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OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP) TREATABILITY STUDY WORK PLAN (INCLUDES DOE LETTER DOE-0848-95)

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OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP) TREATABILITY STUDY WORK PLAN

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

APRIL 1995

U.S. DEPARTMENT OF ENERGY
FERNALD FIELD OFFICE

Department of Energy
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APR 12 1995

DOE-0848-95

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Dear Mr. Saric and Mr. Schneider:

TRANSMITTAL OF THE REVISED OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROJECT WORK PLAN

This letter formally transmits the Department of Energy, Fernald Area Office (DOE-FN) final revised Operable Unit 1 Dewatering Excavation Evaluation Project (DEEP) Work Plan to the United States Environmental Protection Agency (USEPA). This document was revised in accordance with the comment responses approved by the Ohio Environmental Protection Agency (OEPA) and the USEPA. As agreed to by the DOE-FN and USEPA, an engineering evaluation of the data collected in the DEEP project is being prepared for attachment to the final report. This engineering evaluation will support the final remedial design for Operable Unit 1.

If there are any additional questions regarding this submittal, please contact Randy C. Janke at (513) 648-3123.

Sincerely,

Randy Allen

for Jack R. Craig
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FOREWORD

The U.S. Department of Energy has completed and transmitted this work plan for the Operable Unit 1 Dewatering Excavation Evaluation Program (DEEP) under the terms of Section XII.D.1 and D.2 of the Amended Consent Agreement (ACA) between the DOE and the U.S. Environmental Protection Agency. This work plan provides the framework for an additional treatability study for Operable Unit 1 at the Fernald Environmental Management Project (FEMP). As such, this work plan is a secondary document under the terms of the ACA.

This work plan identifies tests that will be performed to support post-remedy-selection remedial design/remedial action of Operable Unit 1. This work plan meets the substantive requirements of the EPA's Guide for Conducting Treatability Studies under CERCLA (CERCLA 1992). The work plan format focuses on each of the technologies for materials handling evaluations, with additional information that supports all the technologies provided in Section 6. In addition, seven attachments provide supplementary information.

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SECTION 1
DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP) PROJECT DESCRIPTION

1.1 SITE DESCRIPTION

This work plan describes the objectives and scope of work for the Dewatering Excavation Evaluation Program (DEEP) to be conducted at the U.S. Department of Energy (DOE) Fernald Environmental Management Project (FEMP) located near Cincinnati, Ohio. The study supports remedial design/remedial action (RD/RA) for Operable Unit 1, the Waste Pits. The FEMP is a government-owned former uranium-processing plant that was placed on the National Priorities List in 1989. Environmental remediation is underway in accordance with the 1991 Amended Consent Agreement between the DOE and the U.S. Environmental Protection Agency (EPA).

Operable Unit 1 is one of five FEMP operable units. Figure 1-1 shows the location of Operable Unit 1. It consists of Waste Pits 1 through 6, the Clearwell, the Burn Pit, miscellaneous structures/facilities, and environmental media within the Operable Unit 1 boundary. Figure 1-2 identifies the waste pits. Radioactive waste, consisting of radionuclides generated from uranium ore processing and various chemicals, are stored in Operable Unit 1.

1.2 GENERAL PROJECT DESCRIPTION

Currently, the Preferred Remedial Alternative for Operable Unit 1 is based upon dry mechanical excavation, front shovel and truck hauling at Waste Pits 1, 2, 3, 4, 6, and the Burn Pit, and slurrying waste from Waste Pit 5 and the Clearwell to a thickener for dewatering. All excavated wastes will then be stockpiled and dried to remove free liquid before shipping them off site to a disposal facility.

The Dewatering Excavation Evaluation Program (DEEP) was developed to:

- Provide data and observational information that will be used to optimize and refine plans for removing waste from the waste pits by using the safest, fastest, and most economical excavation techniques.

Data collected from this project will be evaluated for use in developing the RD/RA work plan for Operable Unit 1. Table 1-1 identifies the tests to be performed during the DEEP. Section 2-5 provides detailed information on each test.

Waste Pits 1, 2 and 3 were selected for the DEEP. Initially, all of the waste units in Operable Unit 1 were considered for inclusion in the DEEP. The waste pits selected for DEEP represent approximately 80 percent of the total material requiring dry mechanical excavation during final remediation. In addition, Waste Pits 1, 2, and 3 were judged to be adequate to provide representative information for the material requiring excavation based on known information. However, there were specific reasons that the other waste pits were excluded:

- Waste Pit 4 is classified as a hazardous waste management unit (HWMU) under the Resource Conservation and Recovery Act (RCRA).
- Waste Pit 5 is already included in a treatability study under the Minimum Additive Waste Stabilization (MAWS) program.
- Waste Pit 6 will be the subject of a separate waste removal pilot study.
- Clearwell contents are similar to the slurry in Waste Pit 5.
- Burn Pit - no additional "new" data would be expected.

1.3 DEEP DATA QUALITY OBJECTIVES (DQOs)

The FEMP Data Quality Objectives (DQO) process, as identified by the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ), guided preparation of this work plan. A brief discussion of the process follows here; a detailed discussion of geotechnical DQOs, as specifically mandated by the SCQ, is provided in Section 2 of this work plan.

1.3.1 Identify the Decisions to Be Made that Affect the Situation

The purpose of DEEP is to identify applicable excavation technique(s) to remove waste pit material and to determine how to optimize and refine these technique(s). Prior to excavation, further information from the following areas of investigation must be evaluated to support the excavation technique selected:

- Pre-dewatering condition of the waste pits of concern. For DEEP, the waste pits of concern include Waste Pits 1, 2, and 3.
- Homogeneity/Heterogeneity of the waste pits.
- Characteristics of the waste within the pits.
- Dewatering methods potentially applicable to the DEEP project.
- Changes in physical properties of the wastes observed during dewatering.
- Stability of the dewatered wastes following dewatering. Stability is related to the waste's ability to support excavation equipment, and the waste's ability to be safely and efficiently removed by conventional excavation methods.

Based upon the results of the field and laboratory investigations which the DEEP project addresses, more detailed information relative to the areas of investigation will allow DOE to determine the most suitable excavation technique(s) for removal of waste from the pits.

A literature search of potentially applicable dewatering and excavation techniques has been performed. The results of this research have shown that the potentially applicable techniques of choice which warrant further study are the following:

Dewatering

Trenching
Driven well point
Conventional well pumping
Well pumping with a vacuum system
Well pumping enhanced by electro-osmosis

Excavation

Wet excavation
Dry excavation
Slurrying

1.3.2 Identify Inputs that Affect the Decision

The listed dewatering and excavation techniques will be tested in the following order:

- Wet excavations, waste reslurring and pump tests. Qualitative and quantitative observations of the behavior of the waste under these conditions will be made.

- Dewatering, to include well comparison and pumping tests, will be performed in areas adjacent to the wet excavations to evaluate waste material consistency and homogeneity/heterogeneity.

- Dry excavations, to include dry trench excavation and ramp excavation, will be performed to determine the efficiency of the dewatering techniques, amenability of the waste to excavation and handling, and the ability of the waste to support heavy equipment.

Geotechnical testing will be utilized to evaluate the characteristics and geotechnical properties of the waste before, during and after dewatering tests have been conducted. An analysis of the following geotechnical tests will provide waste characterization information:

- Grain-size analysis
- Atterburg limits
- Moisture content
- Specific gravity
- Triaxial shear strength test
- Unit weight test
- Standard Proctor compaction test

Additionally, during boring installation, Standard Penetration Tests will be performed. Standard Penetration Tests will provide useful information about the waste's stratification and strength.

The inputs that affect the decision about which dewatering technique(s) is selected are as follows:

- Safety
- Volume of water removed
- Ability of water volume to be sustained during pumping
- Area of influence of the dewatering technique being investigated
- Efficiency of vacuum collection system
- Cost/efficiency analysis
- Surface subsidence
- Waste stability during dewatering
- Waste permeability

Table 2-3 of this work plan provides additional descriptive information about geotechnical testing. Table 2-4 provides additional descriptive information about the frequency of testing within each pit.

1.3.3 Define the Boundaries of the Situation

The boundaries of the situation are Waste Pits 1, 2, and 3. Horizontal boundaries include the extent of the sidewall dimensions of each waste pit. Vertical boundaries include the cap material at the top of each waste pit, and a vertical depth of 5 feet above the liner material at the base of each waste pit.

Boundaries of dewatering and excavation include safety, stability, heterogeneity of the waste pit contents, the amount of water which can be removed from the waste pits in a practical, cost effective and technologically feasible manner, subsidence and the potential for mass movement of the waste during and following dewatering, and the need for each test to remain independent of other tests.

1.3.4 Develop a Logic that Applies to the Decision

Each dewatering and excavation test proposed is a method that has potential applicability for remediation of the waste pits. Each method will be tested and evaluated according to the procedures identified in this work plan. Data collected will be compiled into an interpretative analysis that will be used to support selection of excavation methods during remedial design/remedial action (RD/RA).

The necessary interpretative information will be obtained in the following sequence:

- Geotechnical testing
- Wet excavation
- Dewatering
- Dry excavation

1.3.5 Establish Constraints on the Uncertainty of the Decision

The following constraints affect the uncertainty of the decision:

- Waste pit heterogeneity
- Waste geotechnical properties
- Efficiency of dewatering
- Suitability of excavation method(s) selected within portions of the same pit or within different pits
- Validity of field and laboratory gathered information
- Uncontrollable project schedule impacts due to weather or other similar unforeseen circumstances
- Lack of consistency of field information gathered due to change in field objectives caused by encountering unanticipated objects or difficulties in the field which result in poor or no sample recovery, or the need to relocate field activities.

1.3.6 Optimize a Design for Obtaining Quality Data and Summary

The objectives of the DEEP program have been summarized as to the test technique, the purpose for performing the test, test inputs, and test interpretation. This dewatering test objectives information is shown in Table 1-2. This excavation test objectives information is shown in Table 1-3.

The DEEP work plan represents an optimized design for obtaining quality data. The staged and phased approach to the project helps ensure that all information necessary before proceeding has been interpreted. Collection of quality data will be enhanced and ensured by following appropriate quality guidance documents during the process of obtaining the necessary data. Appropriate guidance documents include the SCQ, American Society for Testing and Materials (ASTM) standards, applicable EPA guidance documents, and written and approved Standard Operating Procedures.

To provide project quality oversight, a rigorous internal self-assessment program, consisting of a system of audits, surveillances and inspections will be utilized. Any deficiencies in project activities, and any deviations from written procedures, work plans, or other guidance documents, will be identified, evaluated as to the best course of further action, and resolved as approved by project quality assurance and quality control staffs. Deviations noted will be documented, and incorporated into the project permanent record.

1.4 WASTE PIT DESCRIPTIONS AND CHARACTERIZATION

Geotechnical and analytical data that have been collected, reported, and interpreted are included in the Operable Unit 1 Final Remedial Investigation (RI) Report (DOE 1994) and the Operable Unit 1 Treatability Study Report (DOE 1993). Table 1-4 provides a summary of the thickness and volumes of the liners, caps, and waste in Waste Pits 1, 2, and 3. Contaminants of concern (and associated action levels) identified in Operable Unit 1 are listed in the DEEP Health and Safety Plan, Attachment A to this work plan. The Operable Unit 1 fence diagram, originally issued in the Final RI Report, is included as Attachment G to this work plan.

1.4.1 Waste Pit 1

According to the RI Report (DOE 1994a), the majority of materials placed in Waste Pit 1 were dry solids, including general sump sludge, depleted slag, trailer cake, depleted residues, graphite and ceramics, thorium waste, and uranyl ammonium phosphate (UAP) filtrate. A photograph taken in mid-1959 shows part of Waste Pit 1 covered, with drums visible along the eastern edge of the waste pit. The open portion was shown filled with water.

Typical water levels range from approximately 3 to 3.5 feet below ground surface. Sieve tests from the RI showed six samples with fines (percent passing a #200 sieve) ranging from 71 to 92 percent (dry weight basis). The fines from the Atterberg limit tests were reported as non-plastic (NP). The material was classified as low plasticity silt (ML) according to the Unified Soil Classification System (USCS).

The Operable Unit 1 Treatability Study Report classifies the material as homogeneous, non-plastic silt. Fines ranged from 70 to 91 percent, sands from 9 to 27 percent, and there was a trace of gravel (3 percent). The samples had moisture contents ranging from 20 to 39 percent, and were characterized as having slight cohesion and low dry strength.

Magnetic anomalies were indicated across 60 percent of the waste pit. Anomaly maps were published in the RI. Sharp magnetic highs and lows in the southeastern quarter indicate a substantial volume of buried ferrous metal or other magnetically susceptible debris at relatively shallow depths. Magnetic anomalies in the northern and western edges indicate smaller volumes of buried ferrous debris at greater depths. Anomaly maps were published in the Operable Unit 1 Final Remedial Investigation Report. EM data were evaluated for more than 70 percent of the pit. High conductivity values were found in the northeast, southeast, and western areas of Waste Pit 1.

1.4.2 Waste Pit 2

The material placed in Waste Pit 2 consisted of general sump sludge, depleted slag, trailer cake, UAP filtrate, depleted residues, and graphite/ceramics. The material in Waste Pit 2 was relatively coarser than the material placed in Waste Pit 1.

Typical water levels range from approximately 1 to 1.5 feet below ground surface. Sieve tests from the RI had seven samples with fines (percent passing a #200 sieve) ranging from 29 to 72 percent (dry weight basis). The fines from the Atterberg limit tests were reported as non-plastic (NP). Samples were classified as sandy silt and silt with sand (ML), sandy elastic silt (MH), and silty sand with gravel (SM) according to the USCS. Moisture contents of the ML and MH material ranged from about 120 to 317 percent; the SM and SC material ranged from about 21 to 33 percent. Measured specific gravities ranged from approximately 2.20 to 2.83. The Treatability Study Report described the material as low-plasticity

clays, high-plasticity silts, and silty sand (USCS Classifications CL, MH and ML). Four samples were tested: one sample was a silty sand with 44 percent fines, 55 percent sands and 1 percent gravel; two samples were sandy lean clays (CL) with 66 to 74 percent fines, 22 to 26 percent sand, and 4 to 8 percent gravel; the fourth sample was a high plasticity silt with 67 percent fines (percent passing a #200 sieve), 28 percent sand and 5 percent gravel. In general, each report confirmed the other report findings. Magnetic anomalies were noted across 35 percent of Waste Pit 2. Anomaly maps were published in the Operable Unit 1 Final Remedial Investigation Report. EM data were evaluated for more than 70 percent of the pit. High conductivity values were found in the north central, south central, and far southwestern areas of Waste Pit 2.

1.4.3 Waste Pit 3

The material placed in Waste Pit 3 consisted of general sump sludge, raffinate, trailer cake, slag leach, water treatment sludge, and thorium wastes.

Typical water levels ranged from approximately 2 to 4.5 feet below ground surface. The RI Report contained data from grain size analyses, specific gravity tests, moisture content tests, and Atterberg limit tests. Based on five sieve tests, fines (percent passing a #200 sieve) ranged from approximately 43 to 63 percent, sand sizes from 37 to 56 percent, and gravel sizes from 0.1 to 1.3 percent. The fines from two samples had Atterberg limit tests which were reported as NP. The samples were classified as elastic silts (MH), silty sands (SM), sandy elastic silt (MH), and sandy silt (ML). The materials with MH fines had moisture contents ranging from 55 to 139 percent. Measured specific gravities ranged from approximately 2.19 to 2.84. Magnetic anomalies were indicated across more than 40 percent of the waste pit. Electromagnetic (EM) conductivity anomalies, indicating solid materials of high electrical conductivity, were not present in the Waste Pit 3 survey. Rather, the conductivities increased toward the center of the waste pit and probably result from flyash, high dissolved solids in the waste pit leachate, or both.

1.5 ORGANIZATION OF THE DEEP TREATABILITY STUDY WORK PLAN

This DEEP Treatability Study Work Plan is organized into the following sections and attachments:

- Section 1 - Site and project description, and data quality objectives

- Section 2 - Description of DEEP geotechnical testing, including soil borings and cone penetrometer testing
- Section 3 - Description of wet excavation tests
- Section 4 - Description of dewatering tests
- Section 5 - Description of dry excavation tests
- Section 6 - Summaries of data management, health and safety, community relations, and management and staffing plans, as well as a project schedule
- Attachment A - DEEP Health and Safety Plan
- Attachment B - DEEP Quality Assurance Plan
- Attachment C - Summary of permitting information
- Attachment D - Description of DEEP dust suppressant testing
- Attachment E - Description of DEEP slug testing
- Attachment F - Samples of field activity logs
- Attachment G - Operable Unit 1 fence diagram.
- Attachment H - Project Specific Plan for Operable Unit 1 Dewatering Excavation Evaluation Program Geotechnical Investigation
- Attachment I - Project Specific Plan for Operable Unit 1 Modular Process Area Geotechnical Investigation

TABLE 1-1

OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP) GENERAL DESCRIPTION AND IMPLEMENTATION SEQUENCE

Test[a]	Description/Comments
1. Soil Borings, Sampling and Geotechnical Testing for SPT and CPT	• SPT and continuous sampling during well drilling for geotechnical laboratory testing. • SPT at each trench for CPT correlation. • Two SPT at each de-watering site. • Geotechnical index and physical properties testing.
2. Wet Excavations and Slurry Pumping	• Excavate trenches with a backhoe. • 7 trenches - 2 in Waste Pit 1, 2 in Waste Pit 2, and 3 in Waste Pit 3. Collect bulk sample from each location. • Re-slurry waste, pump and evaluate settling rates. • Three slurry tests, one each in Pit 1, 2, and 3.
3. Dewatering	• Evaluate three well types (large diameter wells, sand packed well points, and driven well points). • Evaluate well spacing (3 wells in each waste pit). • Yield testing of well points and large-diameter wells. • Install remaining wells and well points. • Pump wells without vacuum. • Pump wells with vacuum. • Pump wells with E-O.
4. Dry Excavation	• Trenches and ramp excavation. • Collect bulk samples from each location.

SPT = Standard Penetration Test
CPT = Cone Penetrometer Test
E-O = Electro-Osmosis

[a] Supporting slug tests are performed at existing leachate wells in Waste Pits 1, 2, and 3; a total of 9 locations will be evaluated. (See Attachment E.)

TABLE 1-2
SUMMARY TABLE SHOWING DEWATERING TECHNIQUES ASSESSMENT: PURPOSES, INPUTS, AND INTERPRETATIONS

TECHNIQUE	TEST PURPOSE	TEST INPUT	INTERPRETATION
Trenching	Evaluate as dewatering technique.	1. Sidewall angle of repose - will sidewall sloughing during excavation and pumping result in a trench which cannot be kept open? 2. Will excess fines lower efficiency of dewatering (water yield)?	1. Sidewall stability - determine a sustainable angle of repose. 2. Excess fines - will excess fines in settling tank lessen tank capacity or cause pumping and water yield problems?
Driven well point	Evaluate as dewatering technique.	1. Well installation. 2. Well development. 3. Water yield.	1. Installation (penetration resistance, clogging of well screen). 2&3. Development (water yield), relative to other techniques could eliminate as applicable technology.
Conventional well pumping	Evaluate as dewatering technique.	1. Well installation. 2. Well development. 3. Water yield. 4. Radius of influence.	1. Installation (penetration resistance, sidewall stability). 2&3. Development (clogging of well screen, water yield) could eliminate as applicable technology. 4. Measure adjacent well water levels.

