to be of sufficient importance (i.e., is potentially patentable), arrange to have it witnessed for content and date of entry.

5.4 Project Documentation Requirements

5.4.1 Every page of the notebook will contain project name, project number, date, and initials of persons entering data. Each project will then be described by the following entries:

5.4.1.1 Objective - briefly describe the planned experiment and the expected or desired result.

5.4.1.2 Plan - give an overview of what you intend to do.

5.4.1.3 Calibrations and Standards - list frequency of calibration, acceptance limits, and concentrations.

5.4.1.4 Analytical Methods - state SOP, standard reference or give a brief description.

5.4.1.5 Experimental Set-ups - sketch and describe the set-up.

5.4.1.6 Data and Observations - provide tables including units and space for observations within or below.

5.4.1.7 Results - include formula and calculations which are necessary to produce results from raw data.

5.4.1.8 Conclusion - how objective was met and any interpretation of results.

3527

6.0 Nonconformance and Corrective Action

6.1 A nonconformance is a deficiency in procedure sufficient to render the quality of an item unacceptable or indeterminate or any event which is beyond the limits documented and established for laboratory operation. A nonconformance may include data recording errors, transcription errors, and failure to document. A nonconformance memo associated with this procedure will be filed with the QC Coordinator.

7.0 Records Management

7.1 TDL Notebooks are the property of IT Corporation.

7.2 Document control of TDL Notebooks is handled by the QC Coordinator (QCC). The QCC will issue all notebooks. All completed notebooks will be returned to the QCC.

7.3 All returned Laboratory Notebooks are filed in TDL Central Files.

INTERNATIONAL TECHNOLOGY CORPORATION

IT Analytical Services

Technology Development Laboratory Standard Operating Procedure

Title: STANDARD LABORATORY SIEVES : SPECIFICATION, CALIBRATION, AND MAINTENANCE

Prepared by: Coy A. Lauer Date: March 5, 1991

Reviewed by: Tom Leist Date: 3/6/91
Technical Specialist

Patti B. Carswell Date: 3/13/91
Quality Control Coordinator

Janet M Jones Date: 6-24-91
Director, Quality and Compliance, ITAS

Approved by: John H Hall Date: 7/5/91
Laboratory Director

Controlled Copy No: Uncontrolled

Key Words: Sieve, ASTM E 11-87, Geotechnical

Revision #	0					
Date	03/05/91					

Regional Office
1570 Bear Creek Road • Oak Ridge, Tennessee 37830-1329 • 615-482-7075 and 1-800-727-7075

IT Corporation is a wholly owned subsidiary of International Technology Corporation

LABORATORY SIEVES
SPECIFICATION, CALIBRATION, AND MAINTENANCE

1.0 Purpose and Application

1.1 This SOP defines the standards for standard laboratory sieves used in the Geotechnical Analysis Laboratory. It also describes calibration requirements and maintenance of the sieves.

2.0 References

2.1 ASTM E 11-87, Standard Specification For Wire Cloth Sieves For Testing Purposes.

3.0 Associated SOPs

3.1 None.

4.0 Definitions

4.1 None.

5.0 Procedure

5.1 All standard sieves will meet the specifications in ASTM E 11-87, Standard Specifications for Wire Cloth Sieves For Testing Purposes. Upon receipt, each sieve will be checked for a label which has the ASTM specification, sieve size, and a identification number or serial number. If the ASTM specification is not on the sieve, that sieve will be returned to the vendor and not used. If the sieve size or a serial number is not on the label, prepare a permanent label with the appropriate information and affix it to the side of the sieve. Due to the corrosive nature of some samples, brass sieves with stainless steel mesh are preferred.

5.2 Sieves put into use prior to this SOP do not require a serial number.

5.3 Calibration certificates should be provided by the manufacturer. If a calibration certificate did not come with the sieve, either return it, or get a certificate from the vendor. Calibration certificates will be kept in the Quality/Operations files maintained

by the lab QC Coordinator.

5.4 If a sieve calibration is suspect, it shall be either checked or replaced. Due to the amount of time involved in checking sieve calibration, replacement is usually the preferred alternative. AASHTO proficiency samples may also be used as an indication of sieve calibration. If the results from a proficiency sample are too far out of line (as determined by the lab supervisor), the suspect sieve shall be pulled for calibration or replacement.

5.5 Sieves with a mesh size of #200 or smaller will be replaced one year after initially being placed into service. Each sieve will be labeled with the replacement date at the time it is placed into service.

5.6 Prior to use, each sieve will be visually inspected for holes, broken mesh, or any other condition which may make the sieve unsuitable for use. Sieves which are clogged will be cleaned with a suitable brush. Caution shall be used when cleaning fine sieves with a wire bristle brush as this may damage the sieve. Any sieve deemed unsuitable for use will be immediately discarded.

5.7 Sieves used in washing samples or sieves used with corrosive samples will be cleaned with water and a brush after use. It may be useful to place the sieve in a drying oven (<120 °C) to dry. This will help to keep corrosion to a minimum.

5.8 Sieves will be stored in a clean, dry environment.

6.0 <u>Nonconformance and Corrective Action</u>

6.1 Sieves which do not meet the required specifications, are damaged, or otherwise unsuitable for use will be discarded or returned to the vendor if newly purchased. If a sieve is discovered nonuseable during use, the sample(s) will be retested and a nonconformance memo generated to describe the problem with the sieve and the fact that the sample(s) are being retested.

7.0 Records Management/Documentation

7.1 Sieve calibration records will be kept in the Quality/Operations files by the QA coordinator.

STANDARD OPERATING PROCEDURE

ITAS-TECHNOLOGY DEVELOPMENT LABORATORY

TITLE:	
UNCONFINED COMPRESSIVE STRENGTH	SOP NO: TDL1109 DATE INITIATED: 7/31/89 REVISION NO: 1 DATE REVISED: 3/28/90 PAGE 1 OF 19

PREPARED BY	APPROVED BY	DATE	QA CONCURRENCE	DATE
John F. McGahan	E. Allen	3/28/90	Janet M. Jones	9-4-90

1.0 Purpose and Application

1.1 This test method covers the determination of the unconfined compressive strength of cohesive soil in the undisturbed, remolded, or compacted condition using strain-controlled application of the axial load.

1.2 This test method provides an approximate value of the strength of cohesive soils in terms of total stresses.

1.3 This test method is applicable only to cohesive materials which will not expel bleed water during the loading portion of the test and which will retain intrinsic strength after removal of confining pressures, such as clays or cemented soils.

2.0 References

2.1 Annual Book of ASTM Standards. 1988. "Soil and Rock; Building Stones; Geotextiles. Vol. 4.08.

3.0 Associated SOPs and Applicable Methods

3.1 ASTM D-422.

3.2 ASTM D-854.

3.3 ASTM D-2216.

3.4 ASTM D-2850.

3.0 Associated SOPs and Applicable Methods (continued)

3.5 ASTM D-4220.

3.6 ASTM D-4318.

4.0 Definitions

4.1 Unconfined compressive strength - the compressive stress at which an unconfined cylindrical specimen of soil will fail in a simple compression test.

4.2 Shear strength - for unconfined compressive strength test specimens, the shear strength is calculated to be one-half of the compressive stress at failure.

4.3 Bleed water - water expelled from the soil due to deformation or compaction.

5.0 Procedure

5.1 ASTM Standard Method D-2166.

6.0 Nonconformance and Corrective Action

6.1 If this procedure cannot be followed for any reason, a nonconformance memo will be filed with the Quality Control Coordinator. Corrective action will be approved by the Operations or Project Manager.

7.0 Records Management

7.1 Data is to be recorded in a standard laboratory notebook with the project it pertains to clearly labeled on the notebook page.

Designation: D 2166 - 85

Standard Test Method for UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL[1]

This standard is issued under the fixed designation D 2166; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the determination of the unconfined compressive strength of cohesive soil in the undisturbed, remolded, or compacted condition, using strain-controlled application of the axial load.

1.2 This test method provides an approximate value of the strength of cohesive soils in terms of total stresses.

1.3 This test method is applicable only to cohesive materials which will not expel bleed water (water expelled from the soil due to deformation or compaction) during the loading portion of the test and which will retain intrinsic strength after removal of confining pressures, such as clays or cemented soils. Dry and crumbly soils, fissured or varved materials, silts, peats, and sands cannot be tested with this method to obtain valid unconfined compression strength values.

NOTE 1.—The determination of the unconsolidated, undrained strength of cohesive soils with lateral confinement is covered by Test Method D 2850.

1.4 This test method is not a substitute for Test Method D 2850.

1.5 The values stated in SI units are to be regarded as the standard. The values stated in inch-pound units are approximate.

1.6 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Applicable Documents

2.1 *ASTM Standards:*

D 422 Method for Particle-Size Analysis of Soils[2]

D 653 Terms and Symbols Relating to Soil and Rock[2]

D 854 Test Method for Specific Gravity of Soils[2]

D 1587 Practice for Thin-Walled Tube Sampling of Soils[2]

D 2216 Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures[2]

D 2487 Test Method for Classification of Soils for Engineering Purposes[2]

D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)[2]

D 2850 Test Method for Unconsolidated, Undrained Compressive Strength of Cohesive Soils in Triaxial Compression[2]

D 4220 Practices for Preserving and Transporting Soil Samples[2]

D 4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils[2]

3. Terminology

3.1 Refer to Terms and Symbols D 653 for standard definitions of terms.

---

[1] This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.05 on Structural Properties of Soils.

Current edition approved July 26, 1985. Published September 1985. Originally published as D 2166 - 63T. Last previous edition D 2166 - 66 (1979)[ε1].

[2] *Annual Book of ASTM Standards*, Vol 04.08.

3.2 *Descriptions of Terms Specific to this Standard:*

3.2.1 *unconfined compressive strength (q_u)*—the compressive stress at which an unconfined cylindrical specimen of soil will fail in a simple compression test. In this test method, unconfined compressive strength is taken as the maximum load attained per unit area or the load per unit area at 15 % axial strain, whichever is secured first during the performance of a test.

3.2.2 *shear strength (s_u)*—for unconfined compressive strength test specimens, the shear strength is calculated to be ½ of the compressive stress at failure, as defined in 3.2.1.

4. Significance and Use

4.1 The primary purpose of the unconfined compression test is to quickly obtain the approximate compressive strength of soils that possess sufficient cohesion to permit testing in the unconfined state.

4.2 Samples of soils having slickensided or fissured structure, samples of some types of loess, very soft clays, dry and crumbly soils and varved materials, or samples containing significant portions of silt or sand, or both (all of which usually exhibit cohesive properties), frequently display higher shear strengths when tested in accordance with Test Method D 2850. Also, unsaturated soils will usually exhibit different shear strengths when tested in accordance with Test Method D 2850.

4.3 If both an undisturbed and a remolded test are performed on the same sample, the sensitivity of the material can be determined. This method of determining sensitivity is suitable only for soils that can retain a stable specimen shape in the remolded state.

NOTE 2—For soils that will not retain a stable shape, a vane shear test or Test Method D 2850 can be used to determine sensitivity.

5. Apparatus

5.1 *Compression Device*—The compression device may be a platform weighing scale equipped with a screw-jack-activated load yoke, a hydraulic loading device, or any other compression device with sufficient capacity and control to provide the rate of loading prescribed in 7.1. For soil with an unconfined compressive strength of less than 100 kPa (1.0 ton/ft^2) the compression device shall be capable of measuring the compressive stress to within 1 kPa (0.01 ton/ft^2). For soil with an unconfined compressive strength of 100 kPa (1.0 ton/ft^2) or greater, the compression device shall be capable of measuring the compressive stress to the nearest 5 kPa (0.05 ton/ft^2).

5.2 *Sample Extruder*, capable of extruding the soil core from the sampling tube in the same direction of travel in which the sample entered the tube, at a uniform rate, and with negligible disturbance of the sample. Conditions at the time of sample removal may dictate the direction of removal, but the principal concern is to keep the degree of disturbance negligible.

5.3 *Deformation Indicator*—The deformation indicator shall be a dial indicator graduated to 0.03 mm (0.001 in.) or better and having a travel range of at least 20 % of the length of the test specimen, or some other measuring device, such as an electronic deformation measuring device, meeting these requirements.

5.4 *Dial Comparator*, or other suitable device, for measuring the physical dimensions of the specimen to within 0.1 % of the measured dimension.

NOTE 3—Vernier calipers are not recommended for soft specimens, which will deform as the calipers are set on the specimen.

5.5 *Timer*—A timing device indicating the elapsed testing time to the nearest second shall be used for establishing the rate of strain application prescribed in 7.1.

5.6 *Balance*—The balance used to weigh specimens shall determine the mass of the specimen to within 0.1 % of its total mass.

5.7 *Equipment*, as specified in Method D 2216.

5.8 *Miscellaneous Apparatus*, including specimen trimming and carving tools, remolding apparatus, water content cans, and data sheets, as required.

6. Preparation of Test Specimens

6.1 *Specimen Size*—Specimens shall have a minimum diameter of 30 mm (1.3 in.) and the largest particle contained within the test specimen shall be smaller than one tenth of the specimen diameter. For specimens having a diameter of 72 mm (2.8 in.) or larger, the largest particle size shall be smaller than one sixth of the specimen diameter. If, after completion of a test on

an undisturbed specimen, it is found, based on visual observation, that larger particles than permitted are present, indicate this information in the remarks section of the report of test data (Note 4). The height-to-diameter ratio shall be between 2 and 2.5. Determine the average height and diameter of the test specimen using the apparatus specified in 5.4. Take a minimum of three height measurements (120° apart), and at least three diameter measurements at the quarter points of the height.

NOTE 4—If large soil particles are found in the sample after testing, a particle-size analysis performed in accordance with Method D 422 may be performed to confirm the visual observation and the results provided with the test report.

6.2 *Undisturbed Specimens*—Prepare undisturbed specimens from large undisturbed samples or from samples secured in accordance with Practice D 1587 and preserved and transported in accordance with the practices for Group C samples in Practices D 4220. Tube specimens may be tested without trimming except for the squaring of ends, if conditions of the sample justify this procedure. Handle specimens carefully to prevent disturbance, changes in cross section, or loss of water content. If compression or any type of noticeable disturbance would be caused by the extrusion device, split the sample tube lengthwise or cut it off in small sections to facilitate removal of the specimen without disturbance. Prepare carved specimens without disturbance, and whenever possible, in a humidity-controlled room. Make every effort to prevent any change in water content of the soil. Specimens shall be of uniform circular cross section with ends perpendicular to the longitudinal axis of the specimen. When carving or trimming, remove any small pebbles or shells encountered. Carefully fill voids on the surface of the specimen with remolded soil obtained from the trimmings. When pebbles or crumbling result in excessive irregularity at the ends, cap the specimen with a minimum thickness of plaster of paris, hydrostone, or similar material. When sample condition permits, a vertical lathe that will accommodate the total sample may be used as an aid in carving the specimen to the required diameter. Where prevention of the development of appreciable capillary forces is deemed important, seal the specimen with a rubber membrane, thin plastic coatings, or with a coating of grease or sprayed plastic immediately after preparation and during the entire testing cycle. Determine the mass and dimensions of the test specimen. If the specimen is to be capped, its mass and dimensions should be determined before capping. If the entire test specimen is not to be used for determination of water content, secure a representative sample of cuttings for this purpose, placing them immediately in a covered container. The water content determination shall be performed in accordance with Method D 2216.

6.3 *Remolded Specimens*—Specimens may be prepared either from a failed undisturbed specimen or from a disturbed sample, providing it is representative of the failed undisturbed specimen. In the case of failed undisturbed specimens, wrap the material in a thin rubber membrane and work the material thoroughly with the fingers to assure complete remolding. Avoid entrapping air in the specimen. Exercise care to obtain a uniform density, to remold to the same void ratio as the undisturbed specimen, and to preserve the natural water content of the soil. Form the disturbed material into a mold of circular cross section having dimensions meeting the requirements of 6.1. After removal from the mold, determine the mass and dimensions of the test specimens.

6.4 *Compacted Specimens*—Specimens shall be prepared to the predetermined water content and density prescribed by the individual assigning the test (Note 5). After a specimen is formed, trim the ends perpendicular to the longitudinal axis, remove from the mold, and determine the mass and dimensions of the test specimen.

NOTE 5—Experience indicates that it is difficult to compact, handle, and obtain valid results with specimens that have a degree of saturation that is greater than 90 %.

7. Procedure

7.1 Place the specimen in the loading device so that it is centered on the bottom platen. Adjust the loading device carefully so that the upper platen just makes contact with the specimen. Zero the deformation indicator. Apply the load so as to produce an axial strain at a rate of ½ to 2 %/min. Record load, deformation, and time values at sufficient intervals to define the shape of the stress-strain curve (usually 10 to 15 points are sufficient). The rate of strain should be chosen so that the time to failure does not exceed about

15 min (Note 6). Continue loading until the load values decrease with increasing strain, or until 15 % strain is reached. The rate of strain used for testing sealed specimens may be decreased if deemed desirable for better test results. Indicate the rate of strain in the report of the test data, as required in 9.1.7. Determine the water content of the test specimen using the entire specimen, unless representative cuttings are obtained for this purpose, as in the case of undisturbed specimens. Indicate on the test report whether the water content sample was obtained before or after the shear test, as required in 9.1.2.

NOTE 6—Softer materials that will exhibit larger deformation at failure should be tested at a higher rate of strain. Conversely, stiff or brittle materials that will exhibit small deformations at failure should be tested at a lower rate of strain.

7.2 Make a sketch, or take a photo, of the test specimen at failure showing the slope angle of the failure surface if the angle is measurable.

7.3 A copy of a sample data sheet is included in Appendix X1. Any data sheet can be used, provided the form contains all the required data.

8. Calculations

8.1 Calculate the axial strain, ϵ_1, to the nearest 0.1 %, for a given applied load, as follows:

$$\epsilon_1 = \Delta L / L_0$$

where:

ΔL = length change of specimen as read from deformation indicator, mm (in.), and

L_0 = initial length of test specimen, mm (in.).

8.2 Calculate the average cross-sectional area, A, for a given applied load, as follows:

$$A = A_0/(1 - \epsilon_1)$$

where:

A_0 = initial average cross-sectional area of the specimen, mm² (in.²), and

ϵ_1 = axial strain for the given load, %.

8.3 Calculate the compressive stress, σ_c, to three significant figures, or nearest 1 kPa (0.01 ton/ft²), for a given applied load, as follows:

$$\sigma_c = (P/A)$$

where:

P = given applied load, kPa (ton/ft²),

A = corresponding average cross-sectional area mm² (in.²).

8.4 *Graph*—If desired, a graph showing the relationship between compressive stress (ordinate) and axial strain (abscissa) may be plotted. Select the maximum value of compressive stress, or the compressive stress at 15 % axial strain, whichever is secured first, and report as the unconfined compressive strength, q_u. Whenever it is considered necessary for proper interpretation, include the graph of the stress-strain data as part of the data reported.

8.5 If the unconfined compressive strength is determined, the sensitivity, S_T, is calculated as follows:

$$S_T = \frac{q_u \text{ (undisturbed specimen)}}{q_u \text{ (remolded specimen)}}$$

9. Report

9.1 The report should include the following:

9.1.1 Identification and visual description of the specimen, including soil classification, symbol, and whether the specimen is undisturbed, remolded, compacted, etc. Also include specimen identifying information, such as project, location, boring number, sample number, depth, etc. Visual descriptions shall be made in accordance with Practice D 2488.

9.1.2 Initial dry density and water content (specify if the water content specimen was obtained before or after shear, and whether from cuttings or the entire specimen).