TABLE 1-2
SUMMARY TABLE SHOWING DEWATERING TECHNIQUES ASSESSMENT: PURPOSES, INPUTS, AND INTERPRETATIONS
(CONTINUED)

TECHNIQUE	TEST PURPOSE	TEST INPUT	INTERPRETATION
Well pumping with vacuum system	Evaluate as dewatering technique.	1. Well installation. 2. Well development. 3. Vacuum system installation and operation. 4. Water yield. 5. radius of influence.	1. Installation (penetration resistance, sidewall stability). 2&4. Development (clogging of well screens, water yield), 3. Bridging of vacuum system could eliminate as applicable technology. 5. Measure adjacent well water levels.
Well pumping with electro-osmosis (E-O) enhancement.	Evaluate as dewatering technique.	1. Well installation. 2. Well Development. 3. E-O system installation and operation. 4. Water yield. 5. Radius of influence.	1. Installation (penetration resistance, sidewall stability). 2&4. Development (clogging of well screens, water yield). 3. E-O system installation and operation (safety, water yield, cathode deterioration) could eliminate as applicable technology. 5. Measure adjacent well water levels.

SOURCE: Final Remedial Investigation Report for Operable Unit 1, August 1994.

TABLE 1-3
SUMMARY TABLE SHOWING EXCAVATION TECHNIQUES ASSESSMENT: PURPOSES, INPUTS AND INTERPRETATIONS

TECHNIQUE	TEST PURPOSE	TEST INPUT	INTERPRETATION
Wet excavation	Evaluate as excavation technique.	1. Sidewall angle of repose - will sidewall sloughing result in a trench which cannot be kept open? 2. Can a stable surface for excavation equipment be maintained? 3. Will dewatering cause mass movement and subsidence within pits?	1. Sidewall stability - determine a sustainable angle of repose. 2. Evaluate bearing capacity of waste, test equipment on surface. 3. Measure subsidence during dewatering to determine degree and extent of subsidence.
Dry excavation	Evaluate as excavation technique.	1. Sidewall angle of repose - will sidewall sloughing result in a trench which cannot be kept open? 2. Can a stable surface for excavation equipment be maintained? 3. Can dewatering cause mass movement and subsidence within pits?	1. Sidewall stability - determine a sustainable angle of repose. 2. Evaluate bearing capacity of waste, test equipment on surface. 3. Measure subsidence during and after dewatering to determine degree and extent of subsidence.
Slurrying	Evaluate as excavation technique.	1. Can fines be suspended in water? 2. Can fines remain suspended in water? 3. Can slurry water source be solely from pit trench? 4. Heterogeneity of pit waste.	1. Perform settling tests. 2. Perform settling tests. 3. Perform water balance evaluation of slurry system. 4. Large material will not slurry.

TABLE 1-4
MATERIAL VOLUME CALCULATION RESULTS FOR WASTE PITS 1, 2 AND 3

WASTE PIT 1

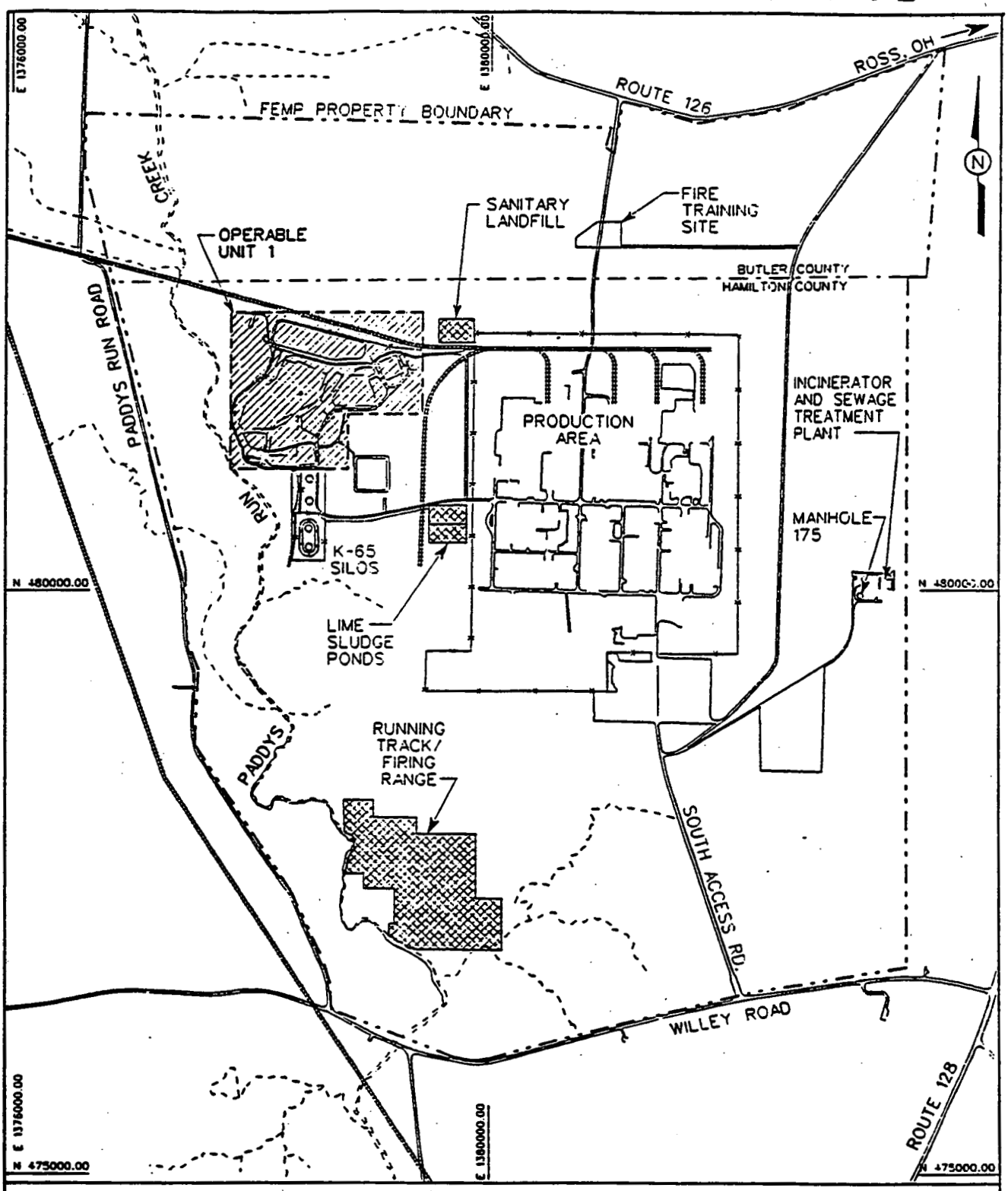
Material		Thickness(ft)	Volume (yd^3)	Volume (m^3)
Cover		0.5	1,700	
Waste		18 (maximum)	48,500	37,083
Low Permeability Material		11 (maximum)	18,200	
	Total	29.5 (maximum)	68,400	

WASTE PIT 2

Material		Depth (ft)	Volume (yd^3)	Volume (m^3)
Cover		1 to 4	4,200	
Waste		15 ± 1	24,200	18,503
Low Permeability Material		4.5 (approx.)	9,000	
	Total	23.5 (maximum)	37,400	

WASTE PIT 3

Material		Depth (ft)	Volume (yd^3)	Volume (m^3)
Cover		14 (maximum)	93,700	
Waste		27 (maximum)	204,100	156,055
Low Permeability Material		1 (approx.)	9,700	
	Total	42 (maximum)	307,500	



NOTE:

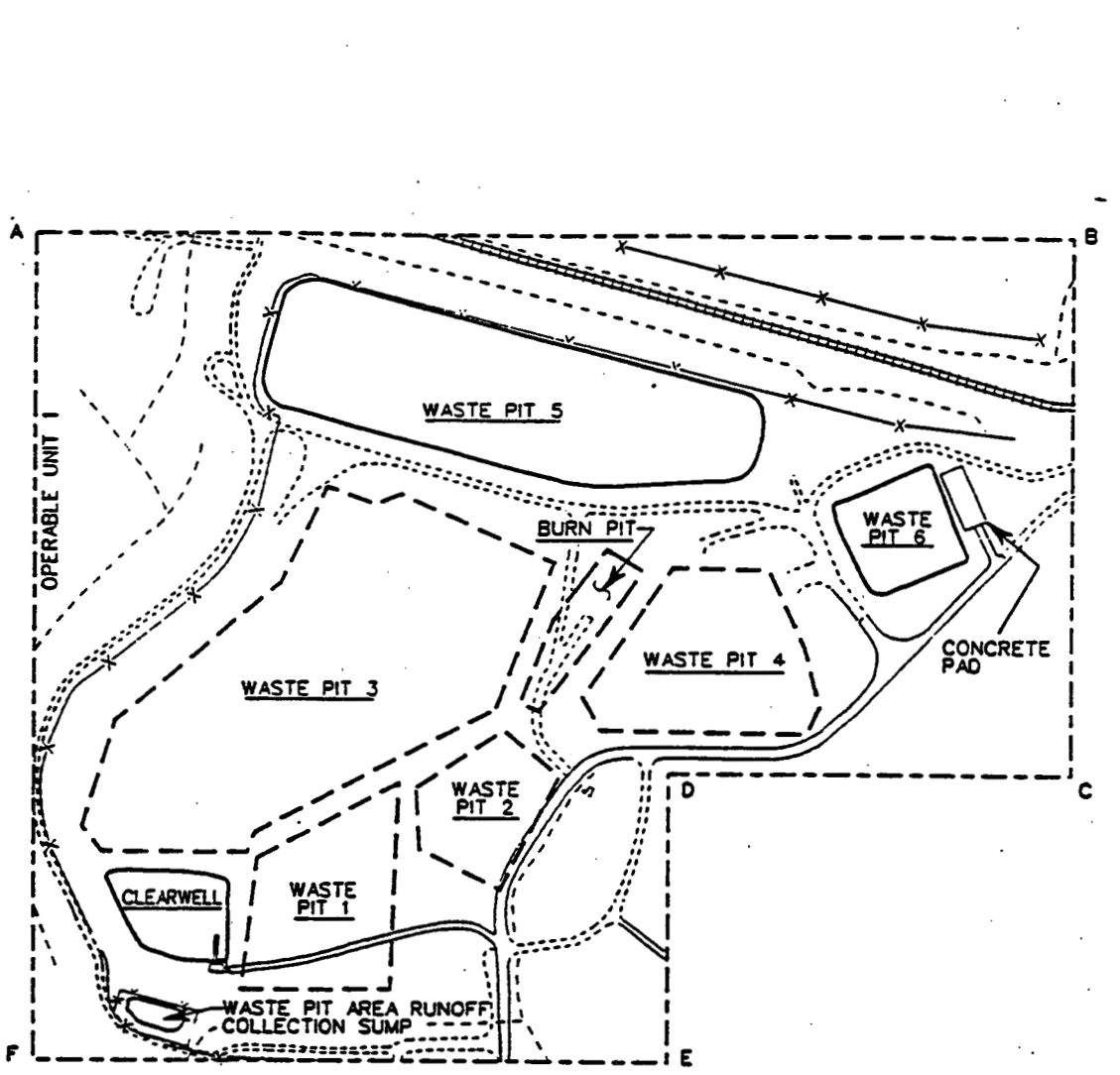
1. OPERABLE UNIT 3 INCLUDES ALL BUILDINGS, PIPELINES, AND ABOVE-GROUND STRUCTURES IN THE PRODUCTION AREA. OPERABLE UNIT 5 INCLUDES GROUNDWATER, SURFACE WATER, SOILS, FLORA AND FAUNA, IN THE REGIONAL AREA AS WELL AS THE PRODUCTION AREA.

LEGEND:

- —x—x— FENCE LINE
- DRAINAGE WAY
- CSX RAIL LINE
- OPERABLE UNIT 1 OUTLINE
- FEMP PROPERTY BOUNDARY
- OPERABLE UNIT 1
- OPERABLE UNIT 2
- OPERABLE UNIT 4

SCALE: 0 — 1200 FEET

FIGURE 1-1. LOCATION OF OPERABLE UNIT 1 WITHIN THE FEMP



NOTES:

1. PITS 1, 2, 3 AND THE BURN PIT ARE COVERED WITH SOIL CAPS AND VEGETATED.
2. PIT 4 HAS AN INTERIM CAP.
3. PITS 5, 6 AND CLEARWELL ARE WATER COVERED
4. COORDINATES SHOWN ARE OHIO STATE PLANAR COORDINATES. ADJUSTED PER THE NORTH AMERICAN DATUM (NAD) OF 1983.

OU1 STATE PLANAR COORDINATES		
POINT	NORTHING	EASTING
A	482364	1377824
B	482364	1379432
C	481499	1379432
D	481499	1378812
E	481033	1378812
F	481033	1377824

LEGEND:

—X—X— FENCE LINE
DRAINAGE WAY
CSX RAIL LINE
PAVED ROADWAY
GRAVEL ROADWAY
OPERABLE UNIT 1 OUTLINE
COVERED PIT OUTLINE
OPEN PIT OUTLINE

SCALE:
0 300 FEET

409191-A-410 / OU1/ KNOX/ DS
409191XOU1 02-10-94 DON GOSS

FIGURE 1-2. OPERABLE UNIT 1 SITE MAP

SECTION 2
GEOTECHNICAL TESTING

This section describes the geotechnical testing to be performed as part of the Dewatering Excavation Evaluation Program (DEEP). Geotechnical testing includes soil borings and cone penetrometer tests. This section provides information about each type of testing, as well as associated residuals management, modifications to the site Sampling and Analysis Plan (SAP), and a description of the DEEP Project Specific Plan (PSP). A discussion of data quality objectives (DQOs) is also provided.

2.1 GEOTECHNICAL TESTING DATA QUALITY OBJECTIVES

Geotechnical boring installations are performed under a PSP, which is a separate plan from the DEEP work plan. The PSP describes in more detail specific aspects of the field activities and health and safety considerations associated with the boring installations. The PSP, and accompanying Project Specific Health and Safety Plan (PSHASP) are listed in the references section of the DEEP work plan.

In accordance with the Fernald Environmental Management Project (FEMP) Sitewide CERCLA Quality Assurance Project Plan (SCQ), the following text describes the DQO process for DEEP geotechnical tests.

2.1.1 Identify the Decisions to Be Made that Affect the Situation

As stated in Section 1.3.1, the purpose of DEEP is to identify applicable excavation techniques to remove waste pit material and determine how to optimize and refine these excavation techniques.

2.1.2 Identify Inputs that Affect the Situation

The following DEEP geotechnical testing is expected to provide additional physical property characteristics of the waste pit material. Geotechnical tests results will be utilized to decide which dewatering and excavation methods are safest, most economical, fastest, and consistent with the Preferred Remedial Alternative as identified in the Operable Unit 1 Proposed Plan (DOE 1994b).

The results of the geotechnical analyses will be in the following areas:

- Permeability of the waste pit material
- Specific gravity of the waste pit material
- Moisture content of the waste pit material
- Atterburg limits of the waste pit material
- Grain size distribution of the waste pit material
- Foundation stability information of the waste pit material
- Waste strength through the Standard Penetration Test

The limitations of the inputs are:

- The acceptability of the data generated
- The actual field observations

2.1.3 Define the Boundaries of the Situation

The boundaries of the situation are defined in two ways: (1) the physical features of the waste pits (refer to Section 1); and (2) the suitability of boring installation-derived field investigation and laboratory analytical results of waste material physical properties. Sampling points were selected to provide a maximum amount of data from a minimum amount of sampling locations, and to minimize disturbance to known magnetic anomalies in the waste pits. Magnetic anomaly maps were consulted when sampling and trenching locations were selected. However, a comparison of the magnetic anomaly maps (provided in the Final RI Report for Operable Unit 1) with the sampling locations (shown in Figure 2-1) dewatering and trenching locations (shown in Figure 3-1) demonstrates that sampling and trenching will occur in areas with and without magnetic anomalies; wet excavation, but no drilling, will be performed in areas with magnetic anomalies. The sampling is for geotechnical purposes and encountering debris would skew results. From a geotechnical perspective, the controlling medium in such analysis will be the soil or sludge-like wastes rather than solid debris. For this reason, the drilling will attempt to focus on areas where the program will not likely be disturbed as a result of debris.

2.1.4 Develop a Logic that Applies to the Decision

Prior to surface excavation, DEEP project investigations, including "wet" and "dry" trench excavations, dewatering operations, ramp construction, and geotechnical data specific to the investigation locations will be needed. A boring for each of the seven "wet" trench excavation sites has been determined appropriate: two each in Waste Pits 1 and 2, and three in Waste Pit 3, has been determined adequate to

provide the required information. In addition, one boring each at or near the center of the "dry" trench excavation location in Waste Pit 1 and the center of the ramp in Waste Pit 3, will provide sufficient information for that part of the project. In total, nine borings will be conducted prior to waste pit trenching or dewatering operations.

In addition, two borings for each dry excavation shall be performed during dewatering; then one boring shall be performed at the end of dewatering for each dry excavation. Thus, six borings total shall be performed during and after the two dry excavations. The borings will be performed at least five feet form each other in the approximate center of the excavations.

Geotechnical data collected during earlier studies of the waste pits for the Final Treatability Study for Operable Unit 1 has been considered in the selection of the proposed trench excavation locations, the ramp construction location, preliminary boring locations, and depths. Locations of known or suspect drilling problem areas have been evaluated, and will be avoided. Surface surveying of proposed boring locations and the approximate depth of waste pit liners have been determined. Table 1-4 identifies the depth to the liner of each waste pit included in the DEEP.

Estimated boring depths, sampling intervals, and sample types are outlined in Table 2-1. The geotechnical tests to be conducted on the samples are listed in Table 2-2.

Boring installation and sampling proposed will be performed in accordance with existing American Society for Testing and Materials (ASTM) standards, and FERMCO standard operating procedures. All activities associated with the field portion of this investigation will be performed in accordance with the SCQ. This field work will comply with all other applicable FEMP requirements.

2.1.5 Establish Constraints on the Uncertainty of the Decision

The behavior of waste pit material during the investigation will influence design of the remedial option selected for the waste pits. For example:

- If drilling or sampling refusal occurs prior to reaching the pre-determined depth, the geologist will select a new boring location at least five feet from any existing boring location, and

commence drilling again. A boring must be completed for every trench or de-watering location. During drilling, two types of samples shall be collected in an alternating sequence: split-barrel samples and thin-walled tubes samples.

- If waste pit material densities, obstacles, or hazardous conditions preclude obtaining piston samples, split-barrel samples will be collected continuously.
- If, during the course of the field investigation, drilling is difficult or impossible due to unanticipated obstacles encountered in the subsurface, a resulting delay in the collection of required samples and other physical property information will result. Such a delay would be to the detriment of the Operable Unit 1 remedial design process and cause it to proceed at risk.
- If samples can not be recovered by normal sampling methods, alternative sampling methods will be used.

2.1.6 Optimize a Design for Obtaining Quality Data and Summary

Geotechnical samples shall be collected and reported on as identified in Sections 2.2 and 2.3 of this work plan.

2.2 SOIL BORINGS

2.2.1 Soil Borings Test Description and Objectives

Fifteen borings will be drilled in Waste Pits 1, 2, and 3. Figure 2-1 depicts proposed boring locations, the general layout of the soil-covered waste pits, and nearby access roads. Refer to Tables 2-3 and 2-4 of this plan for a discussion of the purposes, inputs, and data interpretation for each test. Samples will be collected for geotechnical laboratory testing and will consist of split-barrel samples and thin-walled tube samples taken at selected intervals in coordination with Standard Penetration Tests (SPT). Borings will be installed in multiple phases, that may be days to weeks apart, to satisfy a project objective of determining geotechnical material properties before, during, and after planned dewatering activities.

SPTs will be performed prior to every excavation, and before and during the full-scale dewatering tests begin in Waste Pits 1 and 3. The SPTs will supply data about the nature of the waste strata and strengths. The SPT strength data will yield information on the viability of the waste to support certain types of equipment and excavation slopes for excavation planning. The strata knowledge will yield strength information at known depths. The geotechnical tests that will be performed from the SPT samples will also provide information on the properties of the waste for excavation and process purposes,

i.e. triaxial shear will yield the shear strength for slope stability, moisture contents of the waste will yield information in the dewatering and drying designs, and sieve tests will yield information for material classification and crusher/shredder designs. SPT that are performed during and after dewatering will yield information on the effectiveness of the dewatering, i.e. through an increase in strength of the material and a reduction in moisture content.

Soil and waste material samples will be tested to provide the geotechnical testing information (Table 2-1) to evaluate the effectiveness of the dewatering alternatives to be tested during the DEEP. Geotechnical testing in this project includes:

TABLE 2-1

TABLE OF GEOTECHNICAL TESTS FOR SPT

GEOTECHNICAL TEST	SAMPLE TYPE	METHOD (Appendix H)
Consolidated-Compression Tests with Pore Pressure Measurements	Undisturbed	ASTM D 4767-88 / EM-1100-2-1906, APPENDIX X
Grain-Size Analysis	Disturbed	ASTM D 422-63 / ASTM D 1140-92
Atterberg Limits	Disturbed	ASTM D 4318-84
Moisture Content	Disturbed	ASTM D 2216-92
Specific Gravity	Disturbed	ASTM D 854-92
Unit Weight	Undisturbed	EM-1100-2-1906, APPENDIX II

At distinct lithologic changes, split-spoon samples shall be tested for grain-size analysis, Atterberg limits, specific gravity, and moisture content (Table 2-3). A sample volume of 500 ml will be sufficient sample to complete the requested tests. The thin-walled Shelby tube samples will be tested for unit weight, and Consolidated, Undrained Triaxial Compression Tests with Pore Pressure measurements (TX-CU w/pp). After the TX-CU w/pp is completed on the thin-walled shelby tube samples, the disturbed tests (Table 3-2) will also be completed on the resultant cuttings

from the tube. The University of Cincinnati laboratory personnel will determine if the amount of cuttings is adequate to complete the disturbed tests.

Geotechnical testing for physical properties will be conducted under the appropriate ASTM standards and laboratory procedures using qualified geotechnical laboratory technicians and properly calibrated apparatus which meets ASTM D 3740-90, "Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction" (Appendix H).

Additionally, as described in Section 2.3 of this work plan, STP analysis results will be used to correlate the Cone Penetrometer Test results obtained to verify/refute the results of each type of subsurface investigation. Following completion of field work, the geotechnical testing results obtained will be used to decide which dewatering and excavation methods are safest, most economical, fastest, and consistent with the selected remedy, as identified in the Operable Unit 1 ROD.

2.2.2 Soil Borings Experimental Design and Procedures

2.2.2.1 Boring Locations and Anticipated Depths

The boring diameters shall be large enough to allow for an adequate amount of sample to be collected, and will range in depth from 15 to 35 feet. They will penetrate from 2 to 10 feet of compacted cap materials, will extend into waste materials, and terminate at least 5 feet above the waste pit bottom liner. Borings will be installed and geotechnical sampling will be performed in accordance with FERMCO Site Characterization Department Standard Operating Procedure SCDM FO 001, entitled "Sampling of Solids with a Split-Barrel or Thin-Walled Tube."

Seven borings will be advanced at the proposed wet trench excavations; two each in the Waste Pits 1 and 2, and three in Waste Pit 3. Two borings will be at or near the centers of the proposed Waste Pit 1 and Waste Pit 3 dewatering test areas, for a total of nine borings prior to trenching or dewatering. During dewatering, two borings will be performed each in Waste Pits 1 and 3 at different times to measure changes in the material strength resulting from dewatering. After the dewatering phase is complete, a

final boring for Pits 1 and 3 will be performed. Table 2-1 summarizes boring locations, anticipated depths, sample types, and sampling intervals.

Prior to soil boring activities, locations will be surveyed to establish the surface elevation at each borehole location so that all borings can be terminated 5 feet above the top of the waste pit liner at that location. Pit cross-section information published in the Final Remedial Investigation Report for Operable Unit 1, such as lithological logs from the Characterization Investigation Study (CIS), boring logs, and other data from RI/FS sampling, aided in identifying liner depth. In addition, samples recovered from split-barrel samples will be examined at 2-foot intervals; samples recovered from thin-walled tubes will be examined at 2 1/2-foot intervals.

2.2.2.2 Boring Operations and Sampling Procedures

Cuttings from boring operations will be placed on plastic sheeting and subsequently returned to the excavation site backfill and compacted. Ultimately, the cuttings will be addressed as part of the full-scale remediation of Operable Unit 1. The entire hole will be backfilled with Volclay grout upon completion of each boring. Grouting of completed boreholes will conform to Ohio Administrative Code (OAC) 3745-09-10(A). Following completion and backfilling of the borehole, an identification stake will be placed at the borehole so that follow-up "as-built" surveying can be completed.

Several soil sampling methods will be used to explore subsurface materials because much of the material to be sampled is anticipated to be saturated (part of which is semi-liquid consistency). A variety of sample collection techniques, such as a piston sampler, SPT split-barrel sampler, and a split-barrel sampler with a liner and basket or flap valve retainer, will be required. Other methods may also be used if needed, but must be approved by the Lead Geologist prior to implementation. The focus will be on collection of a testable sample. Table 2-1 identifies the anticipated sampling methods and intervals.

Split-Barrel Sampling. Samples will be recovered in accordance with the SPT and Split-Barrel Sampling of Soils (ASTM D 1586). The sample will be visually classified and recorded; a portion will be saved for further laboratory testing. All split-barrel samples shall be field screened for radiological and organic constituents and shall be identified in the field log book.

Thin-Walled Tube Samples. In addition to the standard split-barrel sampling procedures, relatively undisturbed 3-inch-diameter thin-walled sample tubes (ASTM D 1587) will also be obtained for laboratory testing. The thin-walled tubes will be pushed a minimum of 30 inches into the undisturbed material below the augers. A Dennison sampler or similar piston sampler is recommended for site conditions.

The tubes will be carefully removed from the borehole and inspected by the Lead Geologist. At the direction of the Lead Geologist, the sample tubes will then be cut into approximate 6-inch sections, labeled accordingly, and prepared for transport. Both ends of each tube section will be capped and taped to protect the sample. Tube sections will be packaged in special shipping containers designed to maintain the sample orientation and to prevent shock or vibration during transit. The samples should be protected against freezing or excessive temperatures. All samples will be collected, handled, and shipped to the geotechnical laboratory in accordance with site requirements .

The daily log, including a log of each borehole, sample type, intervals, blow count, material type, and general comments about the borehole advancement process, shall be maintained by the Lead Geologist. All geotechnical laboratory reports will be consistent with the reporting requirements specified in the ASTM test procedures listed in Table 2-2. Subsurface boring logs shall be generated for each boring. Visual classification of the materials will be performed in the field in accordance with ASTM D 2488.

2.2.3 Soil Borings Data Collection, Analysis, Interpretation, and Reporting

Soil borings will be utilized to determine the geotechnical properties of materials sampled from each boring before and after dewatering activities. To provide specific in situ information for use in the investigation of dewatering, boring samples designated to provide accurate physical descriptions and physical property information are essential. The pit waste boring and sampling program will provide comparative data for establishing baseline waste geotechnical conditions within each pit. Due to the heterogeneity of waste pit materials and the existence of analytical results from previous sampling programs in Waste Pits 1, 2, and 3, sampling to identify the chemical nature of the pit wastes will not be performed.

Field-generated documentation associated with soil borings will include:

- Field activity logs
- Lithologic logs (to include visual classification of materials)
- Sample collection logs
- Standard penetration test (SPT) information
- Field screening results for radiological and organic constituents

Soil boring samples will be analyzed to provide the following geotechnical information in reports:

- Grain-size analysis
- Atterburg limits
- Moisture content
- Specific gravity
- Triaxial shear strength test
- Unit weight test
- Standard Proctor compaction test

Table 2-3 identifies the purpose of each of the above analyses. Reported data will include the geologist's daily log (to include a log of each borehole, sample type, intervals, blow count, material type, and general comments), subsurface boring logs, the results of field screening for radiological and organic constituents, and geotechnical laboratory reports.

2.2.4 Soil Borings Equipment

- Truck, platform, or trailer mounted mechanical or hydraulic drill rig with hollow stem auger capabilities
- Split-barrel sampler
- Thin-walled tube sampler
- Photoionization detector (PID)
- Radiation meter

2.3 CONE PENETROMETER TESTING

2.3.1 Cone Penetrometer Test Description and Objectives

Cone penetrometer tests (CPTs) will be performed in Waste Pits 1, 2, and 3 to obtain geotechnical information on the wastes to be excavated by mechanical equipment. An electric penetrometer fitted with a piezocone shall be used to measure tip resistance, side friction, inclination, load, and pore pressure. All ground penetrations will stop at a minimum distance of 5 feet above the estimated depth of the top of the pit liner. Testing will take place throughout the pits, as well as in the approximate area of the

dewatering wells. Testing will provide a continuous record of penetration resistance and pore pressure versus depth for each testing location. All CPTs will be performed according to ASTM D 3441-86 procedures and equipment specifications.

Data obtained, such as waste strength and pore pressure, will be correlated with the SPT information. Samples taken from the borings will have index properties, shear strength, and compaction tests. These tests will provide data for well designs, material classifications, permeabilities, waste strata, slope stability, optimum moisture content and maximum dry density. Maximum dry density and optimum moisture contents will provide design information that will allow the mechanical equipment to be driven over the waste safely.

The CPT advantage is that it is faster and more economical compared to the SPT; however, SPTs will be performed in the area of the CPTs to correlate the CPT data with that which is actually found and tested in laboratory conditions (SPT samples).

2.3.2 Cone Penetrometer Testing Experimental Design and Procedures

The CPTs are part of the U.S. Department of Energy (DOE) Site Characterization and Analysis Penetrometer System (SCAPS) Demonstration Project. SCAPS is designed to gather waste pit geotechnical information. All ground penetrations will stop at a minimum distance of 5 feet above the estimated top of the waste pit liner. After sampling, all CPT holes shall be abandoned and plugged with Volclay grout to the surface. Following grouting, an identification stake will be placed at the location so that follow up, "as-built" surveying can be completed. Locations of the CPTs are shown in Figure 2-1.

Phasing of CPTs in the Waste Pits: The phasing of the CPTs will depend on the availability of the equipment furnished by the SCAPS Demonstration Project. The SCAPS CPTs are scheduled to be performed in the waste pits August 22-26, 1994, in conjunction with the DEEP.

CPT Procedures: Testing procedures shall be in accordance with ASTM D 3441-86, Sections 4, 5, and 6. The rate of penetration shall be 4 feet/minute (10 millimeters/second), plus or minus 1 foot/minute (7.5 millimeters/second). The penetrometer shall be electric with a piezocone.

Calibration: Instrument calibration shall be performed in the field. The results will be recorded in the field log.

2.3.3 Cone Penetrometer Testing Data Collection, Analysis, Interpretation, and Reporting

Data requirements shall be in accordance with ASTM D 3443-86, Section 7. The minimum depth interval between sensor data readings shall be 1 inch and data shall be reported at the same interval. Data shall be provided as continuous plots of tip bearing, sleeve friction, and pore pressure in pounds per square inch and tons per square foot versus depth in feet. Inclination of the probe during penetration shall also be identified.

Continuous plots of friction ratio and pore pressure ratios versus depth in feet will be generated. Strip chart data shall also be provided. Data related to physical probe dimensions used in calculations and any filtering or averaging used in the analysis shall also be reported.

A tabulation of the data presented or the continuous plot shall be provided at 6 inch intervals. Interpreted information, such as equivalent SPT blowcount N, equivalent drained friction angle for sands, equivalent relating density of sands, equivalent undrained strength of clays, and equivalent soil behavior type, shall also be provided on the same tabulation. The method by which these interpreted data are developed shall also be reported. Data analysis information shall be available in the field during dewatering at the dewatering sites. A continuous record of penetration resistance and pore pressure versus depth will be documented for each CPT location.

2.3.4 Cone Penetrometer Testing Equipment

Cone Penetrometer equipment and supplies will be provided by DOE SCAPS Demonstration Project.

2.4 MODIFICATION OF EXISTING SITE SAMPLING AND ANALYSIS PLAN

This section describes how the existing site Sampling and Analysis Plan (SAP) will be modified to address the specific geotechnical testing to be performed during the DEEP. An estimated 365 feet of borings will be taken, comprised of 95 split-barrel samples and 80 thin-walled tube samples.

Sample Identification: Test borings have been assigned an alphanumeric identification number. Each sample from the borings will be assigned a unique sample number. Each section of a single thin-walled tube will be given the same sample number, with additional alphabetic and depth designations to locate the position of the section in relation to the whole thin-walled tube. Additional borings and samples will be numbered using a similar method.

Sample Containers: Samples will be placed in the appropriate containers for further handling and transport for shipment to the on-site lab. Split-barrel samples will be placed in moisture-proof jars. The jars will then be placed in partitioned boxes for off-site shipment, as necessary.

After the sample tubes are cut into sections, the ends of each section will be tightly sealed to prevent disturbance and moisture loss. The thin-walled tube sections will then be packaged upright in specially designed containers for further transport and shipment. The sample tubes will be packed to minimize vibration and shock during transport. Final preparation of shipping containers will be performed by the FERMCO Sample Processing Laboratory.

Sample Labels: Sample jars, sample tubes, boxes, and shipping containers will be permanently labeled and/or marked with the appropriate descriptive information. Sample labels, at a minimum, shall include the project number and site, boring number, sample number, date and time of sampling, depth of the top and bottom of the sample, number of blows for each 6 inches, and recovery. Additional labeling and marking may be necessary for potentially hazardous or radioactive samples.

Sample Handling: Samples obtained during field investigations require careful handling, packaging, and shipping. Disturbance and loss of moisture from the undisturbed samples may have serious effects on the properties of the materials; therefore, every precaution will be taken when handling the samples.

Precautions will be taken to protect samples against exposure, freezing, excessive temperature changes, and moisture loss. Additional handling, packaging, and shipping requirements may be required if potentially hazardous or radioactive samples are encountered during the investigations.

EPA requires that remedial actions at federal facilities taken under Sections 104, 106, or 120 of CERCLA comply with the CERCLA Off-Site Rule (40 CFR 300.440). Under the Off-Site Rule, CERCLA waste samples that are being characterized do not have to meet the full requirements of the rule. The CERCLA waste samples may be returned to the site if the FEMP agrees to assume responsibility for management of the samples.

Sample Shipment: Samples (tubes and jar samples) collected during the subsurface exploration will be shipped to an on-site geotechnical laboratory for analysis. Transportation of samples will be accomplished in a manner designed to protect the integrity of the samples (ASTM D 4220) and to prevent any detrimental effects from the potentially hazardous nature of the samples. All samples shall be preserved, packaged, and transported in accordance with the Sitewide CERCLA Quality Assurance Project Plan (SCQ). Custody of sample containers shall remain with FERMCO for shipment, document preparation, packaging, and final preparation for shipment to the geotechnical laboratory or to the FEMP Sample Processing Laboratory. Upon completion of geotechnical laboratory testing, the geotechnical laboratory will ship the sample material to FERMCO for final disposition.

Sample Archives: Selected samples, as specified by the Lead Geologist, that are not sent to the geotechnical laboratory for testing will be archived in the FEMP Sample Archives. Archiving of samples will be coordinated through the FEMP Sample Processing Laboratory.

Chain-of-Custody: Sample chain-of-custody procedures will be followed during all field and laboratory activities in accordance with the SCQ and applicable FEMP procedures.

Geotechnical Laboratory Test Plan: Samples of pit materials collected during drilling and SPTs will be shipped to an on-site geotechnical laboratory for testing. The testing will consist of classification tests,

shear strength tests, and compaction tests. The general purpose and procedure for each type of geotechnical test is summarized in Table 2-3.

The majority of geotechnical tests will be performed on sample material from relatively undisturbed thin-walled tube samples obtained from boreholes within the covered pits. Bulk samples will be required for compaction testing. This sample material will come from the un-dewatered trench excavations. The anticipated laboratory tests for the waste pit test dewatering and excavation project are presented in Table 2-2. The actual samples selected for particular tests will be determined based on the conditions encountered in the field and sample characteristics. All triaxial shear tests shall include tests of three specimens at different confining pressures. Standard Proctor compaction tests will be performed at five test points. The laboratory testing is anticipated to take 4 to 6 weeks upon final receipt of samples from DEEP.

2.5 GEOTECHNICAL TESTING RESIDUAL WASTE MANAGEMENT

2.5.1 Boring Cuttings

Soil boring cuttings will be placed on plastic sheeting and covered until they are used as backfill at trench excavations.

2.5.2 Waste Returned From Analytical Laboratories

Contact waste will be managed as described in Section 2.5.3. Waste being returned from laboratories will be archived and stored with the dried material awaiting the Waste Pit 6 Drying Study. Sampling of the waste entails geotechnical sampling only; therefore, no additives will be added to the material that could alter the chemical composition of the waste, thus rendering it a RCRA hazardous waste.

2.5.3 Contact Waste and Personal Protective Equipment (PPE)

Contact waste is categorized as personal protective equipment (PPE), gloves, wipes, plastic, etc. generated during a sampling event that may be contaminated as a result of coming in contact with the sampled material. Contact waste generated during the DEEP will be collected in a plastic bag and sealed with tape. The bag will be labeled with the name and phone number of the project supervisor and the name of the person placing the bag in the dumpster. The bag will be placed in the CRU3 RI/FS-

designated locked dumpster. No Material Evaluation Form will be generated. The trash in the dumpster will go to the trash baler, where it will be compacted and boxed for transport from the site as low-level radioactive waste. Grossly contaminated PPE will be placed in a container and stored with the dried material awaiting the Waste Pit 6 Drying Study.

TABLE 2-1A
ESTIMATE OF SAMPLE DEPTHS AND INTERVAL WITH NUMBER OF EACH TYPE PER BORING

Boring No.[1]	Estimated Depth (ft)	Sampling Interval	Split-Barrel Samples	Thin-walled Tube Samples
G1-101[2]	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-102	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-103[3]	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-104[3]	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-105[3]	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-106[3]	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-201	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-202	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-301	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8

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TABLE 2-1A
ESTIMATE OF SAMPLE DEPTHS AND INTERVAL WITH NUMBER OF EACH TYPE PER BORING (CONTINUED)

Boring No.[1]	Estimated Depth (ft)	Sampling Interval	Split-Barrel Samples	Thin-walled Tube Samples
G1-302	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
G1-303	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
G1-304[3]	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
G1-305[3]	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
G1-306[3]	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
G1-307[3]	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
Totals	365		95	80

Notes: (1) See Figure 2-1 for location of borings.
(2) Boring Identification key: G1-101; G = Geotechnical Boring, 1 = Pit 1, 01 = Boring 1.
(3) Borings G1-103, G1-104, G1-105, and G1-106 will be one before two during, and one after dewatering. Five foot separation should be maintained between borings.