9.1.3 Degree of saturation (Note 7), if computed.

NOTE 7—The specific gravity determined in accordance with Test Method D 854 is required for calculation of the degree of saturation.

9.1.4 Unconfined compressive strength and shear strength.

9.1.5 Average height and diameter of specimen.

9.1.6 Height-to-diameter ratio.

9.1.7 Average rate of strain to failure, %.

9.1.8 Strain at failure, %.

9.1.9 Liquid and plastic limits, if determined, in accordance with Test Method D 4318.

9.1.10 Failure sketch or photo.

9.1.11 Stress-strain graph, if prepared.

9.1.12 Sensitivity, if determined.

9.1.13 Particle size analysis, if determined, in accordance with Method D 422, and

9.1.14 *Remarks*—Note any unusual conditions or other data that would be considered necessary to properly interpret the results obtained, for example, slickensides, stratification.

shells, pebbles, roots, or brittleness, the type of failure (that is, bulge, diagonal shear, etc.).

10. Precision and Bias

10.1 No method presently exists to evaluate the precision of a group of unconfined compression tests on undisturbed specimens due to specimen variability. Undisturbed soil specimens from apparently homogeneous soil deposits at the same location often exhibit significantly different strength and stress-strain properties.

10.2 A suitable test material and method of specimen preparation have not been developed for the determination of laboratory variances due to the difficulty in producing identical cohesive soil specimens. No estimates of precision for this test method are available.

APPENDIX

(Nonmandatory Information)

X1. Example Data Sheet

UNCONFINED COMPRESSION TEST—UI

Name _____ Date _____ Job No. _____

Location _____

Boring No. _____ Sample No. _____ Depth/Elev. _____

Description of Sample _____

_____

Proving Ring No. _____ Apparatus No. _____

Water Content Determination

Tare No. _____

Wt. Specimen Wet + Tare _____

Wt. Specimen Dry + Tare _____

Wt. Water _____

Wt. Tare _____

Wt. Specimen Wet _____

Wt. Specimen Dry _____

Water Content in % Dry Wt.

at 105°C _____

Wet Density _____

Dry Density _____

Unconfined Compressive Strength

Initial Diameter D_o _____

Initial Area A_o _____

Initial Height L_o _____

Initial Volume V_o _____

Specific Gravity _____

$$\text{Stress} = \frac{\text{Load}}{\text{Corr. Area}}$$

Data sheet continued

3527

D 2166

Test Data

Unit Strain $\frac{\Delta L}{L_o}$ $\frac{L}{D}$ = _____ Corr. Area = $\frac{A_o}{1 - \text{Unit Strain}}$

Elapsed Time-min	Load Dial	Axial Load	Strain Dial	Total Strain	Unit Strain	Corrected Area	Stress	

Type of Sample _____

Attach a photo or sketch of the specimen after failure to this form

Strain Rate _____ %/Min

Remarks _____

APPENDIX XI:

UNCONFINED COMPRESSION TEST

1. INTRODUCTION. The unconfined compression test is used to measure the unconfined compressive strength of a cohesive soil. The unconfined compression test is applicable only to coherent materials such as saturated clays or cemented soils that retain intrinsic strength after removal of confining pressure; it is not a substitute for the Q test. Dry or crumbly soils, fissured or varved materials, silts, and sands cannot be tested meaningfully in unconfined compression. In this test, a laterally unsupported cylindrical specimen is subjected to a gradually increased axial compression load until failure occurs. The unconfined compression test is a form of triaxial test in which the major principal stress is equal to the applied axial stress, and the intermediate and minor principal stresses are equal to zero. The unconfined compressive strength, q_u, is defined as the maximum unit axial compressive stress at failure or at 15 percent strain, whichever occurs first. The undrained shear strength, s_u, is assumed to be equal to one-half the unconfined compressive strength. The axial load may be applied to the specimen either by the controlled strain procedure, in which the stress is applied to produce a predetermined rate of strain, or by the controlled stress procedure, in which the stress is applied in predetermined increments of load.

2. APPARATUS. The apparatus consists of the following:

a. Equipment for Preparing Specimen. A trimming frame as described in paragraph 3e of Appendix X, TRIAXIAL COMPRESSION TESTS, or a trimming cylinder with beveled cutting edges may be used for trimming specimens. The equipment should include wire saws and knives of various sizes and types for use with the trimming frame. A motorized soil lathe may be used advantageously under certain circumstances. A miter box or cradle is required to trim the specimen to a fixed length and to ensure that the ends of the specimen are parallel with each other and perpendicular to the vertical axis of the specimen.

b. Loading Device. A number of commercially available controlled-strain or controlled-stress types of loading devices are suitable for applying the axial loads in the unconfined compression test. In

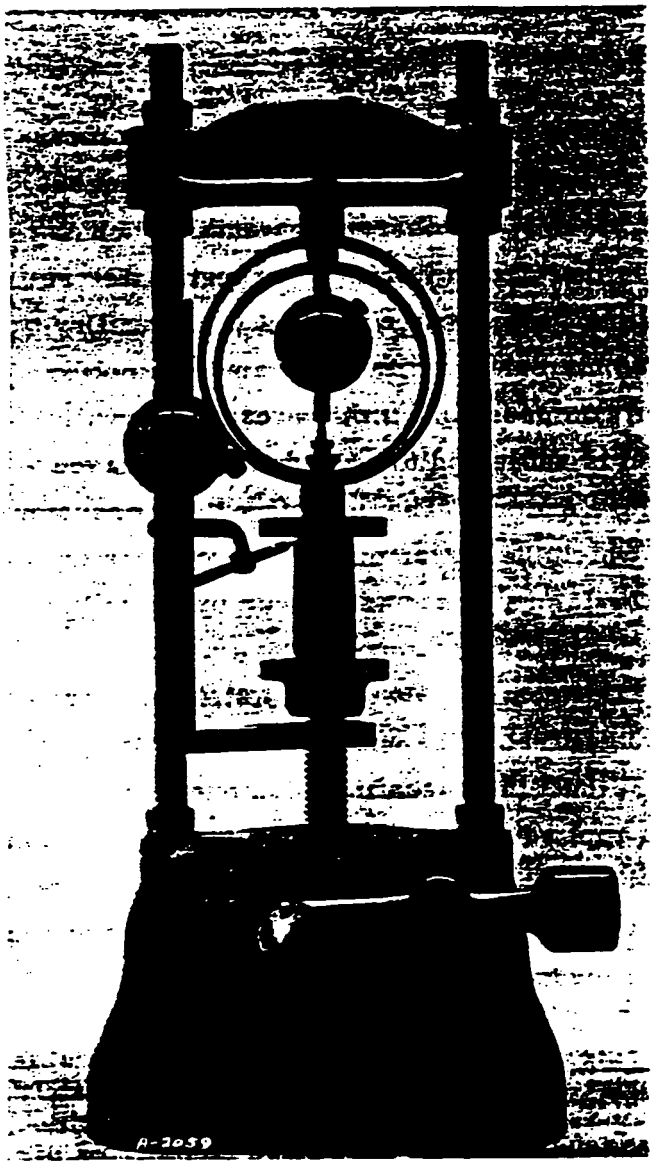


Figure 1. Typical unconfined compression test apparatus

general, controlled-strain type loading devices are preferable, and the procedures described herein are based on the use of this type of equipment. If available, an automatic stress-strain recorder may be used to measure and record applied axial loads and displacements. A typical loading device is shown in Figure 1. Any equipment used should be calibrated so that the loads actually applied to the soil specimen can be determined. The required sensitivity of stress-measuring equipment for both controlled-stress and controlled-strain testing will vary with the strength characteristics of the soil. For relatively weak soils (compressive strengths less than 1.0 ton per sq ft), the unit load should be measurable to within 0.01 ton per sq ft. For soils with compressive strengths of 1.0 ton per sq ft or greater, the loads should be measurable to the nearest 0.05 ton per sq ft.

c. Measuring equipment, such as dial indicators and calipers, suitable for measuring the dimensions and axial deformation of a specimen

to the nearest 0.001 in.

d. Timing device. either a watch or clock with second hand.

e. Balances. sensitive to 0.1 g.

f. Other. Apparatus necessary to determine water content and specific gravity (see Appendixes I, WATER CONTENT - GENERAL, and IV, SPECIFIC GRAVITY).

3. PREPARATION OF SPECIMENS. a. Specimen Size. Unconfined compression specimens shall have a minimum diameter of 1.0 in. (preferably 1.4 in.), and the largest particle in any test specimen will be no greater than one-sixth the specimen diameter. The height-to-diameter ratio shall be not less than 2.1. Commonly used diameters of unconfined compression specimens are 1.4 and 2.8 in. Specimens of 1.4-in. diameter are generally used for testing cohesive soils which contain a negligible amount of gravel.

b. Undisturbed Specimens. Generally, undisturbed specimens are prepared from undisturbed tube or chunk samples of a larger size than the test specimen. Core or thin-wall tube samples of relatively small diameter may be tested without further trimming except for squaring the ends, if the condition of the soil requires this procedure. Specimens must be handled carefully to prevent remolding, changes in cross section, or loss of moisture. To minimize disturbance caused by skin friction between samples and metal sampling tubes, the tubes should be cut into short lengths before ejecting the samples. Sample ejection should be accomplished with a smooth continuous, and fairly rapid motion in the same direction that the sample entered the tube. All specimens shall be prepared in a humid room to prevent evaporation of moisture. The specimen shall be prepared as follows:

(1) From the undisturbed sample cut a section somewhat larger in length and diameter than the desired specimen size.

It is generally desirable to prepare duplicate specimens for unconfined compression testing, and selection of material for testing should be made with this in mind.