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TABLE 2-2
SUMMARY OF GEOTECHNICAL LABORATORY TESTING PROCEDURES

TEST METHODS	TITLE
ASTM D 422	Method for Particle-size Analysis of Soils
ASTM D 698	Test Methods for Moisture-Density Relations of Soils Using a 5.5-lb Hammer and 12-in. drop
ASTM D 854	Test Method for Specific Gravity of Soils
ASTM D 2216	Method for the Laboratory Determination of Water Content of Soil, Rock, and Soil-Aggregate
ASTM D 2487	Test Method for Classification of Soils for Engineering Purposes
ASTM D 2488	Practice for Description and Identification of Soils for Engineering Purposes
ASTM D 4220	Practices for Preserving and Transporting Soil Samples
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4767	Test Method for Consolidated Undrained (CU) Triaxial Compressive Test on Cohesive Soils
EM-100-2-1906 APP.II	Dry Unit Weight
EM-1100-1906 APP. X	Triaxial Compression Testing

TABLE 2-3
TYPES AND PURPOSES OF GEOTECHNICAL TESTS FOR THE DEEP

Type of Geotechnical Test	Purpose
Index Properties Tests:	
• grain-size analysis	The grain size analysis or sieve tests will classify the material as a clay, silt, etc. The grain size distribution curve (from the sieve test) will provide permeability data that will be used in the well design, i.e. fine verses course material will have different well screen sizes and different sand pack gradations.
• Atterberg limits	The Atterberg limits (plastic and liquid limit tests) will provide moisture contents for when the material moves into the plastic (clay) range or liquid range. These values will help to classify the material and provide a contractor information as to how the material behaves at certain moisture contents, i.e. does the material hold when it gets wet or does it tend to slough immediately.
• moisture content	The moisture content of the waste in-situ will help in the design of the dryer, tell us what state the material is in, i.e. elastic, plastic, or liquid.
• specific gravity	The specific gravity of the material will be needed for a slurry pump design (high SG materials are harder to pump), soil classification (clays average 2.7), and thickener design (higher SG material smaller thickener).

TABLE 2-3
TYPES AND PURPOSES OF GEOTECHNICAL TESTS FOR THE DEEP (CONTINUED)

Type of Geotechnical Test	Purpose
Shear Strength: • triaxial shear strength test • unit weight test	The tri-axial shear test will indicate the total shear strength of the material and the pore water pressure. Since the material is in a saturated condition, the effective strength, which is the total strength minus the pore water pressure, will be used for design purposes. The effective shear strength of the material will be utilized in slope stability calculations. Knowing the maximum slope to which the pits can be excavated is crucial to avoiding any slope failures. The laboratory shear strength will also be used to correlate with SPT and CPT data. The in-situ unit weight is needed to determine the density of the material which will be used for geotechnical calculations for material indexing, i.e. relating the percent solid, liquid, and air of the material.
Compaction: • Standard Proctor compaction test	The standard proctor test finds the optimum moisture content and the maximum dry density of a material for compaction purposes. This information will be needed since equipment will be on the waste and the material will have to be compacted to safely place equipment on the waste.

TABLE 2-4
ESTIMATED GEOTECHNICAL LABORATORY TESTING FOR WASTE PIT DEWATERING AND EXCAVATION PROJECT

Boring No. or Trench Location	Boring Type(1)	Grain-size	Atterberg Limits	Moisture Content	Unit Weight	Specific Gravity	Triaxial Comp. (CUw/pp)(2)	Standard Proctor
G1-101(3)	T	2	2	3	2	1		
G1-102	T	2	2	3	2	1		
G1-103	B	2	2	4	2	2	2	
G1-104	D	1	1	2	2	1		
G1-105	D	1	1	2	2	1		
G1-106	A	1	1	2	2	1	2	
Trenches at Pit 1								3(4)
G1-201	T	2	2	3	2	1		
G1-202	T	2	2	3	2	1		
Trenches at Pit 2								2(4)
G1-301	T	2	2	3	2	1		
G1-302	T	2	2	3	2	1		
G1-303	T	2	2	3	2	1		
G1-304	B	3	3	4	3	2	3	
G1-305	D	2	2	3	2	1		
G1-306	D	2	2	3	2	1		

TABLE 2-4
(continued)

Boring No. or Trench Location	Boring Type(1)	Grain-size	Atterberg Limits	Moisture Content	Unit Weight	Specific Gravity	Triaxial Comp. (CUw/pp)(2)	Standard Proctor
G1-307	A	2	2	3	2	1	3	
Excavations at pit 3								4(4)
Totals		28	28	44	31	17	10	9

Notes: (1) Boring Types: T = Boring at trench location
B = Boring at dewatering test site before dewatering
D = Boring at dewatering test site during dewatering
A = Boring at dewatering test site after dewatering
(2) CUw/pp = Consolidated Undrained triaxial compression with pore pressure measurements
(3) Boring Identification key: G1-101; G = Geotechnical Boring, 1 = Pit 1, 01 = Boring 1
(4) Test on bulk sample collected at trenches and ramp located in pits.

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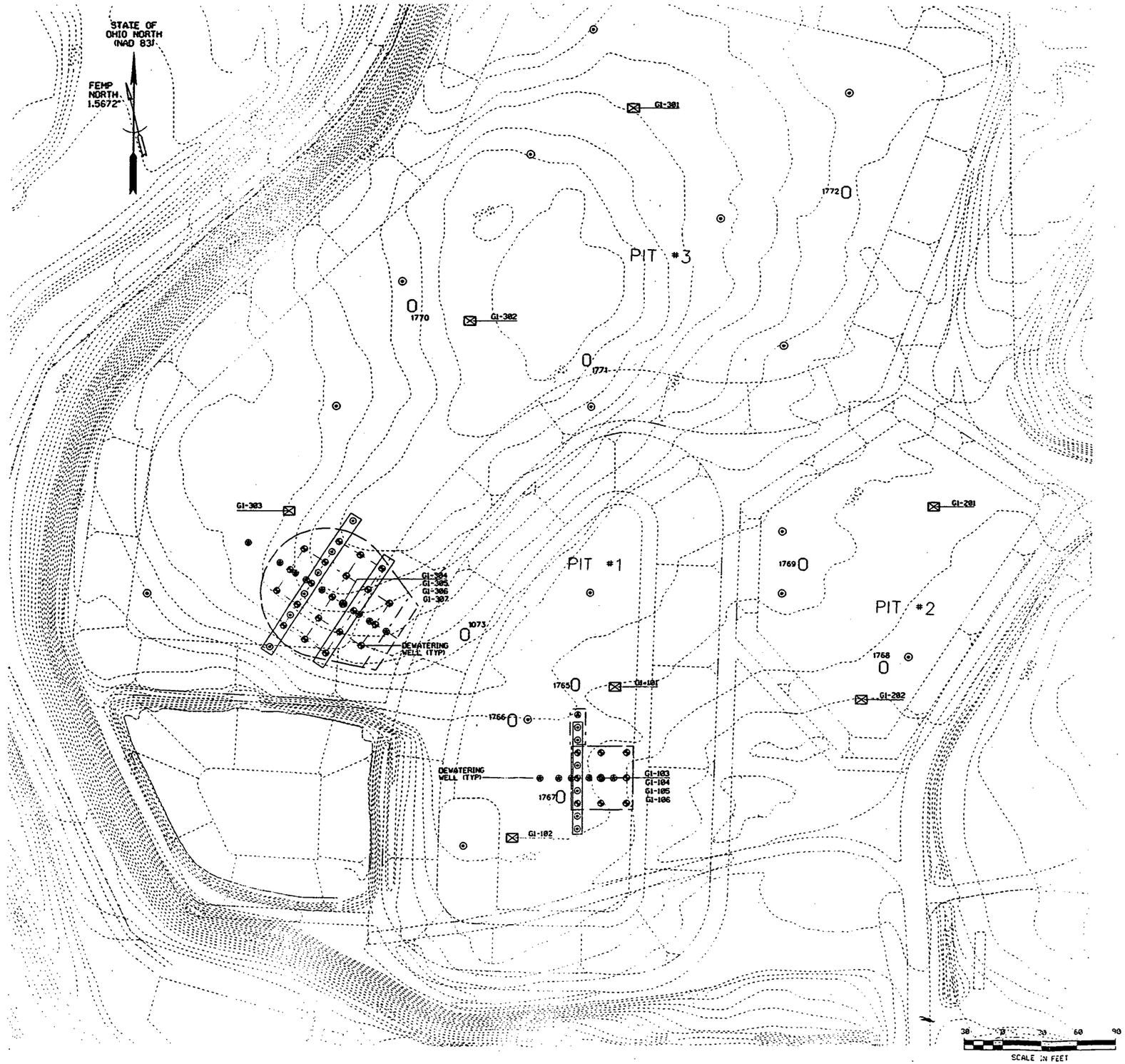


LEGEND

- LEACHATE WELL FOR SLUG TESTING
- BEFORE, DURING AND AFTER DEWATERING SPT
- CONE PENETROMETER TEST (CPT)
- UNDEWATERED TRENCH, SPT AND CPT
- DEWATERING TEST AREA, OBSERVATION WELLS AND ZONE OF INTERIM CPT TESTING.

BORING LOCATION

BORING NO	NORTH	EAST
GI-101	481,405.4	1,346,851.3
GI-102	481,286.4	1,346,769.6
GI-103	481,335.7	1,346,838.3
GI-104	481,335.7	1,346,843.3
GI-105	481,330.7	1,346,838.3
GI-106	481,330.7	1,346,843.3
GI-201	481,551.1	1,347,099.5
GI-202	481,396.2	1,347,044.0
GI-301	481,866.8	1,346,862.8
GI-302	481,698.2	1,346,734.0
GI-303	481,546.0	1,346,593.1
GI-304	481,473.7	1,346,633.6
GI-305	481,473.7	1,346,638.6
GI-306	481,468.7	1,346,633.6
GI-307	481,468.7	1,346,638.6

LOCATION MAP
SLUG TEST, BORING WITH SPT, CPT

FIGURE 2-1

SECTION 3
WET EXCAVATIONS

This section describes the methodology for two wet excavation tests: (1) excavation with no dewatering wells; and (2) a waste reslurry and pumping test.

3.1 WET EXCAVATION

3.1.1 Wet Excavation Test Description and Objectives

Seven wet (not dewatered) trenches will be excavated: two each in Waste Pits 1 and 2, and three in Waste Pit 3. Wet trenches will be excavated where no dewatering wells are planned. This approach is being used to evaluate normal conditions for the waste or sludge. The proposed wet excavations will evaluate the effectiveness of conventional mechanical equipment, and will provide the basis to evaluate the effectiveness of dewatering a wet waste to a dry waste. Waste Pit 1 trenches will be excavated first, followed by Waste Pit 3 trenches, and then Waste Pit 2 trenches. Individual trenches within each waste pit will be sequenced at the discretion of the Dewatering Excavation Evaluation Program (DEEP) project manager or designee. Each trench must be completely backfilled before excavation of another trench can begin. See Figure 3-1 for wet trench locations.

The wet waste will be excavated with side walls as steep as possible. This will provide visual data on how steep the waste can be excavated. For example, if the waste side walls collapse, information on the natural angle of repose will be obtained. The trenches shall be excavated to a maximum depth of 15 feet with an affected top area of 30 by 30 feet. If the trenches are found to be too wet for excavation using conventional equipment, then slurrying the waste or conventional equipment with waste dewatering may be concluded to be the more efficient excavation technique. Samples will be taken from the waste stockpile and placed in steel boxes for treatability studies at a later date. Coatings and surfactants will be applied to the waste stockpiles to test each surfactant's ability to contain the waste and to prevent windborne emissions (see Attachment D).

3.1.2 Wet Excavation Experimental Design and Procedures

3.1.2.1 Stockpile Area

At each trench location, two lined pads will be used: one to store soil cap material while the other will be used to stockpile waste. The cap in Waste Pit 3 is relatively thick, ranging from 6 to 8 feet thick at proposed trench locations. The caps at Waste Pits 1 and 2 may be less than 2 feet thick; therefore, caution will be exercised in removing the cap material and not contaminating it with waste material. All stockpile pads will be graded such that drainage flows back into the trench.

Containment berms for the stock piles will be made with straw bales lined up to form a barrier. The bales will be covered with 6-mil plastic sheeting.

3.1.2.2 Excavation

After lining the pad areas and constructing containment berms, the capping can be stripped. Stockpiles shall be covered when excavations are no longer in progress or dust control agents will be applied (see Attachment D, Dusting Suppressant Testing).

Maximum trench depths will be 15 feet. The backhoe will excavate to near-vertical slopes until failure of the trench walls occurs. An assumed slope of 2V to 1H is expected to maintain stability through the cap, and a 1-to-3 vertical to horizontal ratio (1V to 3H) is expected to maintain stability through the waste sludge. Determining actual angles of repose for the cap and waste sludge is one of the objectives of the excavation.

The typical wet trench excavation is shown in Figure 3-1. The wastes in Waste Pits 1 and 2 may support a slope of 1V to 3H. Waste Pit 3 waste is assumed to be very wet; the 1V to 3H slope is an estimate but may not be stable. If near-vertical slopes can be obtained, then the excavation will progress in that manner. If the walls collapse at near-vertical slopes, then the trench shall be regraded to a stable slope. An estimate of 312 cubic yards (cy) of waste may be retrieved from each trench. Due to the characteristics of the waste, i.e., wet waste, then the excavations will be shallower and less waste will be removed.

In excavating the trenches, an emphasis will be placed on visual observations of the waste behavior; thus, equipment operators will be given direction as to how fast and where to excavate. Field observations will include:

- Angle of repose of the waste
- Amount (depth) of water in the trench
- Waste strata (colors, texture, etc.)
- Approximate trench depth, as determined by the boom length
- Wall stability following contact with equipment
- Waste strength

Excavations will proceed at the discretion of the Field Operations Manager, with no wet excavation remaining open for greater than three days. Equipment used for certain phases of the excavation, i.e. cap removal or waste excavating, will be determined by the field operations lead.

3.1.2.3 Waste Material Archives

A 15 cubic yard (cy) sample shall be taken from each of the three waste pits. Each sample shall be taken from the second trench excavated in each waste pit and placed in a 96-cubic-foot white metal box. After surveying to ensure no contamination exists above the FEMP Radiological Control Manual Criteria, the boxes shall be transferred to the Plant 1 storage pad, or to another suitable hard-surfaced storage pad at the FEMP, in keeping with the Amended Consent Decree with the State of Ohio.

3.1.2.4 Reclamation

Following trench excavation and gathering samples for material handling studies, the waste will be backfilled into the trench and compacted with the track-hoe bucket, if necessary. The cover material will be returned and again compacted to the greatest extent possible with the track-hoe bucket. Any remaining cover will then be added and further compacted by repeatedly driving the track-loader over the returned cover material. These compaction actions will return the soil permeability to a state that is equal to or less than that which previously existed. The sludge will need to be compacted with the backhoe bucket as it is placed in the trench. When the waste stockpile is backfilled down to the plastic liner, the liner will be disposed of in the trench. Next the cap material will be placed on the waste and compacted with the excavation equipment by driving on the disturbed areas. The disturbed areas will then be seeded and

straw will be dispersed over the seeded areas. Caution must be used in backfilling the trench such that rubber-tired equipment does not create any slope failures.

3.1.2.5 Equipment Decontamination

When salvageable equipment is no longer needed for the DEEP project, it will be scraped with a shovel to remove excess sludge waste. Any gross contamination will be removed on site prior to full decontamination at the FEMP Decontamination Facility, where it will be authorized for free release off site. The FEMP will utilize a high-pressure steam and detergent mixture illustrated in FEMP SOP 55-C-101, "Operation of Steam Detergent Cleaner in the Decontamination and Decommissioning Building." Subsequent to decontamination, the salvageable equipment will be radiologically surveyed and authorized for free release off site.

3.1.2.6 Video Recording

All excavations will be video recorded for a permanent record of visual waste characteristics.

3.1.3 Wet Excavation Data Collection, Analysis, Interpretation, and Reporting

3.1.3.1 Wet Excavation Data Collection

The following data will be collected during the wet excavation. This data will be collected by field observation during excavation, and recorded on field logs:

- **Angle of Repose in Excavation and Stockpile** - A visual evaluation of the angle of repose of materials exposed in the trench excavation side walls and the waste stockpiles will be conducted and recorded. The Angle of Repose in the excavation and waste stockpiles will be determined by the use of one or more of the following observation methods:

  1)Evaluating the vertical and horizontal distances between the toe and crest of the slope.
  2)Estimating vertical sidewall and slope distances by use of the backhoe boom.
  3)Using a tape measure or survey rod at the ground surface to gage horizontal distance.

  This information will be necessary to adequately determine the behavior of the excavated trench sidewalls during excavation. Project field staff safety concerns and the determination of safe equipment proximity to the excavation both at the surface, and once full scale excavation below the ground surface begins, drive the need for this information.

- **Moisture Content in Situ** - Waste samples will be taken from the excavation and analyzed for moisture content, per American Society for Testing and Materials (ASTM) method 2216. Moisture content will be used to determine the predewatered waste moisture content for the

purposes of comparison with the postdewatered moisture content, to evaluate the relative success of dewatering. Also, knowledge of moisture content of the wet waste will assist with the waste dryer system design by allowing for duplication of moisture content, as necessary, when the treatability study waste samples collected (Section 3.1.2.3) are ready for batch processing through the waste dryer system.

- **Plate-Bearing Capacity** - A Plate Bearing Capacity test will be performed (and recorded) on the undisturbed waste in the excavation. Three different plate-bearing capacity end pressures will be used to simulate the bearing pressure under an excavator's tracks.

- **Dust Generation From Excavation and Stockpile** - The waste stockpile and atmospheric conditions will be monitored to evaluate the potential for dust generation during waste excavation. Visual observation and air sampling will be performed and recorded. Additionally, dust suppressants will be tested for their effectiveness and reliability over the duration of the test. In addition to the need to evaluate the potential for entrainment of dust entrainment into the atmosphere from both the waste excavation and waste stockpile, FEMP Safety Analysis requirements, as determined by DOE Orders, stipulate that both the excavation and stockpile be continuously monitored to document any particulate release which may occur due to a high wind event. This information is necessary in order to identify any existing or potential dust creation problems prior to full scale waste excavation.

- **Air Emissions From Excavation and Stockpile** - Prior to, during, and following excavation, portable air monitoring instruments will be installed both upwind and downwind of the excavation and stockpile area. Air station monitoring will be performed for the presence of particulates, radon, and organic vapors. In addition to the need to evaluate the potential for dust entrainment into the atmosphere from both the waste excavation and waste stockpile, it will be necessary to determine if any particulates, radon, or organic vapors will be released as a result of the wet excavation. This information can thus be taken into consideration once full scale waste excavation commences.

- **Water Released From Stockpiled Waste and Ponding of Water in Excavation** - The storage pad beneath the waste stockpiles will be graded to divert any resulting leachate drainage back into the open excavation. Grading will also include the creation of small depressions to allow observation, collection, and controlled release of leachate back into the excavation. This information will be used to evaluate the porosity and degree of permeability of both the disturbed waste stockpiled, and the excavation.

- **Stratigraphy of Cap and Waste** - During excavation, efforts will be made to segregate cap materials from the underlying wastes. This will be accomplished by performing visual observation of the excavated material, and utilizing mechanical and manual separation techniques, if possible. If successful, differentiation of cap material from pit wastes may allow for separate temporary storage of the cap material. This will provide information about the homogenization and segregation of the waste/cap material. There exists some variation in the thickness of the waste pits' cap material. Also, during full scale waste excavation, the pit cap material will likely be segregated for the purposes of moisture content and waste

handling/disposal. Informed decisions about the nature and volume of the cap material will be based, in part, on observations made during the wet excavation phase.

- **Ease of Handling Excavated Waste** - Anticipated and unanticipated difficulties associated with mechanical excavation of the waste will be observed and recorded. This information will be documented by observation and documented during the wet excavation phase. Uses of the information will include waste dryer system and components design, and full scale excavation specialized equipment/storage requirements. Some waste material handling problems which are anticipated include the following:

  - Stickiness
  - Viscosity
  - Debris interaction
  - Splashing
  - Dust generation
  - Stiffness

- Other information derived from mechanical excavation will be used to determine the efficiency of simple bucket excavation and the need for liners for the excavation bucket and truck beds.

3.1.3.2 Wet Excavation Data Analysis and Interpretation

Refer to Table 1-3 for a discussion of wet excavation technique, test purpose, test input and interpretation. The following data analyses will be performed during the wet excavation:

- **Angle of Repose in Excavation and Stockpile** - Angle of repose information will be included in remedial excavation planning to provide safe and achievable excavation grades in the waste itself. Angles of repose in wet and dewatered waste will be compared to determine if pit dewatering results in slopes that can maintain stability under the variety of waste conditions anticipated.

- **Moisture Content in Situ** - Moisture content of the waste material will be measured at several locations throughout the waste pits. This information will allow a reasonable estimation of the average moisture in the waste pits and of the variations of the moisture content. Changes in moisture content with fluctuations in the water table within the waste pits is critical to the development of waste drying requirements during the project remedial design phase.

- **Plate-Bearing Capacity** - The analysis of Plate-Bearing Capacity will provide general engineering evaluation information of the capacity of the waste in situ to support excavation and equipment.

- **Dust Generation** - Several dust suppressants will be tested on waste in the pits and in the stockpiles. These suppressants include, but are not limited to:

- Water
- Foams
- Surfactants
- Latex coatings

To optimize the excavation sequence, all surfactants will be tested and evaluated for suitability based on the following criteria:

- Ease of application
- Durability
- Application manpower requirements
- Adhesion to waste
- Performance at various moisture levels
- Performance in different weather conditions
- Minimum effective thickness
- Resistance to sloughing
- Amount of waste generation conditions

All surfactants will be evaluated for composition to determine the potential for leachate generation, and chemical and physical interaction between the waste and the surfactant. Material Safety Data Sheets (MSDS) for each surfactant that requires a MSDS will be used to determine interaction potential and to identify personal protection requirements for application personnel.

3.1.3.3 Wet Excavation Data Reporting

Data (as identified in Subsection 3.1.3.1, above) will be collected on field logs and retained for reporting purposes. The wet excavation videotapes will also be retained to provide a permanent record of visual waste characteristics. Wet excavation tests will be reported in the wet excavation test report.

3.1.4 Wet Excavation Residuals Management

3.1.4.1 Unused Field Samples

Excess field sample material will be returned to each excavation area in Waste Pits 1, 2, and 3 and used as backfill. Additional backfill will be obtained from other areas within Operable Unit 1 that have been characterized under Removal Action 17: Improved Storage of Soil and Debris.

3.1.4.2 Excavation Waste

Approximately 45 cubic yards (15 cubic yards per pit for Waste Pits 1, 2, and 3) of the excavated waste will be used as feed material for the Waste Pit 6 Drying Study. The dried pit material will be placed in white metal boxes and placed on the best available hard-surfaced storage area in a manner that is protective of human health and the environment. The dried material will remain in temporary storage until the Waste Pit 6 Drying Study is implemented. Drying is scheduled to begin April 1996 and completed November 1996.

The remaining portion of the excavated waste will be returned to each excavated area in Waste Pits 1, 2, and 3.

3.1.4.3 Wastewater

Wastewater will be managed as described in Section 4.5.

3.1.4.4 Contact Waste and PPE

Contact waste is categorized as PPE, such as gloves, wipes, plastic, etc. generated during a sampling event that may be contaminated from contact with the sampled material. Contact waste generated during the DEEP will be collected in a plastic bag and sealed with tape. The bag will be labeled with the name and phone number of the project supervisor and the name of the person placing the bag in the dumpster. The bag will be placed in the CRU3 RI/FS-designated locked dumpster. No Material Evaluation Form will be generated. The trash in the dumpster will go to the trash baler, where it will be compacted and boxed for transport from the site as low-level radioactive waste. Contaminated PPE will be placed in a container and stored with the dried material awaiting the Waste Pit 6 Drying Study.

3.1.5 Wet Excavation Equipment

Equipment:

- Large backhoe
- Front-end loader or tractor-loader
- Mobile lift platform
- Generator
- Submersible electric sump pump
- Lighting

- Electrical cable
- Video camera
- TV monitor

Supplies:

- 6-mil plastic sheeting for liner
- Light-weight plastic (tarp) for covering waste stockpile
- Timber ties and mats
- Orange plastic hazard fencing and fence posts
- Grass seed
- Straw bales
- Dust control agents and application equipment

3.2 WASTE RESLURRY AND PUMPING TEST

3.2.1 Waste Reslurry and Pumping Test Description and Objectives

The waste reslurrying and pumping test will be performed as part of the wet excavation testing. The test objectives are:

- To evaluate the practicality and cost of excavating the waste by slurry pumping.
- To obtain information needed for preliminary design of a waste pumping system. This preliminary design will allow a viability and cost comparison between waste excavation by mechanical methods and slurry excavation with mechanical excavation of residual debris.

Reslurrying was selected as a test because of the fine-grained nature of much of the waste in the waste pits and because of the potential for difficulty in dewatering the wastes. Most of the waste is fine material, perfect for reslurrying. (Heavy and large debris would be picked up by a backhoe or clam shell.) Previous studies of pit waste have shown that significant amounts of amorphous materials exist within the waste pits and that these amorphous materials may behave more like a liquid after water has been introduced. Thus, pit amorphous materials removal may be more efficiently performed by reslurrying. Additionally, it is likely that the presence of significant quantities of amorphous materials may hinder the effectiveness of conventional well dewatering.

The test will consist of lowering a slurry pump into an excavation in the waste pits, slurrying the waste, and pumping it to a holding tank. Moisture content, pulp density, and settling rates of the slurry will be measured to provide critical design information, i.e., to determine the amount of solids that can be

pumped from the trenches and the thickeners required to separate out solids. This information will be collected by visual observation of the slurry/clear water interface and measuring the moisture content of samples taken from each vertical foot of the contents of the tank at specified time intervals. The waste and supernatant will be pumped back into the excavation after the test is complete. Three trenches shall be reslurried, one in each waste pit. Slurrying and pump tests will be performed on the second "wet" trench to be excavated in each waste pit.

3.2.2 Waste Reslurrying and Pumping Test Experimental Design and Procedures

The water to be used during reslurrying will be derived from existing water in the waste pits, which are located within the perched water table. Water run-in should be adequate to reslurry. Water would be added to the excavation only if insufficient run-in occurs; this water would be slurried immediately and there would be no standing water. When this occurs, only enough water would be added to support the reslurry and would be negligible relative to the amount of water already contained in the waste pits. The negligible amount of water to be added during reslurrying will be offset by the treatability information gained by performing an experiment to determine the viability of the technique. Decant water from the slurry settling tank is pumped to a temporary holding tank, then ultimately treated through the FEMP water treatment system. Solids resulting from decant operations are to be directed back into the respective waste pit of origin.

The slurry pump assembly will be suspended (at a safe standoff distance) from a backhoe bucket or a crane boom and lowered into the waste pit trench. Water will be added to cover the pump inlet to allow the pump to prime itself. The slurry pump is then started and will operate from 10 to 50 gallons per minute (gpm). Water flow will be decreased gradually to achieve a balance with sustained slurry pumping of the wastes. The slurry pump will be raised or lowered, as needed, to achieve desired waste inflow and slurry concentration. Water may be added through jet rings or a water hose for priming and normal operation. The waste will be pumped through a rubber hose into a large translucent tank (minimum 3,000 gallons). The waste in the tank will also be sampled to measure the pulp density of the slurry immediately after pumping as well as after various settling times. The waste slurry will be sampled at the following intervals: 5, 10, 15, 30, 60, 240, and 1,440 minutes. This information will be used to design the thickening and filtration system. This information will also be collected from

laboratory testing, but this field settling test will help to evaluate large-scale field effects, such as segregation of debris, as the waste is pumped.

The slurry pumping will be monitored and videotaped to record the waste/pump interaction. Samples will be taken at regular intervals to measure pulp density. These samples can be correlated to the videotaped pumping record. These samples will be analyzed at the laboratory for settling rates, particle size distribution, specific gravity of solids and moisture content.

The tank will be placed on a plastic liner on a unimat base near the trench. Hoses will be connected to the tank near the top. The hoses will have a sampling tee and valve to allow sample collection during pumping. The tank overflow hose will be directed to the excavation.

A top port and side valve ports will be installed in the tank for stratified sampling. After the tank has been filled with waste, strata samples will be taken at regular intervals depending on the settling rate of the slurry; the recommended intervals are stated above. These intervals may be changed by the Field Operations Manager after initial settling rates have been observed.

The contents of the tank will be pumped back to the excavation after settling is complete (or 24 hours). The tank top will have an opening 36 inches in diameter to insert the pump into the tank to reslurry and pump the material back into the pit. If possible, the waste will be agitated and drained by gravity back into the pit.

Water which separates from the waste in the trench will be pumped with a sump pump to a holding tank for disposal. The trench can be backfilled as with the other wet excavations.

The contents of the tank will be pumped back to the excavation after settling is complete (24 hours). The tank top will have an opening 24 inches in diameter to insert the pump into the tank to reslurry and pump the material back into the waste pit. If possible, the waste will be agitated and drained by gravity back into the waste pit. Water which separates from the waste in the trench will be pumped with the sump pump to a holding tank for disposal.

3.2.3 Waste Reslurrying and Pumping Test Data Collection, Analysis, Interpretation, and Reporting

3.2.3.1 Waste Reslurrying and Pumping Test Data Collection

Refer to Table 1-3 for a discussion of slurry test technique, test purpose, test input and interpretation. The following waste slurry-related information will be obtained during this phase of the DEEP:

- Solids content at which the waste is pumpable
- Minimum amount of water to maintain sustained pumping for distinct waste strata
- Jetting water flow rate and pressure
- Slurry pumping flow rate
- Visual and video observations of waste movements in the trench
- Moisture content of the waste prior to pumping
- Moisture content of the slurry during pumping
- Moisture content of slurry at distinct strata in the tank after pumping at selected intervals
- Visual and video observations of waste entering tank during pumping
- Visual observations of the waste settling in the storage tank
- Slurried waste flow ability versus slurry density
- Settling rates and particle size distribution
- Specific gravity of solids

3.2.3.2 Waste Reslurrying and Pumping Test Data Analysis and Interpretation

This information will be analyzed and interpreted to support design for the pumping, thickening and filtration system. Much of this information can be collected from laboratory testing; however, the field settling test will help to evaluate large-scale field effects, such as segregation of debris as the waste is pumped. Filtration data will be derived from a laboratory test, but the results from this field test will provide input to filter sizing. Enough information should be produced by this test to estimate the costs of slurry excavation relative to mechanical waste excavation.

3.2.3.3 Waste Reslurrying and Pumping Test Data Reporting

Data (as identified in Subsection 3.2.3.1, above) will be collected on field logs and retained for reporting purposes. The slurry pumping videotapes will also be retained for reporting purposes and will remain available for further technical review. Waste slurry and pumping tests will be reported in the wet excavation test report.

3.2.4 Waste Reslurrying and Pumping Residuals Management

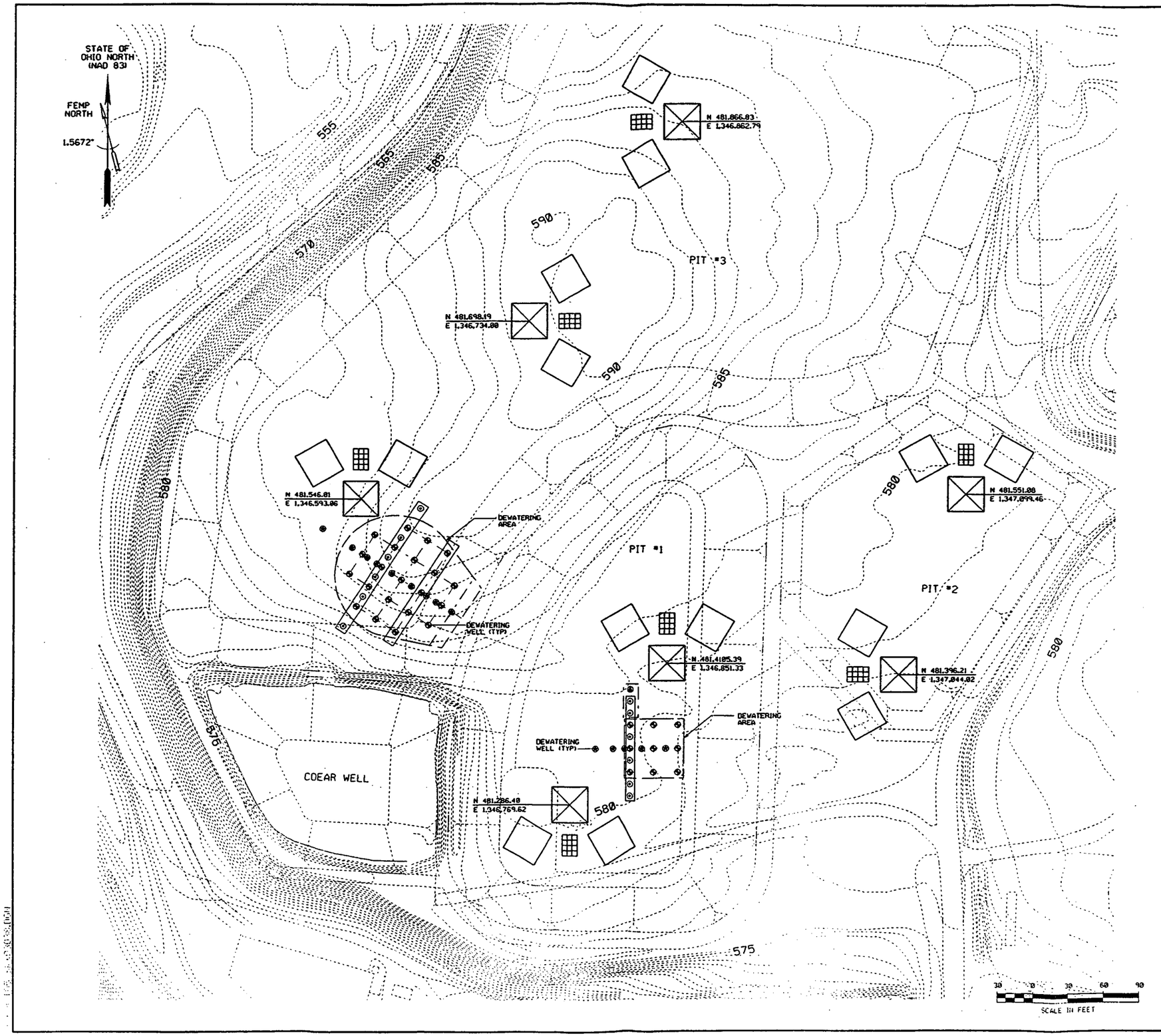
Waste will be controlled to prevent release to the environment during this test. Waste will be pumped in a sealed line (preferably double walled) to prevent spills. The hose will be attached to the pump and the tank. The ground under the hose will be lined with plastic and graded to drain back into the trench (or double walled pipe/hose will be used.). The venting from the tank will be equipped with a mist eliminator and will be monitored to assure no unacceptable release to the air.

Waste pumped to the tank will be pumped back into the trench when the test is completed. Excess water will be pumped to a tank and treated along with the water from the dewatering wells. Residual sludge in the bottom of the test tank will be vacuumed out with the site's large vacuum truck. The tank will be rinsed out after the test. Rinse water will be sent to the AWWT and treated before release.

3.2.5 Waste Reslurrying and Pumping Test Equipment

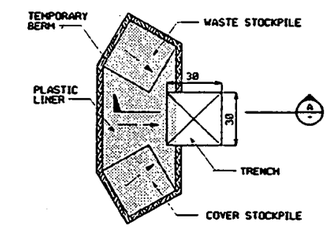
Equipment

- Agitator slurry pump (50 gpm) Toyo or equivalent, with jetting water nozzle assembly
- Temporary power supply for pump
- Sling to suspend pump from backhoe or crane
- Slurry hose from pump to tank
- Polypropylene or fiberglass tank (3000 gallons strong enough for specific gravity fluids 1.8) with drain, overflow, vent, 6 side ports, and 3 ft. manway in top (approximately 8 feet diameter 6-7 feet high)
- Wooden platform for tank (unimats)
- Water supply pump with pressure gauge
- Slurry overflow hose
- Plastic liner under tank > 10 mil thick
- Water hose with in-line flow meter
- Slurry hose from pump to tank (30 to 60 ft)
- Wooden platform for tank (unimats)
- Water hose with in-line flow meter

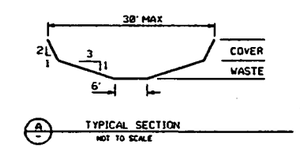


LEGEND

- UNDEWATERED TRENCH
- DEWATERING TEST AREA OBSERVATION WELLS
- PLASTIC LINER
- BACKHOE LOCATION



TYPICAL TRENCH DETAIL



LOCATION MAP
WET EXCAVATION

FIGURE 3-1 000064

SECTION 4
DEWATERING

This section describes dewatering tests to be performed during the Dewatering Excavation Evaluation Program (DEEP).

4.1 DEWATERING TEST DESCRIPTION AND OBJECTIVES

Dewatering the waste in-situ may be economically advantageous over removing the water thermally and may make excavation of the pits easier and safer. To determine if this is in fact the case, the dewatering system must be defined. To determine if installing a dewatering system will improve excavation conditions, an area of the pits must be dewatered and excavated. The first two phases of the dewatering test respond to the first information gap. The third phase responds to the second information gap.

Dewatering tests will be performed in three phases to support design optimization for the final dewatering test systems. Phase 1, the Comparative Well Test, will be conducted in Waste Pit 1. A driven well point will be compared to a drilled cased well. Two pumping methods will also be compared. Phase 2 will attempt to confirm (or revise) well spacing distances that will be used in the final test of dewatering systems (Phase 3). Phase 2 will be conducted in Waste Pits 1 and 3. Phase 3 will involve dewatering an area in Waste Pit 1 and an area in Waste Pit 3 to facilitate excavation of a trench in each pit.