(2) Carefully trim the specimen to the required diameter using a trimming frame and various trimming tools (see Fig. 7, Appendix X, TRIAXIAL COMPRESSION TESTS). Remove any small shells or pebbles encountered during the trimming operations. Carefully fill voids on the surface of the specimen with remolded soil obtained from the trimmings. Cut the specimen to the required length, using a miter box (see Fig. 8, Appendix X, TRIAXIAL COMPRESSION TESTS). Where the presence of pebbles or crumbling results in excessive irregularity at the ends, cap the specimens with a minimum thickness of plaster of Paris, hydrostone, or other support material. Care must be taken to insure that the ends of the specimen are parallel with each other and perpendicular to the vertical axis of the specimen.

(3) From the soil trimmings obtain 200 g of material for specific gravity and water content determinations (see Appendixes I, WATER CONTENT - GENERAL, and IV, SPECIFIC GRAVITY).

(4) Weigh the specimen to an accuracy of ±0.01 g for 1.4-in.-diameter specimens and ±0.1 g for 2.8-in.-diameter specimens. If specimens are to be capped, they should be weighed before capping.

(5) Measure the height of the specimen with calipers or a scale and the diameter with calipers or circumference measuring devices. If the specimen is cut to a fixed length in a miter box, the length of the miter box can be taken as the height of specimen for routine tests, and additional height measurements are not usually necessary. It is always advisable to measure the diameter of the specimen after trimming, even though specimens are cut to a nominal diameter in a trimming frame. Make all measurements to the nearest ±0.01 in. Determine the average initial diameter, D_o, of the specimen using the diameters measured at the top, D_t, center, D_c, and bottom, D_b, of the specimen, as follows:

$$D_o = \frac{D_t + 2D_c + D_b}{4}$$

(6) If the specimen is not tested immediately after preparation, precautions must be taken to prevent drying and consequent development of capillary stresses. When drying before or during the test is anticipated, the specimen may be covered with a thin coating of grease such as petrolatum. This coating cannot be used if the specimen is to be used in a subsequent remolded test.

c. Remolded Specimens. Remolded specimens usually are prepared in conjunction with tests made on undisturbed specimens after the latter has been tested to failure. The remolded specimens are tested to determine the effects of remolding on the shear strength of the soil. The remolded specimen should have the same water content as the undisturbed specimen in order to permit a comparison of the results of the tests on the two specimens. The remolded specimen shall be prepared as follows:

(1) Place the failed undisturbed specimen in a rubber membrane and knead it thoroughly with the fingers to assure complete remolding of the specimen. Take reasonable care to avoid entrapping air in the specimen and to obtain a uniform density.

(2) Remove the soil from the membrane and compact it in a cylindrical mold with inside dimensions identical with those of the undisturbed specimen. The compaction effort is not critical since the water contents of soils subjected to remolded tests are always considerably wetter than optimum. Care must be taken, however, to insure uniform density throughout the specimen. A thin coat of petrolatum on the inside of the molding cylinder will assist in the removal of the specimen after compaction.

(3) Carefully remove the specimen from the mold, preferably by means of a close fitting piston, and plane off the top of the specimen. The specimen is then ready for testing.

(4) Follow the steps outlined in paragraphs 3b(4) and 3b(5).

4. PROCEDURE. The procedure shall consist of the following steps:

a. Record all identifying information for the sample such as project, boring number, visual classification, and other pertinent data on the data sheet (see Plate XI-1 which is a suggested form). The data sheet is also used for recording test observations described below.

b. Place the specimen in the loading device so that it is centered on the bottom platen; then adjust the loading device carefully so that the loading ram or upper platen barely is in contact with the specimen. If a proving ring is used for determining the axial load, contact of the platen and specimen is indicated by a slight deflection of the proving ring dial. Attach a dial indicator, sensitive to 0.001 in., to the loading ram to measure vertical deformation of the specimen. Record the initial reading of the dial indicator on the data sheet (Plate XI-1). Test the specimen at an axial strain rate of about 1 percent per minute. For very stiff or brittle materials which exhibit small deformations at failure, it may be desirable to test the specimen at a slower rate of strain. Observe and record the resulting load corresponding to increments of 0.3 percent strain for the first 3 percent of strain and in increments of 1 or 2 percent of strain thereafter. Stop the test when the axial load remains constant or when 20 percent axial strain has been produced.

c. Record the duration of the test, in minutes, to peak strength (time to failure), type of failure (shear or bulge), and a sketch of specimen after failure on the data sheet (Plate XI-2).

d. After the test, place the entire specimen or a representative portion thereof in a container of known weight and determine the water content of the specimen in accordance with Appendix I, WATER CONTENT - GENERAL.

5. COMPUTATIONS. The computations consist of the following steps:

a. From the observed data, compute and record on the data sheet (Plate XI-1) the water content, volume of solids, void ratio, degree of

saturation, and dry density, using the formulas presented in Appendix II, UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION.

b. Compute and record on the data sheet the axial strain, the corrected area, and the compressive stress, at each increment of strain by using the following formulas:

$$\text{Axial strain, } \varepsilon = \frac{\Delta H}{H_o}$$

$$\text{Corrected area of specimen, } A_{corr}\text{, sq cm} = \frac{A_o}{1 - \varepsilon}$$

$$\text{Compressive stress, tons per sq ft} = \frac{P}{A_{corr}} \times 0.465$$

where

ΔH = change in height of specimen during test, cm

H_o = initial height of specimen, cm

A_o = initial area of specimen, sq cm

P = applied axial load, lb

6. PRESENTATION OF RESULTS. The results of the unconfined compression test shall be recorded on the report form shown as Plate XI-2. Pertinent information regarding the condition of the specimen, method of preparing the specimen, or any unusual features of each specimen (such as slickensides, stratification, shells, pebbles, roots, or brittleness) should be shown under "Remarks." The applied compressive stress shall be plotted versus the axial strain in Plate XI-2. The unconfined compressive strength, q_u, of the specimen shall be taken as the maximum or peak compressive stress. For tests continued to 20 percent strain without reduction of axial load occurring, the unconfined compressive strength as a rule shall be taken as the compressive stress at 15 percent strain.

Where the unconfined compressive strength of a specimen is also obtained after remolding, the sensitivity ratio, S_t, shall also be calculated and reported. The sensitivity ratio is defined as follows:

$$S_t = \frac{q_u \text{ (undisturbed)}}{q_u \text{ (remolded)}}.$$

7. POSSIBLE ERRORS. Following are possible errors that would cause inaccurate determinations of unconfined compressive strength:

a. Test not appropriate to type of soil.

b. Specimen disturbed while trimming.

c. Loss of initial water content. A small change in water content can cause a larger change in the strength of a clay, so it is essential that every care be taken to protect the specimen against evaporation while trimming and measuring, during the test, and when remolding a specimen to determine the sensitivity.

d. Rate of strain or rate of loading too fast.

8. USE OF OTHER TYPES OF EQUIPMENT FOR UNDRAINED SHEAR STRENGTH DETERMINATIONS. Various other types of laboratory equipment, such as cone penetrometers and vane shear apparatus, may be used advantageously in the laboratory as a supplement to the basic unconfined compression test equipment for determining the undrained shear strength of cohesive soils. The use of these testing devices generally results in savings in cost and time. However, the devices should be used with caution until sufficient data and procedural details are established to assure their successful application. Use of such testing apparatus, as a rule,

should be preceded by careful correlations with the results of tests with the basic unconfined compression test equipment on the same type of soil, and correlations developed for a given type of soil should not be used indiscriminately for all soils.

3527

UNCONFINED COMPRESSION TEST

Date _____

Project _____

Boring No. _____ Sample No. _____

Specimen No.		Classification					
Tare No.			Height	H_o	in.	H_o	cm
Weight, g: Tare plus wet specimen			Average diameter	D_o	in.	D_o	cm
Tare plus dry specimen			Initial area	A_o	sq in.	A_o	sq cm
Water	W_w		Volume in cc = A_oH_o			V_o	
Tare			Volume of solids in cc = $W_s \div G_s$			V_s	
Wet specimen	W		Void ratio = $(V_o - V_s) \div V_s$			e_o	
Dry specimen	W_s		Saturation in % = $G_s w_o \div e_o$			S_o	%
Water content	w_o	%	Dry dens., lb/cu ft = $62.4\ (W_s \div V_o)$			γ_d	
Specific gravity of solids	G_s						

Note: If only a portion of the specimen is used for the water content determination, $W_s = W \div \left(1 + \frac{w_o}{100}\right)$

Elapsed Time min	Dial Reading 10^{-} in.	Cumulative Change, ΔH 10^{-} in.	Proving Ring Dial Reading 10^{-} in.	Axial Load, P lb	Axial Strain $\epsilon = \Delta H/H_o$	$1 - \epsilon$	$A_{corr} = A_o/(1-\epsilon)$ sq cm	Compr Stress tons/sq ft $0.465(P/A_{corr})$

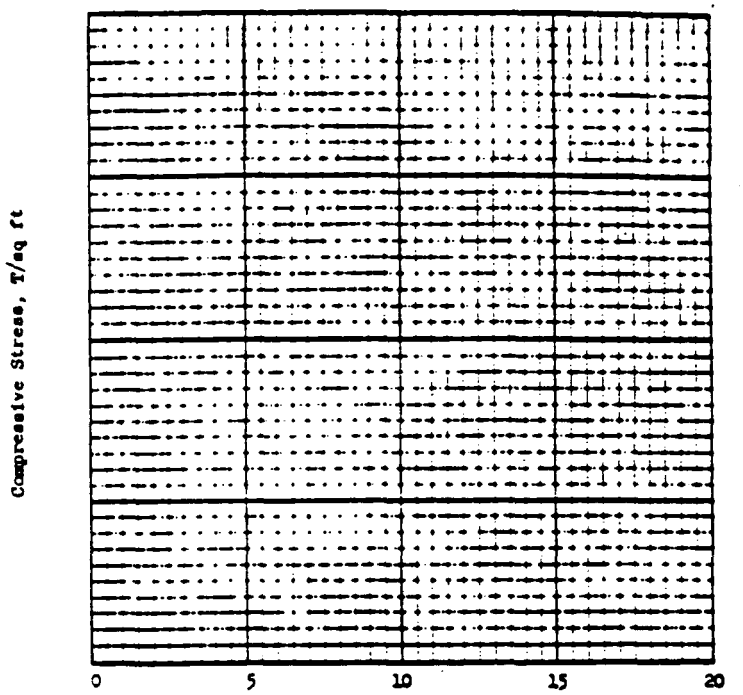
Remarks _____

_____ Type Failure _____

Technician _____ Computed by _____ Checked by _____

PLATE XI-1 ENG FORM 1 JUN 68 3857

Failure Sketches



☐ Controlled stress

☐ Controlled strain

Test No.					
Type of specimen					
Initial: Water content	w_o	%	%	%	%
Initial: Void ratio	e_o				
Initial: Saturation	S_o	%	%	%	%
Initial: Dry density, lb/cu ft	γ_d				
Time to failure, min	t_f				
Unconfined compressive strength, T/sq ft	q_u				
Undrained shear strength, T/sq ft	s_u				
Sensitivity ratio	S_t				
Initial specimen diameter, in.	D_o				
Initial specimen height, in.	H_o				

Classification

LL	PL	PI	G_s

Remarks

Project

Area

Boring No. | Sample No.