The following figures are provided to identify test locations:

- Figure 4-1 shows the general layout of the dewatering wells through the three phases.
- Figure 4-2 details a sand-packed, surface-located well point pump that will be used in all three phases.
- Figure 4-3 details a sand-packed well with a downhole submersible pump which will be used in all three phases.
- Figure 4-4 details a driven well point and the Phase 1 general arrangement.
- Figure 4-5 details a vacuum piezometer and the Waste Pit 1 general arrangement for Phase 2.

- Figure 4-6 shows the Waste Pit 3 general arrangement for Phase 2.
- Figure 4-7 shows the Waste Pit 1 general arrangement for Phase 3.
- Figure 4-8 shows the Waste Pit 3 general arrangement for Phase 3.

Phases 2 and 3 are designed according to the anticipated results of Phases 1 and 2, respectively. If the results are different from those anticipated, then the tests will be modified accordingly by the Lead Geologist.

Phase 1 - Comparative Well Test - The objectives of Phase 1 are:

- Determine if a driven well point will work in the fine-grained pit wastes
- Determine if there are any installation or development difficulties for the proposed drilled well design (drilled, cased, and sand packed)
- Determine if a surface well point pump will work adequately for a more shallow well and how it compares to a submersible pump
- Determine pumping characteristics for the wells and expected sustainable flows

Data from Phase 1 are expected to confirm (or prompt revisions to) the drilled well design in Phase 2 testing. Data gathered will include flow rate from the well in gallons per minute and total volume of water pumped (in gallons); well water levels in pumping wells and wells used for observation; well or well point discharge line pressure readings; and vacuum readings within the well or well point casing.

Phase 2 - Well Spacing Test - The objectives of Phase 2 well-spacing testing are to determine the effect of vacuum enhancement, E-O enhancement, and a combination of E-O and vacuum enhancement on the flow rate and to determine if the proposed 20-feet well spacing for Phase 3 will be adequate for dewatering. For the spacing testing, nine wells will be installed in Waste Pit 1, and 16 wells will be installed in Waste Pit 3. Various well combinations will be pumped and observations made to determine the zone of influence of the final well spacing. This phase will collect and document the same type of data as gathered in Phase 1. In addition, total energy use for E-O testing in kilowatt-hours (kwh) and direct readouts of power, voltage, and amperage will be recorded.

Phase 3 - Full Installation Dewatering Test - The primary objective of Phase 3 is to dewater selected areas of Waste Pits 1 and 3, to facilitate trenching with minimal interference from groundwater. This phase will include installing the full complement of wells in Waste Pits 1 and 3, then proceeding with dewatering. The best well design and spacing, as determined in Phases 1 and 2, will be installed in Phase 3. These wells will be pumped for several weeks to dewater those areas of the waste pits such that dry or post-dewatered excavations can be performed in the waste pits.

This phase will collect the following performance data:

- Variations in the volumetric rate of water removal over time
- Changes in shear strength of the waste as dewatering progresses
- The magnitude and area of influence of sustainable vacuum for the downhole pump configuration versus the surface-based pump configuration, if two configurations are adopted
- Water table elevations over time during pumping
- Vacuum measurements over time, if vacuum techniques are adopted.

4.2 DEWATERING EXPERIMENTAL DESIGN AND PROCEDURES

4.2.1 Surveying

Surveying will be performed to locate the borings, dewatering wells, and piezometers. Additionally, surveying of each waste pit's surface will be used to measure subsidence due to dewatering and excavation.

Subsidence at the surface of each waste pit to be dewatered will be measured in the following manner:

- A grid pattern will be established across each Waste Pit.
- Grid line intersections will be surveyed prior to dewatering and the elevations recorded.
- Following dewatering, the grid line intersections will be surveyed and the resulting elevations compared to the pre-dewatering elevations.

4.2.2 Well Construction and Installation Requirements

Waste permeability must not be reduced during well construction and installation. Well borehole advancement methods will be designed to minimize any potential for smearing borehole side walls. Installation of the well casing, screen, and sand pack must also be accomplished in a manner that does

not reduce the waste permeability at the borehole face. The driven well point will be installed by hammering, pre-augering, or jetting.

4.2.3 Well Development Requirements

Well development for each of the well types will be accomplished by bailing and surging. Resultant wastewater will be collected and sent to the existing Fernald Environmental Management Project (FEMP) wastewater treatment system before being discharged to the Great Miami River in accordance with National Pollutant Discharge Elimination System (NPDES) effluent limits set at manhole 175 (*4001). Development of these wells will be an iterative process, but completion will be terminated once pumped water reaches a "steady state" clarity.

4.2.4 Phase 1 - Dewatering and Testing

4.2.4.1 Phase 1 Dewatering

The comparative well test will be conducted with a line of three wells installed in Waste Pit 1; one driven well point and two drilled wells. The wells will be spaced as shown in the General Arrangement Plan (Figure 4-4). The two drilled wells will be used in the well spacing test system in Waste Pit 1 during Phase 2.

The designs of the driven well point, and the drilled well equipment with a surface well point pump, are shown in Figures 4-4 and 4-2, respectively. The design of the drilled well using a downhole submersible pump is shown in Figure 4-3. The well design is the same for both, but the pumping systems are different; the two systems will be compared for economy and effectiveness.

Tentative well depths are shown in the figures for each well, based on a well termination depth 5 feet above the top of the liner in Waste Pit 1. These well depths will be confirmed prior to construction, based on surveyed ground surface elevations at each well location and the previously established top-of-liner elevation in Waste Pit 1 (elevation 563 ft. $\pm$).

A downhole submersible pump will be installed in one of the drilled wells. The discharge pipe for the pump will pass through an airtight seal in the well casing so a vacuum may be applied to the well. A valve is provided on the discharge line for control of the discharge rate, and a check valve is also included to prevent the system from draining into the well. A fitting and valve at the top of the well is also provided for attachment of the vacuum line (Phase 2).. The driven well point and the other drilled well will use a conventional surface-located well point pump (centrifugal and vacuum) for removing water from the wells (see Figures 4-2 and 4-3). The well caps will be air-tight sealed. A valve will be installed in the drop pipe to control the flow rate out of the well and a check valve will prevent the system from draining back into the well.

The drilled well will include a reinforcing bar (rebar) installed in the well sand pack attached to the electro-osmosis (E-O) system wiring. When active, the steel rebar serves as the cathode in the E-O electrical circuit.

4.2.4.2 Phase 1 Testing Procedure

Phase 1 testing and evaluation will occur in three stages. The following testing descriptions and procedures for each stage are subject to field modification by the Lead Geologist based on interim testing results. In particular, drilled well/well point pumping rates and pumping periods will be subject to adjustment based on field review of data. Residual wastewater generated during Phase 1 testing will be collected in tanks at the waste pit and trucked to the existing FEMP wastewater treatment system (Plant 8) before being discharged to the Great Miami River in accordance with NPDES effluent limit at outfalls *4605 and *4001.

Stage 1 - Stage 1 will evaluate construction and development methods, described in Sections 4.2.2 and 4.2.3, used for installation of the two drilled wells and the well point. Any resultant construction-related well design changes will be incorporated into the Phase 2 well design and testing.

Stage 2 - Stage 2 will evaluate the performance of the single well point pumped with a well point pump. Flows, if any, will be noted and pumping will continue until the Lead Geologist is satisfied that no

significant sustained flow can be attained. If flows are observed, the well point flow will be adjusted to provide a uniform, sustainable flow from the well point. During the well point pumping, observations will be made in the two non-functioning wells to monitor any changes in water level and vacuum levels.

Stage 3 - Stage 3 testing will compare the pumping systems used for the two drilled wells and will establish tentative pumping rates for the Phase 2 testing. One well will use a downhole submersible pump and the other will use a surface well point pump. With the shallow depth of the Waste Pit 1 wells (approximately 15 feet), both pumping systems are expected to work satisfactorily, although the well with the submersible pump is expected to offer an advantage in vacuum application (part of Phase 2 testing). The vacuum system used with the submersible pump is separate from the pump, so the vacuum applied to the well is constant, even if the pump is pumping water. Alternatively, with the well point pump, the pump and vacuum are combined, so the vacuum decreases when water is being pumped. Vacuum readings from the well casing ports will also be collected at the direction of the Lead Geologist.

Both wells will be pumped starting at very low rates, approximately 0.1-0.25 gallons per minute (gpm); well water levels and durations sustained during pumping will be monitored. If pumping is continuous, pumping rates will be increased in increments of approximately 0.1-0.25 gpm. Pumping rates will continue to be increased until a uniform, sustained flow, with minimal incremental decline in well water level, is observed. Testing should then be continued, in the same manner, beyond the sustainable flow rate, to the rate where the pumping occurs only about 25 percent of the time; that is, the pumping rate is about four times the sustainable flow. All of the flow testing is expected to establish sustainable pumping rates for the Phase 2 testing.

4.2.5 Phase 2 - Dewatering and Testing

Phase 2 was designed based on the anticipated results of Phase 1. It is anticipated that Phase 1 testing will show that the drilled well with the well point pump is the most effective well/pump design for dewatering the shallow wells in Waste Pit 1 and the drilled well with the submersible pump is the best well pump design for the deeper wells in Waste Pit 3.

4.2.5.1 Phase 2 Dewatering

The well spacing testing will be conducted with three lines of dewatering wells. Dewatering wells will be located in Waste Pits 1 and 3 as identified on the well location plan (Figures 4-5 and 4-6). The long line of wells (DW3-1 through DW3-11) in Waste Pit 3 will be used to test the E-O system, and the short line (DW3-20 through DW3-24) will be used to test the vacuum enhancement system. Three of the wells in Waste Pit 1 and ten of the wells in Waste Pit 3 are placed at the anticipated final well spacing and will become part of the Phase 3 test dewatering system. The additional wells will be installed at half the anticipated final well spacing. Two additional wells will also be at the ends of the long line of wells located in Waste Pit 3. These additional wells will be used for testing purposes, but are not expected to be pumped in the final dewatering test systems.

The design and material specifications for the dewatering wells using the surface well point pump (Waste Pit 1) are shown in Figure 4-2; those for the drilled wells with submersible pumps (Waste Pit 3) are shown in Figure 4-3. It is anticipated these well designs will be satisfactory, although there may be design revisions that may occur following the well comparative testing (Phase 1 testing) planned prior to this test. Also, if the submersible pump wells are much more effective for application of vacuum, then all wells will use submersible pumps.

The dewatering wells will be drilled and sand packed with 6-inch diameter casings and screens in 16-inch-diameter holes. The dewatering well design will allow for use of either a surface mounted well point pump (with a water pickup drop pipe in the well) or a downhole submersible pump (with water discharge pipe). The well caps and any penetrations through the well casings for piping and electrical wiring will have air-tight seals. A valve will be provided in the piping at the top of each well for control of the pumping rate. A check valve will be provided to prevent backflow and draining. All wells will have a fitting and valve for attachment of a vacuum line.

Tentative well depths are shown on the figure for each well, based on a well termination depth 5 feet above the top of the liner, in each waste pit to minimize the risk of puncturing the liner. These well

depths will be confirmed prior to construction based on surveyed ground surface elevations at each well location and previously established top-of-liner elevations in each waste pit.

A separate cathode (No. 5 rebar) will be installed in the dewatering well sand-pack zone as part of the E-O system (see Figures 4-2 and 4-3). The separate cathode allows the use of a poly vinyl chloride (PVC) well screen and casing to minimize well installation cost and disposal cost when excavation begins. It is recommended a spare cathode also be installed during initial well construction to ensure continued operation in the event of cathode deterioration.

Piezometers - Fourteen piezometers (PZ1-1 through PZ1-5) and (PZ3-1 through PZ3-9) will be installed and used to function as both water table piezometers and as vacuum piezometers. The piezometer design is shown in Figure 4-5; the locations and configuration of the piezometers are identified in Figures 4-5 and 4-6 for Waste Pits 1 and 3, respectively. The design allows use of the piezometer for both vacuum and water level measurements.

Each piezometer will be hermetically sealed when the vacuum piezometer function is required. The piezometer will be constructed with a long seal zone to prevent air short circuits from surface to filter pack through any defects in the bentonite well seal.

Each piezometer will have a gauge attached to measure vacuum. Additionally, each will have provisions for determining water level for both open atmospheric conditions and sealed vacuum conditions. Field conditions will take into account that a vacuum could result in artificial raising of the water level due to decreased air pressure.

Depths of the piezometers will also only extend to 5 feet above the waste pit liner (based on the current established liner elevation). Surveyed waste pit surface elevation at each piezometer location will be used to reaffirm estimated well depth prior to piezometer installation.

E-O Systems - Electro-osmosis enhances dewatering and consolidation of some saturated fined-grained soils that cannot be effectively drained by gravity methods. The electric double-layer concept developed by Helmholtz (1926) and Freundlich (1926) helps explain how electro-osmosis works. Water near the soil particles is made up of two layers. One layer is bonded to the soil particles; the other layer is free moisture. The bonded layer has excess anions; the free moisture has excess cations. When a direct current voltage is applied across a given volume of soil by use of an anode (+) and a cathode (-), the unattached cations, and thus the free liquid, migrate toward the cathode. The electro-osmotic velocity of the water flow in the soil is related to the electrical conductivity, permeability, porosity, and the plasticity of the soil. If the cathode is installed next to a well casing, the water flowing out of the electrically charged area can be removed by in-well or suction pumps. If the anodes are placed near the excavation, the water flow induced by the electric current opposes the natural hydraulic gradient that contributes to harmful seepage. The following six paragraphs explain the E-O system proposed for the DEEP.

The E-O systems for Waste Pits 1 and 3 will be powered by a direct current (DC) generator. The DC generator controls must provide for a range of operating conditions, as resistances in the wastes change with anticipated reduced moisture content. Equipment performance requirements will be based on the Phase 3 full-system configuration; however, the equipment must also satisfactorily meet the reduced need for Phase 2 testing. The E-O system will use a steel rebar, placed within the sand- pack of the dewatering well, as the cathode(-) and separate anodes (+) spaced around the wells as shown in Figures 4-5 and 4-6. No. 5 (5/8-inch diameter) steel rebar will be used for the cathodes and anodes. Anodes will be pushed or driven to the same depth as the dewatering wells, maintaining 5 feet of clearance to the top of the waste pit liner. Cathodes will also extend over the depth of the dewatering well as shown in Figures 4-2 and 4-3. Some cathodes will be switched to act as anodes in Phase 3 testing.

The heterogeneity of the waste makes electrical characteristics unpredictable. Therefore, preliminary testing of waste resistance will be necessary to assure assumed operating conditions and equipment characteristics are compatible. E-O system operation and dewatering enhancement still seem possible, and if the tentative equipment sizing assumptions are reasonable. Presuming E-O testing continues, the

spacing testing work would provide additional information to further refine the design and operation of the E-O system for use in the final phase (Phase 3) of dewatering testing.

4.2.5.2 Phase 2 Testing Procedure

Well spacing testing will be performed in two stages. For the first stage of testing, only well pumping will be conducted. The second stage of testing will add the E-O and vacuum systems to enhance dewatering.

The stages will be conducted in a series of steps that will start with only the farthest spaced wells (with 40- to 60-feet spacing) being tested. Additional wells will be pumped to test smaller well spacings (30-, 20- and 10- foot spacings).

During testing, the piezometers associated with each string of spacing testing wells will be used to collect water level data and vacuum data when appropriate. Also, for most of the testing, there will be inactive dewatering wells which will also be used for data collection.

All the following testing descriptions and procedures will be subject to field modification by the Lead Geologist based on interim testing results. In particular, dewatering well pumping rates and pumping periods will be subject to adjustment based on field review of data.

The E-O enhancement testing is expected to require preliminary testing and field adjustment to optimize well flows for a system that is expected to be continually changing (i.e., reduced waste pit water levels and increased waste resistances).

Stage 1 - No Dewatering Enhancements (Gravity Drainage Only)

Step 1 - Two end wells and a center well in each waste pit will be pumped at a steady state rate to define the zone of influence around each line of dewatering wells. In Waste Pit 1, these wells will be spaced at 40 feet. In Waste Pit 3, only the long line of wells will be pumped and the three dewatering wells will

be spaced at 60 feet. Water levels in the remaining dewatering wells and the piezometers will be monitored to determine drawdown rates and the zone of influence.

Step 2 - The overall objective of Step 2 is to establish or confirm well spacing. Assuming the wells in Step 1 were spaced too far apart, Step 2 will pump wells of decreasing distance until optimum well spacing has been achieved.

Stage 2 - E-O and Vacuum Enhancement

The objective of Stage 2 is to determine what improvements vacuum enhancement may have on dewatering. It is assumed that a 20-foot well spacing and constant pumping rate was established during Stage 1. Only the long line of wells in Waste Pit 3 shall be tested with E-O. E-O should increase the pumping rates. Depending on the results of the E-O enhancement, the well spacing may be increased to minimize the number of wells, while achieving comparable dewatering flows or total volumes.

Vacuum testing will be conducted in Waste Pit 3 using only the short line of wells, where the separate vacuum system is installed. If the results are insufficient, then E-O may be used in conjunction with vacuum enhancement.

Step 1 - With pumping continuing from Stage 1, operating conditions (pumping rates, draw-down levels in surrounding wells, etc.) without E-O and vacuum dewatering enhancements will be recorded.

Step 2 - The E-O system will be activated and adjusted to impart approximately 0.015 kilowatts per cubic yard (approximately 5 kwh over a 14-day period) of waste within the zone affected by the E-O system. System operating conditions for voltages and current flows must also be maintained in appropriate bounds.

The vacuum system will be activated and operated to apply maximum possible vacuum in the test wells. The wells that are not being pumped and the piezometers will be monitored to evaluate the extent of vacuum propagation through the waste.

Step 3 - Based on flow rates and water level data, adjustments to the E-O system operation may be warranted. Depending on continuing results of the E-O and vacuum enhancement tests, dewatering should continue, with adjustment for expected conditions change, until dewatering rates decline, or sufficient data is collected to evaluate each system.

4.2.6 Phase 3 - Full Installation Dewatering Testing

The Phase 3 system is designed with the assumption that the results from Phases 1 and 2 will indicate that the drilled, sand-packed wells spaced at 20 feet apart are the best well design for dewatering the pits, that well point pump is the best pump for the shallow Pit 1 wells, and that submersible pumps are the best pumps for the deeper Pit 3 wells. It is also assumed that E-O and vacuum enhancements must be used together. If the results of Phases 1 and 2 are different than what has been assumed, the test design for Phase 3 will be modified accordingly.

The third phase of testing will comprise installing the full complement of wells in Waste Pits 1 and 3 and then proceeding with the dewatering. The primary objective of Phase 3 is to dewater selected areas of Waste Pits 1 and 3 to facilitate trenching with minimal interference from groundwater.

Each well will be installed with full E-O, vacuum and/or dedicated pump capability as determined in Phase 2.

4.2.6.1 Phase 3 Dewatering Wells

Twenty-seven wells will be installed in Waste Pit 3 and 15 wells will be installed in Waste Pit 1. These numbers include 16 Phase 2 wells in Waste Pit 3 and nine Phase 2 wells in Waste Pit 1. The wells will be configured in Waste Pits 1 and 3 as identified on the well location map (Figure 4-1). These wells represent the location and arrangement of the final test dewatering system. In all cases, wells will be laid

out in an approximately square array at a spacing of 20 feet. Anodes used for the E-O system will be evenly spaced between the wells. In all waste pits, anodes will be spaced at 20-foot centers between the wells, as indicated in Figures 4-7 and 4-8.