Depth ft / m | Date

UNCONFINED COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 3659

PLATE XI-2

International Technology Corporation

IT Analytical Services

Technology Development Laboratory Standard Operating Procedure

Title: CALIBRATION OF THERMOMETERS

Prepared by: David McNeil **Date:** 5/17/91

Reviewed by: Walter W. [illegible] **Date:** 5/29/91
Technical Specialist

Patti B. Carswell **Date:** 5/29/91
Quality Control Coordinator

Jerry M. Jones **Date:** 6-24-91
Director, Quality and Compliance, ITAS

Approved by: James [illegible] **Date:** 6-27-91
Laboratory Director

Controlled Copy No: Uncontrolled

Key Words: CALIBRATION, THERMOMETER, NBS

Revision #	1					
Date	02/27/91					

Technology Development Laboratory
304 Directors Drive ▪ Knoxville, Tennessee 37923 ▪ (615) 690-3211 ▪ FAX (615) 694-9573
IT Corporation is a wholly owned Subsidiary of International Technology Corporation.

1.0 Purpose and Application

1.1 The purpose of this SOP is to detail proper procedures for the calibration of all laboratory thermometers, such that temperature measurements are accurate and traceable.

1.2 This procedure applies to any thermometer used in the laboratory directly or indirectly in the preparation, storage or analysis of samples.

1.3 Working thermometers in the laboratory shall be calibrated annually against reference thermometers that have initial NBS traceability and that are recertified every three years with equipment directly traceable to the NBS.

2.0 References

2.1 ITAS-SW SOP No. MW104R0, "Calibration of Thermometers."

3.0 Associated SOPs and Applicable Methods

3.1 ITAS System Procedure No. 9014-HSC-01, "General Health and Safety Practices for Tasks Performed in the Laboratory."

4.0 Definitions

4.1 None.

5.0 Procedure

5.1 Copies of the NBS traceable certification of reference thermometers will be kept in the Quality/Operations files.

5.2 Every three years reference thermometers will be recertified with equipment directly traceable to the NBS. A record of the date of this certification will be kept in the Equipment Maintenance and Calibration files by the QCC.

5.3 Each working thermometer in use in the laboratory will be assigned a unique number and will be calibrated annually against a reference thermometer using the calibration methods listed below as appropriate for the specific use of the thermometer:

5.0 Procedure (continued)

5.3.1 Calibration Method 1:

5.3.1.1 Working thermometer and reference thermometers are allowed to remain together in the same room for at least 24 hours. The bulbs are then put together on desk top for at least 30 minutes and read.

5.3.2 Calibration Method 2:

5.3.2.1 A one-liter beaker is filled with regular refrigerator ice cubes prepared with deionized water. The remainder of space in beaker is filled with deionized water. The working thermometer and reference thermometer are immersed with bottom of bulbs at same level. Wait at least 30 minutes and read.

5.3.3 Calibration Method 3:

5.3.3.1 Fill a one liter glass beaker with deionized water and bring to a boil on a hot plate. The working and reference thermometer are immersed with bottom of bulbs at same level. At least the whole bulb on each thermometer must be completely immersed. Wait 5 minutes and read.

5.3.4 Calibration Method 4:

5.3.4.1 Working thermometers and a reference thermometer are allowed to remain together in a freezer for at least one hour. After one hour, read the thermometers.

5.4 A Thermometer Calibration form (Figure TDL102-1) shall be completed for each working thermometer calibrated and placed in the Quality/Operation files.

5.5 Any thermometer that does not meet the acceptance criteria (± 1°C) shall be tagged to prevent inadvertent use. New thermometers that do not meet the acceptance criteria will be sent back to the vendor. Old thermometers that do not meet the acceptance criteria will be removed from the lab.

5.6 All applicable safety and compliance guidelines set forth by IT Corporation and by federal, state, and local regulations must be followed during performance of this procedure. All work must be stopped in the event of a known or potential compromise to the health or safety of any ITAS Associate, and must be reported immediately to a laboratory supervisor.

6.0 Nonconformance and Corrective Action

6.1 Any thermometer that does not meet the acceptance criteria (± 1°C) shall be tagged to prevent inadvertent use. New thermometers that do not meet the acceptance criteria will be sent back to the vendor. Old thermometers that do not meet the acceptance criteria will be removed from the lab.

7.0 Records Management

7.1 A Thermometer Calibration form (Figure TDL102-1) shall be completed for each working thermometer calibrated and placed in the Quality/Operation files.

FIGURE TDL102-1

ITAS TECHNOLOGY DEVELOPMENT LABORATORY

THERMOMETER CALIBRATION

Date: _____

Number of thermometer being calibrated: _____

Description of thermometer being calibrated: _____

_____

Date last calibrated: _____

Time since last calibration _____

Description of reference thermometer: _____

_____

_____

Calibration Method Number	Temperature Reading	
	Reference Thermometer	Thermometer Being Calibrated

Working range: _____

Acceptance criteria: _____ ± _____ °C

Signed: _____

BULKING FACTOR PROCEDURE FOR NONSLUDGE TYPE WASTE

The bulking factor is the measured percent volume increase/decrease of the treated waste, relative to the original waste volume. The bulking factor measurement for a pourable waste sludge will follow the Standard Operating Procedure (SOP) in Appendix D. For a nonsludge material, the bulking factor will be determined by using bulk density values. The bulking factor will be calculated by using the following equation:

$$BF = 100 * \frac{[(100 + A)/P_t - 100/P_r]}{100/P_r} \qquad (1)$$

where

BF = percent change in volume relative to untreated waste
A = percent additives relative to untreated waste (weight to weight)
P_t = density of treated waste
P_r = density of raw waste

The bulk density of the raw waste will be determined in the site characterization. The bulk density of the treated waste will be calculated by dividing the weight of the unconfined compressive strength (UCS) solid cylinder (e.g., 1.5 by 3 or 2 by 4 inches) by its volume. (See "Stabilization/Solidification of CERCLA and RCRA Wastes," [EPA/625/6-89/022], Section 4.2.4 for a description of bulk density measurement of stabilized waste.)

Bulk density of the raw waste values used in the treatability study will be averaged values from several locations in each waste area. These average values will be used in the bulking factor calculation.

The BF equation was derived as follows:

BF is defined as the percent change in volume resulting from treatment to the initial volume. This change can be presented mathematically as follows:

$$BF = 100 \frac{V_t - V_r}{V_r} \qquad (2)$$

where

V_t = volume of waste after treatment
V_r = volume of waste before treatment

Volume can be expressed as a function of density.

$$V = \frac{m}{P} \tag{3}$$

where

m = mass of waste
P = density of waste

Equation (2) can be used to express V_t and V_r.

$$V_r = \frac{m}{P_r} \text{ and} \tag{4}$$

$$V_t = \frac{m + t}{P_t} \tag{4}$$

where

t = mass of reagents added

Substituting equations (3) and (4) into (1) gives:

$$BF = 100 \frac{[(m + t)/P_t - m/P_r]}{m/P_r} \tag{5}$$

This can be reduced as follows:

$$BF = 100 \frac{[(1 + \frac{t}{m})/P_t - 1/P_r]}{1/P_r} \tag{6}$$

$\frac{t}{m}$ is the fraction of reagents relative to the untreated waste. This can also be expressed as a percentage and redefined as follows:

$$\frac{100\ t}{m} = A \tag{7}$$

Using equation (7) in (6) gives

$$BF = 100\ \frac{[(100 + A)/P_t - 100/P_r]}{100/P_r} \tag{8}$$

MODIFIED TCLP LEACH TEST PROCEDURE

The modified toxicity characteristic leaching procedure (MTCLP) leach test is a modification of the TCLP test. The TCLP procedure is in Federal Register, Vol. 55, No. 126, pages 26986 through 26998. The MTCLP screening data will be acquired in the initial stage(s) to minimize costs and waste generation.

The same leachant to solid ratio and leachants (TCLP Type 1 and 2) are used in both procedures. The MTCLP differs from the standard TCLP as follows: the MTCLP uses 2.5 grams of material instead of 100 grams; the MTCLP generates 50 milliliters of leachate instead of 2 liters; and the leachate from the MTCLP is analyzed for metals only rather than metals and organics.

WASTE AND REAGENT MIXING PROCEDURE

The waste will be sieved through a 3/8-inch-mesh screen before testing. Obvious debris such as chunks of wood and metal will be removed. The percent weight and visual observation of removed debris will be noted. The waste will be ground to one-tenth the inner diameter of the UCS before mixing, if necessary. In the preliminary phase, 100 to 110 grams of waste and correct amounts of reagents will be mixed in a plastic container or a metal mixing bowl. The amount of water added will be determined empirically. Enough water will be added to make the mixture into a paste. Mixing will be done by hand with a spatula until the mixture has an even consistency without any lumps or mixed in a Planetary mixer. The mixture will be compacted using a vibrating table. The plastic container will be filled approximately half full and vibrated at least 1 minute. The remainder of the container will be filled and vibrated for another 1 minute. The vibrating table will be set at approximately 38 percent maximum power. The container will be sealed with a lid and taped. The treated samples will be cured at room temperature for 28 days in the sealed containers.

In the advanced phase, approximately 300 grams of waste per mold will be mixed with the correct amount of reagents in Planetary mixer. The mixture will be placed into a 2- by 3-inch Jatco plastic cylinder in three to six aliquots. The mixture will be compacted using a vibratory table. After the molds are loaded, they will be capped and sealed with tape until the sample is tested on day 28.

The specified quantity of waste to use in the test may be changed due to the radiological activity of the waste.

STABILIZATION WASTE FORM TEMPERATURE RISE GENERIC PROCEDURE

1. Measure room temperature (A).

2. Mix waste and reagents thoroughly to homogenize the mixture.

3. Place 50 to 100 grams of homogenized mixture in a separate container. If the sample is cohesive, press the mixture into a mass along the side of the container. Place the thermometer near the center of the mass.

4. Monitor the mixture temperature. Record the temperature when the temperature reaches a peak and starts to decline (B).

5. Calculate the temperature rise (dT): $dT = B - A$.

The measured temperature rise is a qualitative test. It is conducted as a screening test to alert of potential problems and hazards during scale-up. Further investigations of the actual temperature rise may be made during the remedy design phase when larger equipment, which has a design similar to the full-scale equipment, will be used.

PERMEABILITY

The permeability of the treated samples will be determined by using procedures in EPA SW-846 and EM-1110-2-1906 as guidelines. There are several methods to choose from, depending on the sample matrix, and sample constraints (e.g., radioactivity and hazardous contaminants, sample condition on receipt, and clients' end use).

The method of choice for determining permeability of treated samples is described in SW-846, Method 9100, Section 2.8. This is the constant-head method using a triaxial-cell with back pressure. This method is applicable to cohesive samples, which are supplied in a molded form.

The constant head triaxial cell method may take a couple of days longer to run, but there is more control over sample conditions during the test, and a wide range of field conditions can be simulated.

There will be one slight modification to the method. A permeability cell will be substituted for the triaxial cell. The permeability cell is similar to the triaxial cell but does not have the plunger for applying a load to the sample. This plunger is not used in permeability testing, and its absence has no effect on the test.

It is anticipated that all of the samples for permeability testing will be of the cohesive, molded type. If a sample is in a form that precludes the above test, there are several options available in the referenced method. Items that would preclude the above test may include: small sample size due to radioactivity level, noncohesive sample, loose sample requiring remolding, and chemicals in the sample that are incompatible with the latex membrane.

A small sample size may require permeability testing in a consolidation cell. This method is not addressed in SW-846, but is found in the Army Corps of Engineers Manual EM 1110-2-1906, Appendix VII, paragraph 8.

Noncohesive samples will require the use of a solid wall permeameter, such as a compaction or standard permeameter. These methods are found in SW-846, Method 9100, Sections 2.5, 2.6, and 2.7, and include both constant-head and falling-head methods. The selection of constant- or falling-head methods is not critical as both methods provide similar results. These methods are also applicable to samples containing chemicals incompatible with the latex membrane.

If a sample requires remolding, a remolding density should be supplied. A moisture/density relationship curve can be generated to aid in the determination of remolding density. The permeability of

remolded samples may be determined by any of the aforementioned methods. If the sample is cohesive, the constant-head method, using a triaxial cell with back pressure, is again the method of choice.

GENERIC pH AND Eh PROCEDURE

I. Single Component Sample

1. Calibrate electrode as specified by the vendor. Record calibration data.

2. Place a few grams of material in a container (e.g., a 5-ounce plastic container).

3. Add water to mixture and stir with a spatula until a wet slurry is produced. There should be free water present. Enough water must be added to allow insertion of electrode in liquid phase with minimal contact with the solid phase. This procedure will minimize damage to the electrode.

4. Insert pH or Eh probe in liquid phase.

5. Take reading when measurement stabilizes.

II. Multicomponent Sample

The procedure is the same with the single component sample except that the sample is mixed before it is added to the container.

PROPOSED RADON EMISSIONS FROM STABILIZED SOLIDS

1.0 Purpose and Application

A radon emission measurement technique is proposed for determining radon emissions from treated Operable Unit 2 materials. The test will determine the activity of radon emitted from the material's final form by measuring the radon activity in the air flowing through a chamber containing the waste form.

2.0 Definitions

2.1 See Figure E-1

3.0 Procedure

3.1 Summary

3.1.1 A cylinder of solidified material, having a known volume and surface area, is placed in a sealed container having one inlet and one outlet. Air is pumped through the chamber until equilibrium is reached. The radon in the exhaust stream is then measured. The radon emitted from the solidified material during a known time will be equal to the radon removed in the chamber's exhaust stream.

3.2 Interference

No known inteferences.

3.3 Sample Handling, Preservation, and Holding Time

3.3.1 Application of these procedures on hazardous waste samples must consider the known or suspected hazardous compounds present. Project-specific selection of work area, safe working practices, and personal protective equipment shall be made based upon exposure potential to the hazardous components.

3.3.2 All applicable safety and compliance guidelines set forth by IT Corporation and by federal, state, and local regulations must be followed during performance of this procedure. All work must be stopped if a known or potential compromise to the health or safety of any IT Analytical Services (ITAS) Associate, and must be reported immediately to a laboratory supervisor.

3.3.3 There are no holding times applicable to this procedure.

3.3.4 There are no preservation requirements applicable to this procedure.

3.4 Required equipment

3.4.1 Air-tight test chamber of known volume.

3.4.2 One (1) small fan.

3.4.3 One (1) diaphragm pump (Brailsford TD-3LL or equivalent).

3.4.4 One (1) rotameter.

3.4.5 Two (2) activated carbon radon canisters.

3.4.6 One (1) desiccant canister.

3.4.7 One (1) metering valve (Swagelok B-SS4 or equivalent).

3.4.8 Tubing, fitting, and connectors.

3.4.9 One (1) continuous flow radon detector (Pylon AB-5 or equivalent).

3.5 Operation

3.5.1 Assemble test equipment as shown in Figure E-1.

3.5.2 Place treated solid in test chamber with fan.

3.5.3 Start fan.

3.5.4 Open valve "A," and close valve "B."

3.5.5 Start pump.

3.5.6 Start radon detector in continuous counting mode.

3.5.7 Monitor detector until counts stabilize.

3.5.8 Switch detector to integrated count and count for 10 minutes. Record count.

3.5.9 Repeat step 3.5.7 two (2) times and record counts each time, for a total of three recorded measurements.

3.5.10 Open valve "B" and close valve "A."

3.5.11 Repeat steps 3.5.6 through 3.5.8.

3.5.12 Remove solid and store in air-tight container.

3.5.13 Switch radon detector to continuous mode.

3.5.14 Continue operating system until count rate returns to background levels.

3.5.6 Quality Control

3.5.6.1 None.

4.0 Nonconformance and Corrective Action

4.1 Any failure to follow this procedure will be noted on a nonconformance memo. The corrective action will be verified by the quality control coordinator and approved by the appropriate operations manager.