The designs and specifications for the wells will be the same as used in the well spacing test (Figures 4-2 and 4-3) unless the design is revised based on previous test results (Phases 1 and 2).

4.2.6.2 Phase 3 Testing Procedure

Once the arrays have been installed the wells will be adjusted for optimal performance and the dewatering period will commence. Although the actual duration for dewatering is not known in advance, a period of 4 to 6 weeks is estimated. This may be modified on the basis of information obtained in Phases 1 and 2.

4.3 DEWATERING DATA COLLECTION, ANALYSIS, INTERPRETATION, AND REPORTING

4.3.1 Dewatering Data Collection

Refer to Table 1-2 for a discussion of dewatering test techniques, test purposes, test inputs and interpretations. This test will collect and evaluate the same data as the wet excavation test. The analysis will generally be the same with specific attention to changes in moisture content and shear strength. To provide specific in situ information for use in the investigation of dewatering concepts, pumping and observation wells will be installed within the waste pits. The field information logs are provided in Section 4.3.1 of the PSP; examples are provided in Attachment F to this work plan. The information to be submitted includes the following:

- Field Activity Logs
- Lithologic Logs
- Sample Collection Logs
- Surface/Groundwater Sample Collection Logs
- Well Completion Logs
- Monitoring Well Development Form

For Phases 1 and 2, the data to be collected directly from each well and well point include the following:

- Flow rate (in gpm) from the well and total flow (in gallons)
- Well water levels in both pumping wells and wells used for observation
- Well or well point discharge line pressure readings will be recorded
- Vacuum readings within the well or well point casing will be recorded

In addition, the following other data should also be collected:

- Water level data in designated observation wells
- Vacuum readings within designated observation wells

Field observations will include:

- Optimum well spacing
- Type of wells that work best
- Water flow rates based on daily measurements
- Increase in waste strength as dewatering proceeds.

All dewatering tests will collect components of the following project-related information. The comparative well test will collect the following information:

- **Installation and Development Problems with Each Well Type** - Anticipated problems associated with the installation and development of each well include the following:

- **Drilling** - Penetration, sidewall smearing, surface contamination, prevention of hole collapse

- **Development** - Screen size, screen clogging, sand-pack size, sand-pack clogging recharge rate

- **Vacuum in Pumping and Observation Wells** - Vacuum in both the pumping wells and vacuum piezometers will be evaluated to determine the effective radius of groundwater drawdown of the vacuum pumping wells. The ability of the vacuum system to maintain a vacuum will be evaluated, along with the increased well yield due to the vacuum enhancement.

- **Water Levels in Pumping and Observation Wells** - Groundwater levels within the pits will be measured to determine the aquifer drawdown in both pumping and observation wells. This drawdown information in combination with the basic geotechnical properties of the waste can be used to calculate the in situ hydraulic conductivity of the wastes in the immediate vicinity of the pumping wells along with determination of the effectiveness of each well type in the fine-grained pit waste.

- **Energy and Power Use in E-O** - The energy requirements relative to increasing water recovery will be evaluated to determine the feasibility and efficiency of E-O. The cost of E-O will be compared to waste drying to optimize the remedial design.

4.3.2 Dewatering Data Analysis and Interpretation

Well Yield - This information will be used to design the optimum dewatering well system during remedial design. This information can be used to calculate the hydraulic conductivity of the waste matrix within the immediate vicinity of the wells. The transient drawdown analysis will use the equations shown below:

(1) $T = QW(u)/4\pi s$

Where: T = transmissivity
Q = pumping rate
W(u) = well function of u
s = drawdown

(2) $S = 4Ttu/r^2$

Where: S = storage coefficient
T = transmissivity
t = time
r = distance from pumping well to observation well

(3) $T = Kb$

Where: T = transmissivity
K = hydraulic conductivity
b = aquifer thickness

The assumption is made that the waste pits, due to their presently known degree of saturation, nature of material composition, and heterogeneity, will behave as an aquifer following dewatering well installation, and well pumping rates and capture zones anticipated under dewatering conditions. Thus, determination of the Hydraulic Conductivity of the waste pit material will provide valuable information about the ability of the waste pits to produce water over the anticipated duration of dewatering. This information will allow for monitoring of the relative success of dewatering on a daily basis. It will be necessary to quantify this information in order to know at what point further dewatering will no longer be productive.

Dewatering well pumping rates will be graphically plotted versus time of pumping. Equation (1) will be used to determine the dewatering wells' Transmissivity value at the wells' location. From the Transmissivity values determined from Equation (1), Equation (2) will be used to determine the Storage Coefficient. Equation (3) will be used to determine Hydraulic Conductivity, based on the previously derived variables, and solution of the waste pit depth for the Aquifer Thickness.

Once Hydraulic Conductivity has been determined and as dewatering progresses, comparison of each wells' relative yield can be accurately assessed. When a significant drop in yield has been noted, then the Field Operations Lead, with input from dewatering project staff, can make the determination that further dewatering would no longer be cost effective and efficient. At that time, the Field Operations Lead, with input from other DEEP project staff, will stop dewatering, and progress directly into the Dry Excavation phase of DEEP.

4.3.3 Dewatering Data Reporting

Data (as identified in Subsection 4.3.1, above) will be collected on field logs and retained for reporting purposes. Dewatering tests will be reported in the dewatering test report.

4.4 DEWATERING EQUIPMENT

4.4.1 Dewatering - Phase 1

For Phase 1, comparative well testing in Waste Pit 1, the following equipment, materials, and test instrumentation will be required:

Equipment:

- One drilled well and appurtenances set up for a surface well point pump
- One driven well point and appurtenances set up for a surface well point pump
- Well point pump and collection piping system
- One drilled well with submersible pump, discharge line and appurtenances
- Alternate Current (A-C) generator power supply system
- Discharge water piping system and discharge tank

Instrumentation:

- Flow meters (rate and total) for both drilled wells and one well point
- Vacuum gauge for each well and well point casing
- Pressure gauge on discharge pipe from well and well point to the well point pump
- Automatic water level sensor and recorder for both wells and one well point

4.4.2 Dewatering - Phase 2

For Phase 2, well spacing testing, the following equipment, materials, and test instrumentation are required:

Equipment:

Waste Pit 1

- Nine dewatering wells and appurtenances
- Five combined piezometers
- Well point pump (with gas or diesel engine drive) and collection piping system
- E-O system and power supply
- A-C generator power supply system
- Discharge Water piping system including a discharge tank

Waste Pit 3

- 16 dewatering wells with submersible pumps and appurtenances
- Nine combined piezometers
- Well discharge collection piping system
- Vacuum pump and vacuum piping system
- Electro-osmosis (E-O) system and power supply
- AC generator power supply system
- Discharge water piping system, including a discharge tank

Instrumentation:

Waste Pit 1

- Flow meters (rate and total) for each dewatering well
- Vacuum gauge for each dewatering well casing
- Pressure gauge on discharge pipe from each dewatering well
- Automatic water level sensor and recorder for each dewatering well
- Vacuum gauge on each combined piezometer
- Automatic water level sensor and recorder for each combined piezometer
- Energy use meter (kwh) and voltage and current meters for E-O operation

Waste Pit 3

- Flow meters (rate and total) for each dewatering well
- Vacuum gauge for each well casing
- Pressure gauge on discharge pipe from each well
- Automatic water level sensor and recorder for each well
- Vacuum gauge on each combined piezometer
- Automatic water level sensor and recorder for each combined piezometer
- Energy use meter (kwh) and voltage and current meters for E-O operation

4.4.3 Dewatering - Phase 3

All equipment (with the exception of some of the submersible pumps) will be in position from the well spacing test (Phase 2 testing). Submersible pumps and separate vacuum pumps will be used in Waste Pit 3. Waste Pit 1 will use surface-based well point pumps to provide both water pumping and vacuum. It is possible that separate vacuum pumps may be used, depending on the results of Phase 2 testing. During Phase 2 the decision will be made whether to use surface-based well point pumps or to use submersible pumps for Pit 1 dewatering. The following equipment is required to perform Phase 3 activities:

Equipment:

Waste Pit 1

- 15 wells (Phase 2 wells plus 6 more) and appurtenances
- Surface well point pump or dedicated submersible pump and collection piping system
- E-O system and power supply
- A-C generator power supply system.
- Well discharge water system.

Waste Pit 3

- 27 wells (Phase 2 wells plus 11 more) with submersible pumps and appurtenances
- Well discharge water system
- Vacuum pump and vacuum piping system
- E-O system and power supply
- A-C generator power supply system
- Well discharge water system

For the final dewatering test, the following test instrumentation is required:

Instrumentation:

Waste Pit 1

- Flow meters (rate and total) for each well
- Vacuum gauge for each well casing
- Pressure gauge on discharge pipe from each well (only if surface pump option is selected for final test)
- Automatic water level sensor and recorder for each well
- Vacuum gauge for each combined piezometer.
- Water level sensor and recorder for each combined piezometer.
- Energy use meter (kwh) and voltage and current meters for E-O operation

Waste Pit 3

- Flow meters (rate and total) for each well
- Vacuum gauge for each well casing
- Pressure gauge on discharge pipe from each well
- Automatic water level sensor and recorder for each well
- Vacuum gauge for each combined piezometer.
- Water level sensor and recorder for each combined piezometer.
- Energy use meter (kwh) and voltage and current meters for E-O operation

4.5 DEWATERING RESIDUALS MANAGEMENT

4.5.1 Wastewater

The total volume of wastewater to be generated by the project is difficult to quantify; however, current estimates call for approximately 105,000 gallons of water per day to be pumped during the initial three to four days of the project. After start-up operations are complete, the pumping rate is expected to decline to a relatively stable rate of 5,000 gallons per day. Two additional 20,000 gallon tanks will be installed within the Waste Pit area to supply surge capacity for wastewater produced during initial pumping operations. These tanks will also be used to provide storage capacity once the pumping rate stabilizes.

Figure 4-9 describes the treatment and discharge process that DEEP wastewater will undergo. Wastewater will be pumped from the 20,000-gallon tanks as needed and transferred to the existing Plant 8 treatment system using a 5000 gallon mobile tank truck. Plant 8 has a treatment capacity of 30,000 gallons per day and utilizes lime precipitation, sedimentation, and filtration to remove uranium, heavy metals and fluoride from wastewaters. At Plant 8, the wastewater will be treated to remove uranium and other heavy metals through lime precipitation,

sedimentation, and filtration. The quantity of water that can be pumped in any one day is limited by the combined storage and treatment capacity of 75,000 gallons per day. Treatment will be provided for all wastewaters generated by the project. Rather than providing additional storage for the excess water produced during initial dewatering, the dewatering activities will be phased so the maximum quantity of water produced in any one day does not exceed the maximum storage and treatment capacity of 75,000 gallons. Treated effluent from Plant 8 will be discharged to the uranium-contaminated side of the General Sump, where it will be combined with other wastewater and discharged to the Biodenitrification (BDN) Facility.

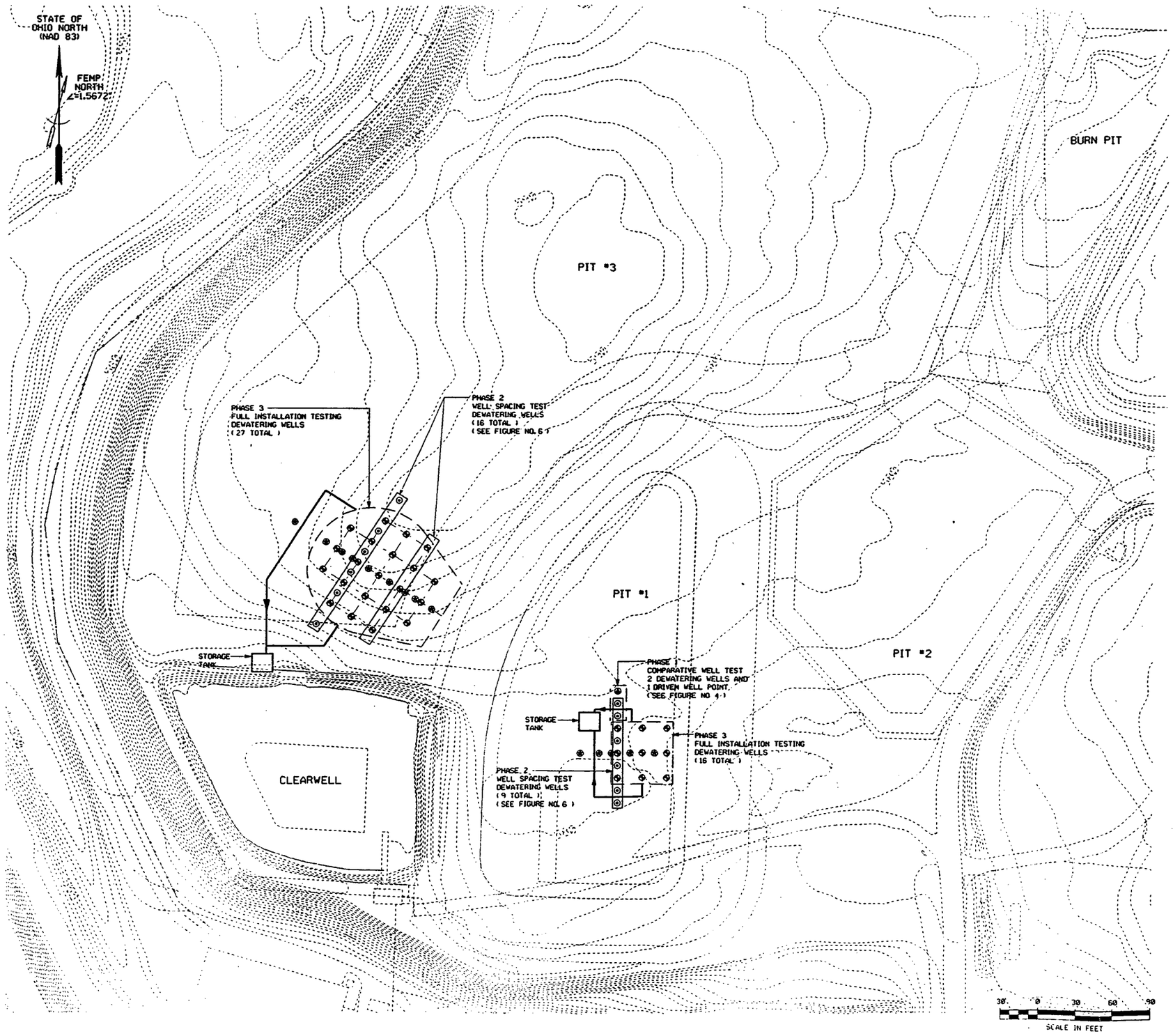
There is a clear discrepancy between the total wastewater storage and treatment capacity, in that the total dewatering water which potentially can be produced is 105,000 gallons per day, while the total available treatment capacity is 75,000 gallons per day. To address the potential for the dewatering system exceeding the total available water treatment system capacity, a phased dewatering and water quantity generation approach will be utilized. Each dewatering system will be equipped with a flow meter and totalizer. Potential overload of total treatment system capacity will be monitored in the following manner:

1. Twice per day, after dewatering commences, the Field Operations Lead/designee will inspect the dewatering system totalizers to evaluate the potential for exceeding the available treatment system's capacity.

2. If the Field Operations Lead determines that the total treatment system capacity may be exceeded, then the dewatering system(s) in use at that time will be halted.

3. If the dewatering system proves to be so successful that the total treatment system capacity may be exceeded on a daily basis, then either more temporary wastewater storage capacity will be obtained and utilized, or else dewatering will be confined to after hours and weekends, when the normal hydraulic load to the treatment system is less, thus freeing up more treatment capacity flow for the DEEP wastewater.

The BDN facility consists of the BDN Surge Lagoon (BSL), a High Nitrate Storage Tank (HNT), four BDN Towers, followed by the BDN Effluent Treatment System (NPDES outfall *4605). At the BDN facility, removal of organic constituents will occur through aeration within the BDN Towers and through activated sludge processes at the BDN-Effluent Treatment System (BDN-ETS). After treatment at the BDN-ETS, the wastewater will be discharged through the NPDES-permitted outfall *4605 (BDN-ETS), with ultimate disposition occurring to the Great Miami River via outfall *4001 (MH-175).



NOTES:

1. DISCHARGE WATER PIPING SYSTEM IS SIZED FOR EXPECTED FLOW IN PHASE 3 TESTING. A PART OF THE SYSTEM MUST BE IN PLACE FOR PHASE 1 AND 2 TESTING.
2. PIPELINE ROUTING MAYBE ADJUSTED IN FIELD AT DIRECTION OF FERMCO CONSTRUCTION MANAGER.
3. "WET" EXCAVATIONS COMPLETED IN THE TEDAP PROGRAM TESTING SHOULD BE BACKFILLED PRIOR TO LAYING DISCHARGE PIPING OR PIPING SHOULD BE REROUTED TO AVOID EXCAVATION AREAS.
4. DISCHARGE WATER PIPING SYSTEM TO BE LAID ON GROUND SURFACE. PIPELINE TO BE HELD IN PLACE WITH SAND BAGS AT ALL FITTINGS AND VALVES AND AT 20' INTERVALS ALONG THE PIPELINE.
5. SEE FIGURES 7 AND 8 FOR DETAIL OF THE WELL TEST ARRAY DISCHARGE WATER SYSTEM PIPING AT EACH PIT.