5.0 Records Management

5.1 All data will be recorded in standard laboratory notebooks.

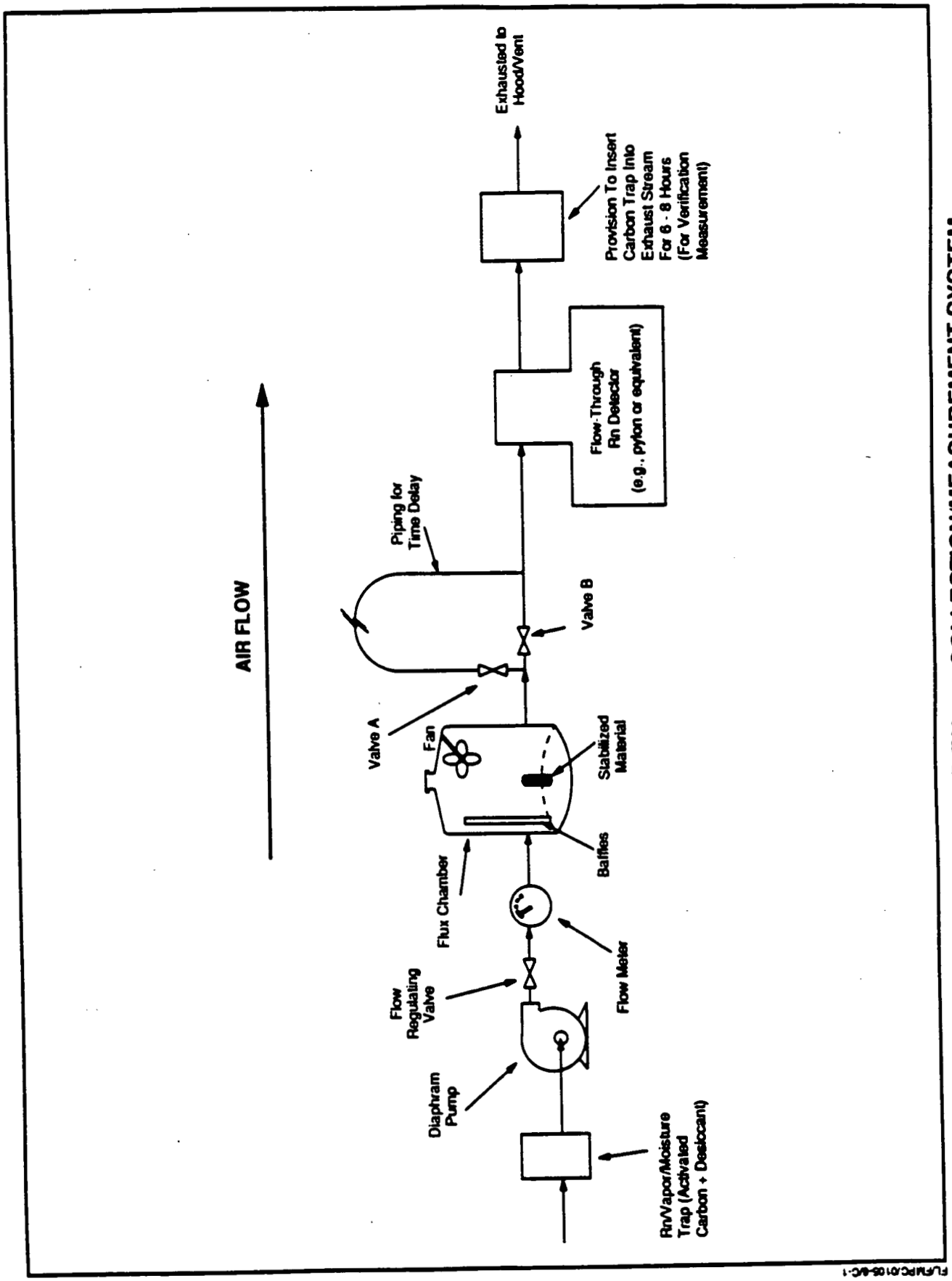


FIGURE E-1. PROPOSED RN-222 COLLECTION/MEASUREMENT SYSTEM

FL/RI/PC/0105-6/C-1

Calculations:

The radon emitted from the solidified form will be calculated using the following equation:

$$A\ (pCi) = C\ (pCi/L) * Q\ (L/min) * T\ (min)/M\ (g) \qquad (1)$$

where

A =	Radon activity emitted per gram of sample over time, t (pCi/g)
C =	Measured concentration of radon in exhaust air at equilibrium (pCi/L)
M =	Initial mass of sample in solidified material (g)
Q =	Flow rate (L/min)
T =	Time of count (10 min)

Example calculation:
Assuming the measured concentration of radon from a 200 gram sample (M = 200) is 100 pCi/L (C = 100) during a 10-minute count (T = 10) at a flow rate of 1 L/min (Q = 1), A becomes:

$$A = 100\ pCi/L * 1\ L/min * 10\ min/200\ g$$

and

$$A = 5\ pCi/g$$

PROPOSED MEASUREMENT OF RADON LEACHING IN WATER

1.0 Purpose and Application

This procedure proposes a method for determining the leachability of radon (Rn) from stabilized Operable Unit 2 waste into a water leachant. The test will determine the activity of radon leached or emitted from the stabilized waste form by measuring the radon activity in the water leachate. The detection limit goal for Rn will be 300 pCi/l. See Federal Register 56, p. 33050 - 33127, July 18, 1991.

2.0 Procedure

2.1 Summary

2.1.1 A stabilized material of known mass and approximate geometric surface area will be leached in deionized water for 30 days. The leachant volume (cm^3) to specimen geometric surface area (cm^2) will be maintained greater than 10. The measured Rn in the leachate will be back calculated to the amount of Rn leached from the stabilized mass during the leaching period.

2.2 Interference

No known interferences

2.3 Sample Handling, Preservation, and Holding Time

2.3.1 Application of these procedures on hazardous waste samples must consider the known or suspected hazardous compounds present. Project-specific selection of work area, safe working practices, and personal protective equipment shall be made based upon exposure potential to the hazardous components.

2.3.2 All applicable safety and compliance guidelines set forth by IT Corporation and by federal, state, and local regulations must be followed during performance of this procedure. All work must be stopped if a known or potential compromise to the health or safety of any IT Analytical Services (ITAS) Associate, and must be reported immediately to a laboratory supervisor.

2.3.3 There are no preservation requirements applicable to this procedure.

2.4 Required Equipment

2.4.1 Demonstrated sealable Teflon or glass container of known volume.

2.4.2 Timer

2.4.3 Agitator

2.4.4 Polymeric net to suspend sample in leachant.

2.4.5 Liquid scintillation counter

2.5 Operation

2.5.1 Remove plastic mold or crucible from stabilized waste.

2.5.2 Determine approximate surface area of stabilized waste.

2.5.3 Insert stabilized waste into polymeric net.

2.5.4 Insert waste and net assembly into container. The waste should not contact the bottom or sides of the container.

2.5.5 Add deionized water to the container. Enough water shall be added to exceed the 10 to 1 leachant volume to sample geometric surface area requirement and to minimize vapor space in the container.

2.5.6 Close container, note the date and time the container was sealed.

2.5.7 Place container in agitator. Agitate slowly.

2.5.8 Agitate during normal working hours for 30 days.

2.5.9 Rapidly remove enough leachate to conduct the liquid scintillation test.

2.5.10 Perform liquid scintillation test.

2.5.11 Calculate the Rn in the liquid scintillation sample, in the original leachate solution, and the amount of Rn leached or emitted during the leaching period.

2.6 Quality Control

2.6.1 The data will be inspected by the QC officer. Deviations from the established procedure will be noted in nonconformance memos.

3.0 Nonconformance and Corrective Action

3.1 Any failure to follow this procedure will be noted on a nonconformance memo. The corrective action will be verified by the quality control coordinator and approved by the appropriate operations manager.

4.0 Records Management

4.1 All data will be recorded in standard laboratory notebooks.

SHEAR STRENGTH

The following is a procedure to determine shear strength.

MODEL ~~CL-600A~~

~~TORVANE SHEAR DEVICE~~

Technical Data

SOILTEST®

Soiltest, Inc. • 86 Albrecht Drive • P.O. Box 8004
Lake Bluff, Illinois 60044-8004 U.S.A.
Telephone (708) 295-9400
Telex: 687-1537 SOILT UW • FAX (708) 295-9414

TABLE OF CONTENTS

Section	Title	Page
1	GENERAL	1-1
	PROCEDURE	1-2
	LAB USES	1-3

1. GENERAL

The CL-600A Torvane is a scientifically designed soil testing instrument for the rapid determination of shear strength of cohesive soils, either in the field or in the laboratory.

The Torvane permits the rapid determination of a large number of strength values with different orientation of failure planes. It is simple to use and sample trimming is eliminated. All that is required is a reasonably flat two-inch minimum diameter surface.

The Torvane, ideally suited to field usage, is an invaluable addition to the inspector's kit or to the consulting engineer. Here are some suggested applications for evaluation of shear strength.

1. Ends of Shelby tube samples.
2. Standard penetration samples.
3. Split spoon samples.
4. Chunk samples from test pits and backhoe excavations.
5. Sides of test pits.

The instrument has a stress range of zero to 2.5 kg./sq. cm (tons/sq. ft.). This is also the approximate range of torque that can be easily applied by the fingers. It should be used only for fully saturated cohesive soils whose undrained strength is independent of normal pressure. The stress range permits it to be used for clays varying in consistency from very soft to stiff. The dial head is equipped with a mechanism to hold the maximum reading after release. The instrument is supplied with three vanes. The standard vane (1 inch diameter) is for a range of 0 to 1.0 kg./sq. cm. The sensitive vane (1 7/8 inch diameter) is for a range of 0 to 0.2 kg./sq. cm. When this vane is used, multiply the scale reading by 0.2 to get the shear strength of the material. The high capacity vane (3/4 inch diameter) is for the range of 0 to 2.5 kg./sq. cm. When this vane is used, multiply the reading by 2.5.

The Torvane was developed in connection with an investigation of several massive landslides which occurred as a result of the Alaska earthquake in 1964. Its original purpose was to speed up the job of determining the shear strength of cohesive soil at the ends of Shelby tube samples rather than resort to conventional compression testing methods.

Tests performed with the Torvane also provide excellent supplemental data for extensive foundation investigation programs. The results of such tests are rapid and accurate. The Torvane also can be used successfully in evaluating site conditions in the planning of laboratory investigations.

The shear strength of a cohesive soil is dependent upon many factors, including rate of loading, progressive failure, orientation of the failure plane and pore water migraiton during testing. The Torvane does not eliminate the effects of any of the variables. Homogeneous clay and extensive laboratory testing indicates excellent agreement between the unconfined compression test and the Torvane. The smallest division on the dial is in units of 0.05 kg./sq. cm., permitting visual interpolation to the nearest 0.01 kg./sq. cm. The graph showing the correlation between readings of the Torvane and shear strength values by unconfined compression tests and triaxial tests are given in Figure 1.

2. PROCEDURE

2.1 Prepare a flat surface on the cohesive undisturbed material.

2.2 Attach the standard vane of suitable range to the stem by pressing the end of the stem into the square recess on the vane all the way.

2.3 Check that the zero of the circular scale coincides with the index on the head. If not, rotate the dial with finger tip on the embossed numbers in the counter clockwise direction until it stops at the index.

2.4 Press the Torvane carefully into the soil with the stem at right angles to the surface, to the depth of the blades.

2.5 Maintaining a constant vertical load by finger pressure, slowly turn the knob at a constant rate to provide a torque on the vane. Note: A rate of rotation such that failure develops in 5 to 10 seconds is recommended.

2.6 After sample fails, read Torvane shear strength on the circular scale just against the index.

2.7 Multiply the reading by the proper scale factor to get the shear strength. (For the high capacity vane, the smallest, the scale factor is 2.5; for the sensitive vane, the largest, the scale factor is 0.2; for the standard vane, medimum size, the scale factor is 1.)

2.8 Before making another test, re-zero the scale by rotating it with finger tip in the counter clockwise direction until it stops at the index.

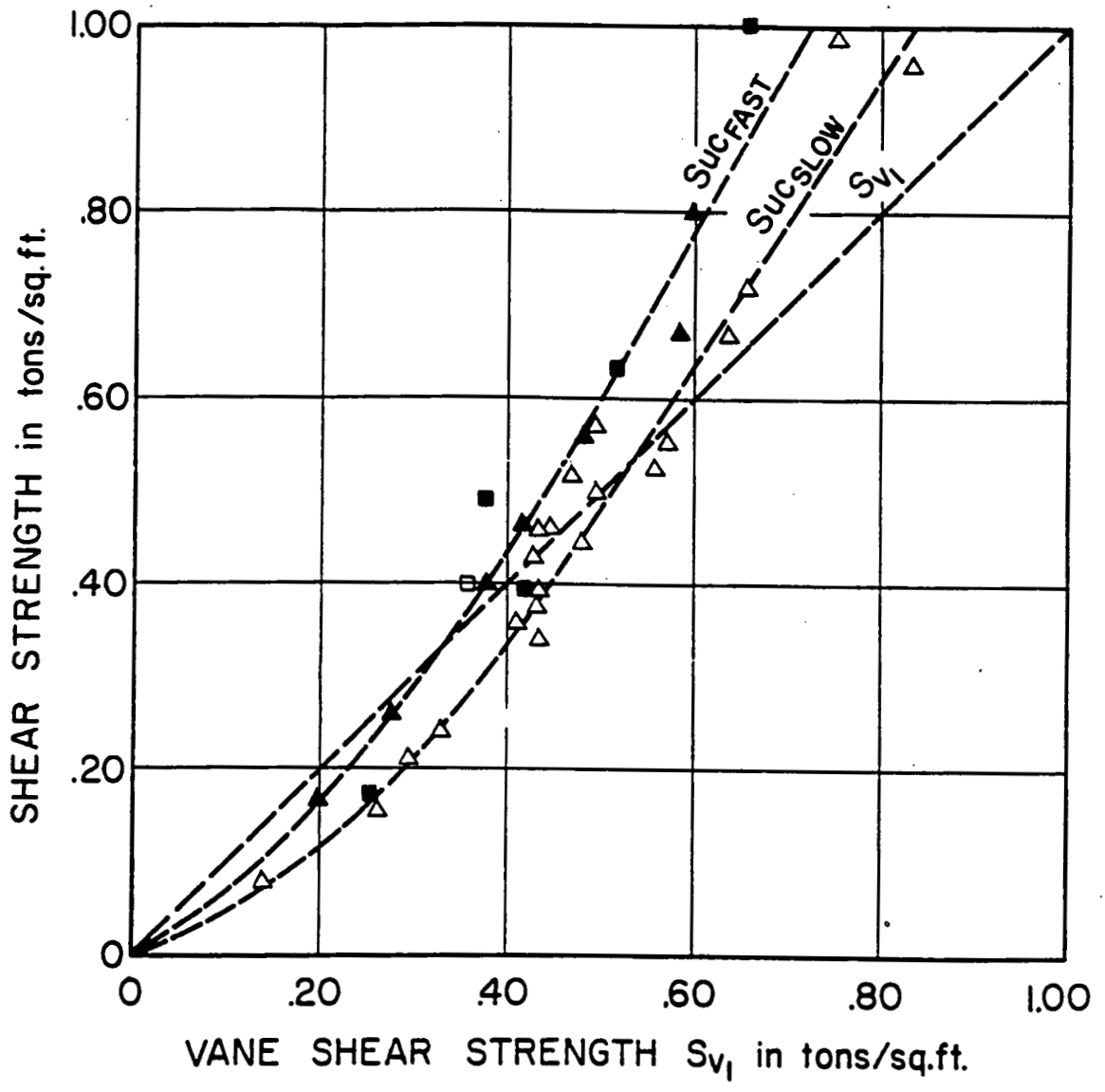
2.9 Take readings at different spots (if possible) on the surface and calculate the average value.

3. LAB USES

3.1 Before conducting unconfined compression tests or triaxial tests on undisturbed samples, cut the sample into segments 1/2 inch longer than the desired length, and perform Torvane test on each end. Then trim the material disturbed by the test. It is easier to do the test while the specimen is in the sampling tube, after trimming at one end.

3.2 Use the Torvane test as a control test to determine the shear strength prior to other testing.

3.3 In consolidation testing, after the specimen has been consolidated under a desired normal stress, remove the upper porous stone and determine the consolidated shear strength of the specimen using the Torvane.



LEGEND

△ Suc_{SLOW} - Unconfined compression test, slow test: Suc = 1/2 qu

▲ Suc_{FAST} - Unconfined compression test, quick test: Suc = 1/2 qu

■ S_Q - Triaxial compression test, Q test: $S_Q = 1/2(\sigma_1 - \sigma_3)max.$

Figure 1

GENERIC URANIUM BY ION CHROMATOGRAPHY WITH POST-COLUMN REACTION AND PHOSPHORESCENCE OR FLUORESCENCE DETECTION

This method uses ion chromatography in the cation-exchange mode to separate the uranium as UO_2^{+2} (uranyl ion) from interferences. As the uranyl ion leaves the analytical column it is mixed with 39 percent H_3PO_4 to give a final concentration of approximately 19 percent H_3PO_4. The addition of H_3PO_4 enhances the fluorescence of the uranyl ion. Finally, the post-column reaction mixtures pass through a flow-through cell mounted in a fluorescence detector. Response has been found to be linear over the range studies (10 to 500 parts per billion [ppb]). The equipment and conditions for this method are listed below:

- High performance liquid chromatography (HPLC) pump - LDC/Milton Roy Constametric III
- Post-column reagent pump - LDC/Milton Roy Constametric III
- Injection valve - Altex 210
- Sample loop size - 147 uL
- Analytical columns - Dionex HPIC-CG2 Cation Guard
- Analytical columns - Dionex HPIC-CG2 Cation Analytical
- Post-column reactor (PCR) - 1/16-inch SS low dead volume "TEE" and 12-inch coil, heated 60°C with a water bath
- Detector - Perkin Elmer 204 - S Fluorescence Detector
- Detector excitation wavelength - 275 nm
- Detector emission wavelength - 515 nm
- Eluant - 0.1 M H_3PO_4
- Eluant Flow - 1.5 mL/min
- PCR reagent - 39 percent weight H_3PO_4 (1 volume 85 percent H_3PO_4 to two volumes H_2O)
- PCR reagent flow rate - 1.1 mL/min

The concentrations of H_3PO_4 and brands of equipment are for examples only. They may be modified during the study.

APPENDIX F

REASONS FOR LIMITED NUMBER OF SOUTHFIELD SAMPLES

Department of Energy
Fernald Environmental Management Project
P.O. Box 398705
Cincinnati, Ohio 45239-8705
513: 738-6357

NOV 2 1 1991
DOE-378-92

Mr. James A. Saric, Remedial Project Director
U. S. Environmental Protection Agency
Region V - 5HR-12
230 South Dearborn Street
Chicago, Illinois 60604

Mr. Graham E. Mitchell, DOE Coordinator
Ohio Environmental Protection Agency
40 South Main Street
Dayton, Ohio 45402-2086

Dear Mr. Saric and Mr. Mitchell:

OPERABLE UNIT (OU) 2 TREATABILITY STUDY PRELIMINARY STAGE II SCREENING

Preliminary Stage I Screening of the OU 2 Treatability Study work plan consists of developing a matrix of experimental formulations to evaluate their effectiveness in treating the various wastes. After 28 days curing, the molds developed for evaluating the cement stabilization technology are subjected to Unconfined Compressive Strength (UCS) tests. If the molds achieve a UCS of approximately 500 psi, they are considered to be successful. These successful formulations are then subjected to a Modified TCLP (MTCLP) test. Formulations that pass both the USC and the MTCLP are then subjected to the Advanced Phase testing.

The work plan states that a minimum of six formulations per waste type must pass UCS and MTCLP before being subjected to Advanced Phase testing. The work plan also states that if less than six formulations for each waste stream are judged to be successful, Preliminary Stage II will be initiated to develop new formulations.

Preliminary results obtained for the South Field Waste indicate there are four formulations that meet the UCS criterion. The Department of Energy (DOE) is proposing to subject these four formulations to Advanced Phase Testing if they also pass MTCLP, and not to develop additional new formulations in a Preliminary Stage II testing.

The rational for moving forward with the evaluation of the four successful formulations and not developing a total of six that pass the UCS and MTCLP is as follows:

- Constituent variation is exhibited in the four successful formulations (see enclosed preliminary results)
- As stated in the work plan, the range of formulations will be evaluated during the remedial design phase.
- The estimated cost to develop and evaluate an additional six formulations is approximately $48,000.
- The four successful formulations illustrate that a desirable UCS can be achieved.
- These formulations must pass the MTCLP prior to being subjected to Advanced Phase Testing.
- Preliminary Stage II testing may impact timing of final results.

I would appreciate an opportunity to discuss this matter with you in the near future.

If you or your staff have any questions, please contact Johnny Reising at (513) 738-9083.

Sincerely,

Jack R. Craig
Fernald Remedial Action
Project Manager

FO:Reising

Enclosure: As Stated

PRELIMINARY RESULTS

South Field Waste

Constituents for Stabilization (in grams)

Run	Waste	Type 1 Port. Cement	FEMP Flyash	Sodium Silicate	Attapulgite & Clinoptilolite	Water Weight	USC (psi)
A	300	75	75	15	0	150	354
B	300	150	150	0	10	225	469
C	300	150	75	0	10	225	478
D	300	150	75	15	0	180	481

3527

bcc w/encl.:

J. Ford, DP-14, GTN
T. Hindman, DP-12, GTN
R. P. Berube, EH-20, FORS
E. G. Feldt, EH-221, FORS
S. W. Coyle, WEMCO
H. F. Daugherty, WEMCO
E. D. Savage, WEMCO
T. Tucker, Radian
J. D. Wood, ASI
J. E. Razor, IT
R. F. Duda, Parsons