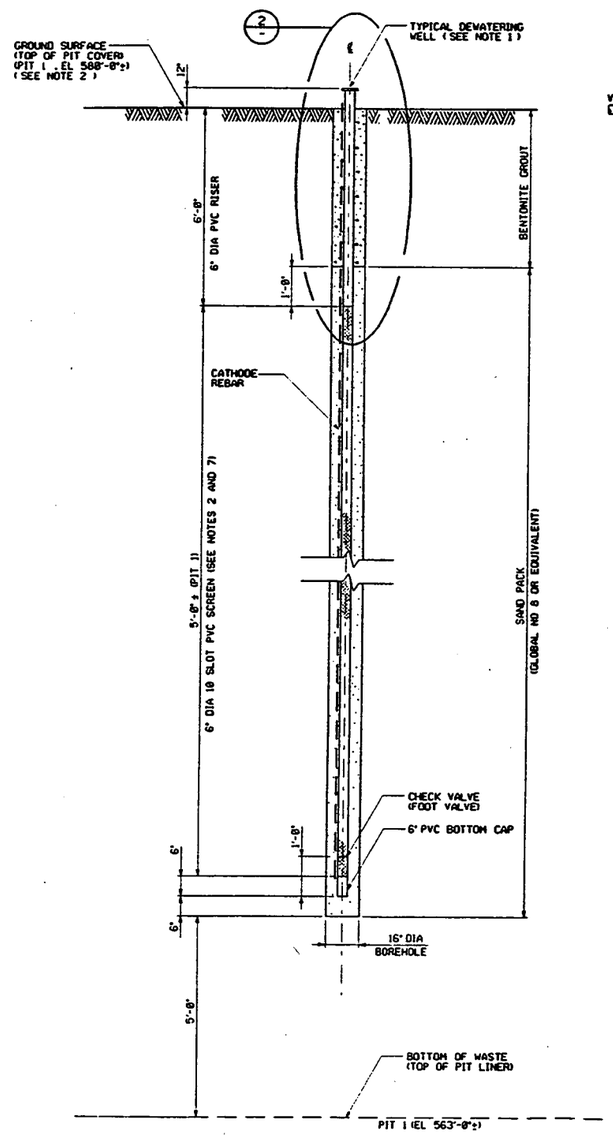
LEGEND

- DEWATERING WELL
- COMBINED VACUUM AND WATER TABLE PIEZOMETER
- WELLS UTILIZED FOR SPACING TEST (PHASE 2)
- DRIVEN WELL POINT

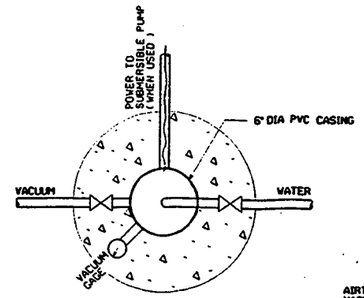
GENERAL LOCATION MAP
PHASES 1, 2 AND 3

TESTING SYSTEMS LOCATIONS
IN PITS 1 AND 3

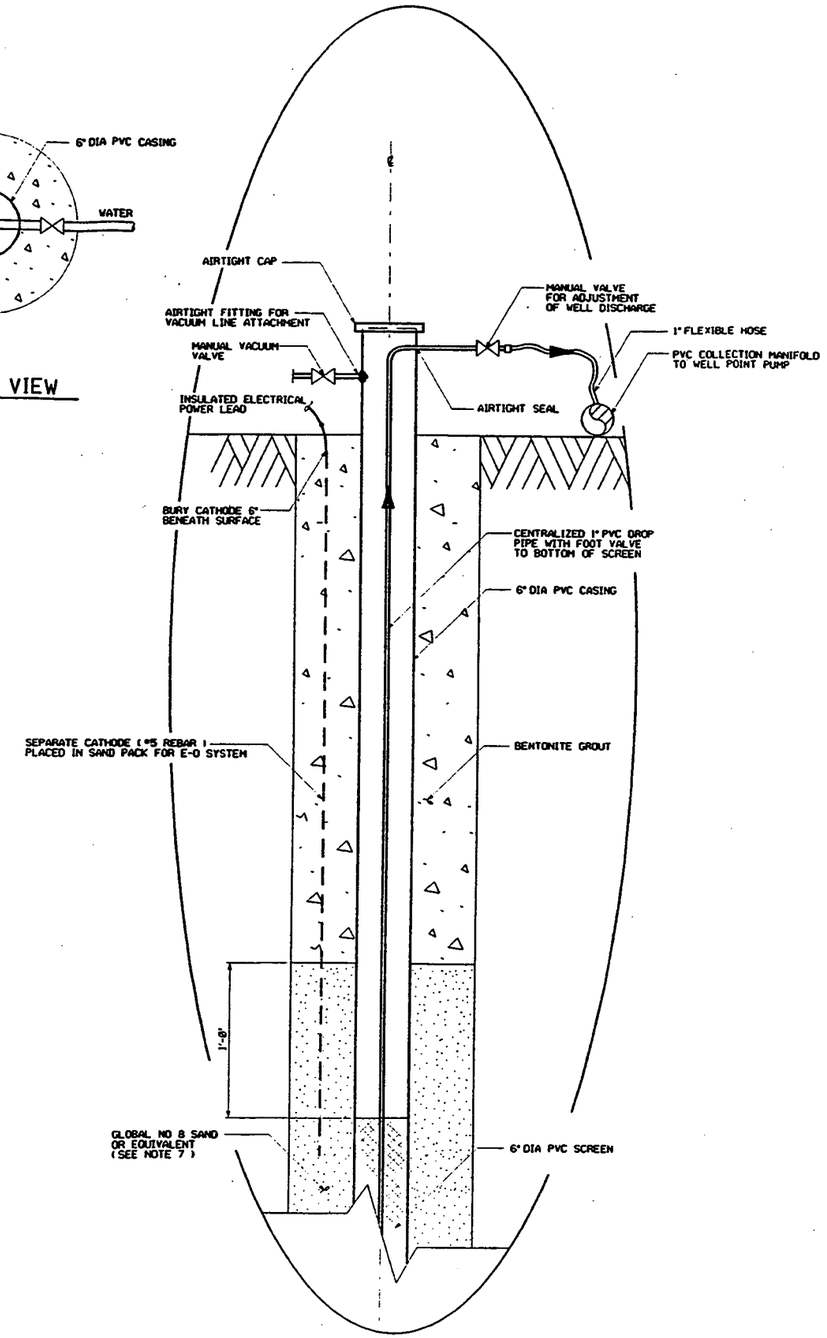
FIGURE 4-1



DETAIL 1 NTS REF FIGURES NO. 5 & 7



TYP PLAN VIEW



DETAIL 2 NTS

NOTES

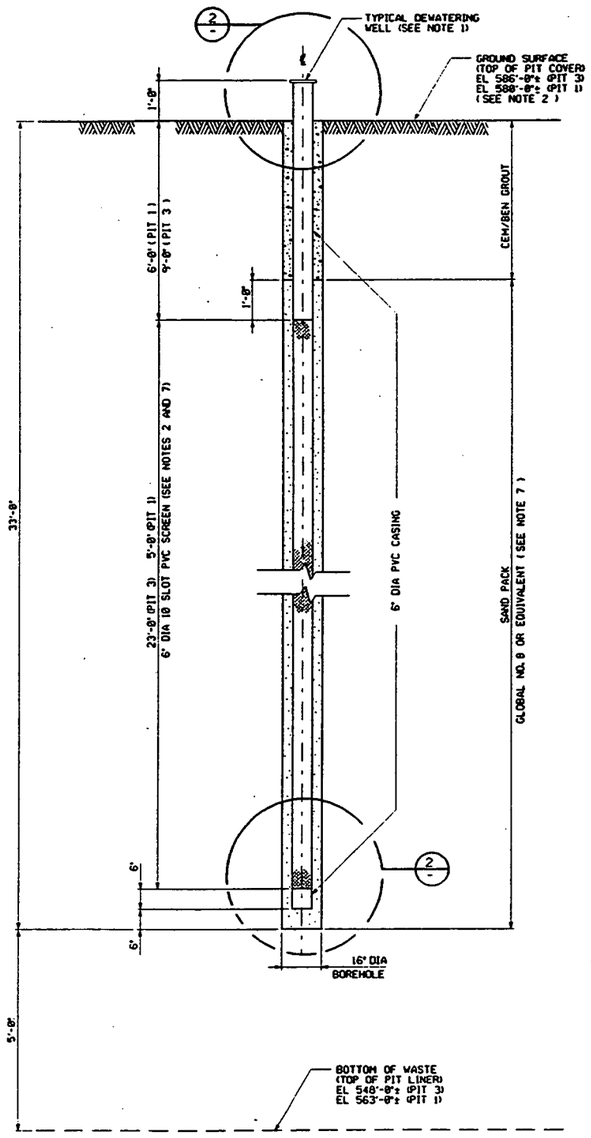
1. WELL LOCATIONS ESTABLISHED/SURVEYED BEFORE AND AFTER WELL CONSTRUCTION.
2. ESTABLISH WELL SCREEN LENGTH BASED ON SURVEYED GROUND ELEVATION AT WELL LOCATION ; ASSUME PIT-1 WASTE BOTTOM EL 563'-0".
3. ALL SCREEN AND RISER DIMENSIONS ARE GIVEN IN NOMINAL PIPE SIZE.
4. ALL PVC PIPE SHALL BE SCHEDULE 80.
5. WELL SCREEN SHALL BE SIZED FOR A MAXIMUM PUMPING RATE OF 4 GPM PER LINEAL FOOT OF WELL SCREEN.
6. INSTRUMENTATION FOR WELL TO INCLUDE:
   A. VACUUM GAGE ON WELL CASING
   B. FLOW RATE AND TOTALIZER ON WELL DISCHARGE
   C. WATER LEVEL SENSOR AND RECORDER
7. IF ENCRUSTATION IS CONSIDERED TO BE A POSSIBLE PROBLEM THE SLOT SIZE CAN BE INCREASED UP TO 20 SLOT. IF 20 SLOT IS USED, SAND PACK EQUIVELENT TO GLOBAL NO. 7 SHOULD BE USED.

DEWATERING WELL DESIGN
SURFACE LOCATED WELL POINT PUMP

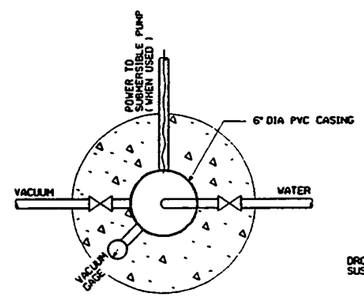
P019/CRU1

FIGURE 4-2

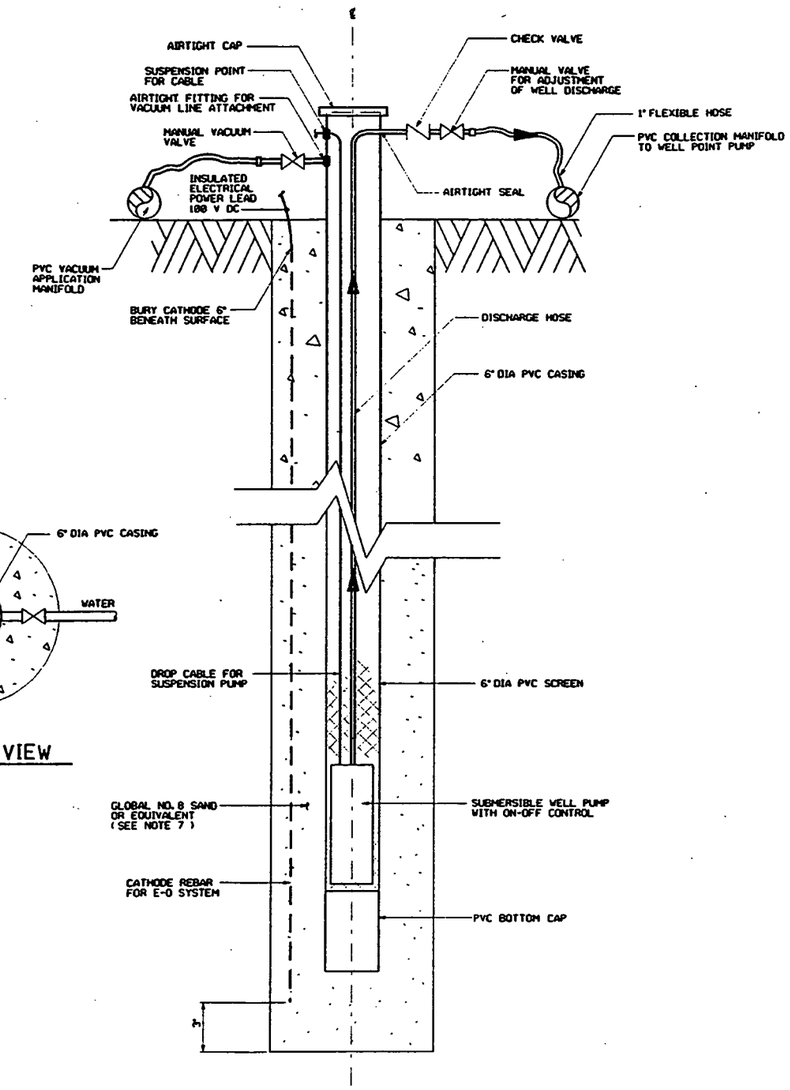
000687



DETAIL 1 NTS REF FIGURES NO. 6 AND 8 (TYP OF 27)



TYP PLAN VIEW



DETAIL 2 NTS

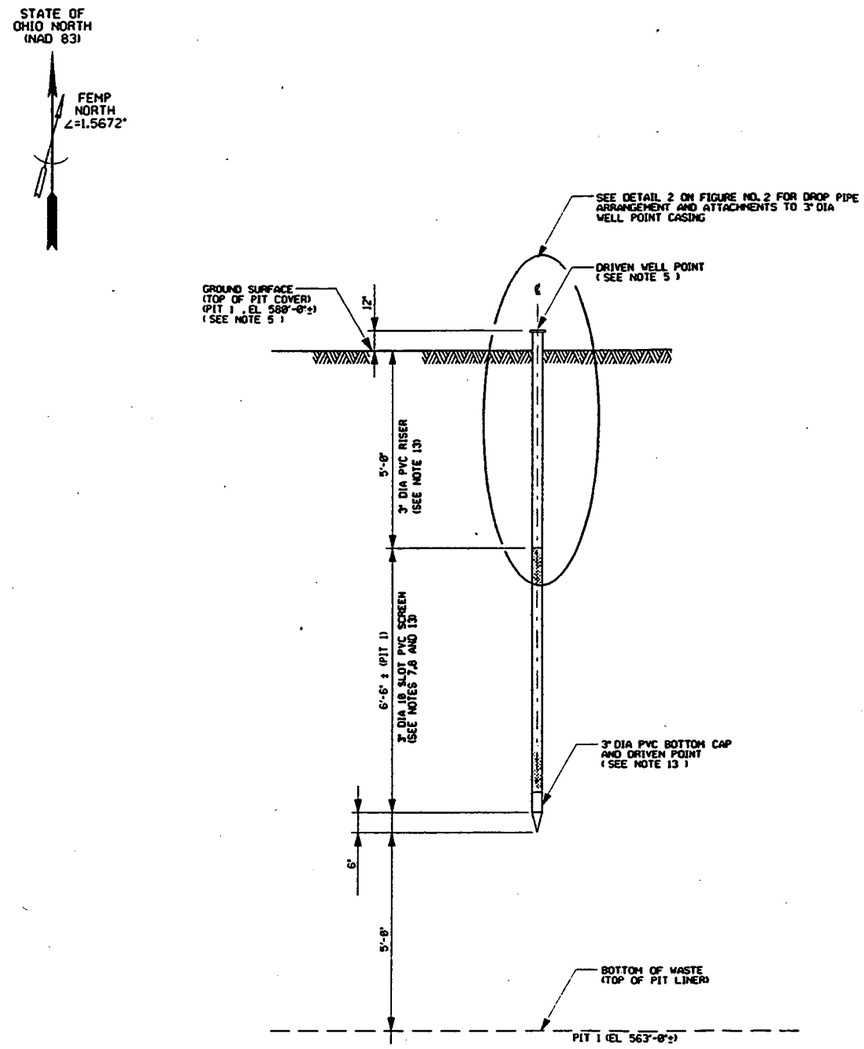
NOTES

1. WELL LOCATIONS ESTABLISHED/SURVEYED BEFORE AND AFTER WELL CONSTRUCTION.
2. ESTABLISH WELL SCREEN LENGTH BASED ON SURVEYED GROUND ELEVATION AT WELL LOCATION ; ASSUME PIT-3 WASTE BOTTOM EL 548'-0" AND PIT 1 WASTE BOTTOM EL 563'-0".
3. ALL SCREEN AND RISER DIMENSIONS ARE GIVEN IN NOMINAL PIPE SIZE.
4. ALL PVC PIPE SHALL BE SCHEDULE 80.
5. WELL SCREEN BE SIZED FOR A MAXIMUM PUMPING RATE OF 5 GPM PER LINEAL FOOT OF WELL SCREEN.
6. INSTRUMENTATION FOR WELL TO INCLUDE:
   A. VACUUM GAGE ON WELL CASING
   B. FLOW RATE AND TOTALIZER ON WELL DISCHARGE
   C. WATER LEVEL SENSOR AND RECORDER
7. IF ENCRUSTATION IS CONSIDERED TO BE A POSSIBLE PROBLEM THE SLOT SIZE CAN BE INCREASED UP TO 20 SLOT. IF 20 SLOT IS USED, SAND PACK EQUIVALENT TO GLOBAL NO. 7 SHOULD BE USED.

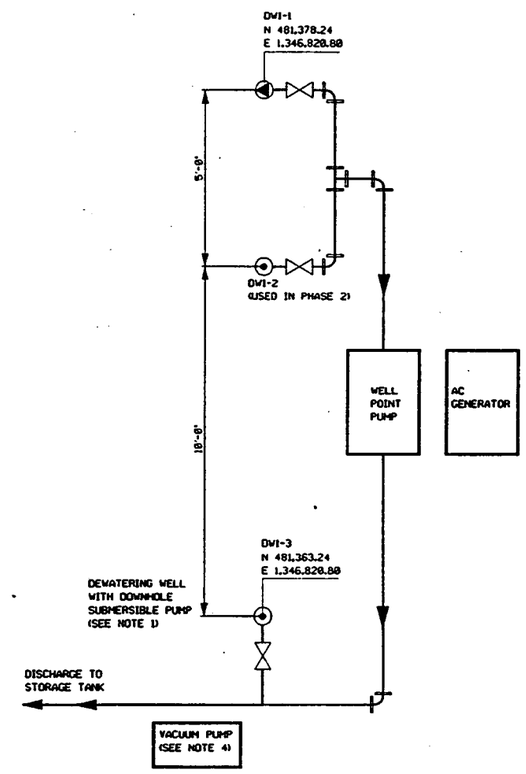
DEWATERING WELL DESIGN
WITH DOWN HOLE SUBMERSIBLE PUMP

FIGURE 4-3

P019/CRU1



DRIVEN WELL POINT
DW1-1
(FOR PHASE 1 TESTING)



GENERAL ARRANGEMENT
WELLS, EQUIPMENT, PIPING
(INSTALLATION IN PIT 1)

NOTES

1. SEE FIGURE NO. 3 FOR DESIGN OF DEWATERING WELL WITH DOWN HOLE SUBMERSIBLE PUMP.
2. SEE FIGURE NO. 2 FOR DESIGN OF DEWATERING WELL WITH SURFACE LOCATED WELL POINT PUMP.
3. LOCATE AC GENERATOR AND WELL POINT PUMP AS SHOWN IN FIGURE NO. 7.
4. VACUUM PUMP TO BE USED IN PHASE 3 IF DOWN HOLE PUMP OPTION IS SELECTED.
5. WELL LOCATIONS ESTABLISHED/SURVEYED BEFORE AND AFTER CONSTRUCTION.
6. ALL PIPE DIMENSIONS GIVEN IN NOMINAL PIPE SIZE.
7. A 10 SLOT PVC SCREEN USING NO. 8 GLOBAL SAND EQUIVALENT AS A FILTER PACK SHOULD BE SATISFACTORY FOR THIS APPLICATION. ALTERNATIVELY A 20 SLOT PVC SCREEN USING GLOBAL NO. 7 SAND OR EQUIVALENT COULD BE SUBSTITUTED IF ENCRUSTING IS A CONCERN OR IF BLOCKAGES DURING DEVELOPMENT ARE CONSIDERED TO BE A POTENTIAL DRAWBACK.
8. ESTABLISH WELL POINT SCREEN LENGTH BASED ON SURVEYED GROUND ELEVATION AT WELL LOCATION ; ASSUME PIT-1 WASTE BOTTOM EL 563'-0".
9. ALL SCREEN AND RISER DIMENSIONS ARE GIVEN IN NOMINAL PIPE SIZE.
10. ALL PVC PIPE SHALL BE SCHEDULE 80.
11. WELL SCREEN SHALL BE SIZED FOR A MAXIMUM PUMPING RATE OF 4 GPM PER LINEAL FOOT OF WELL SCREEN.
12. INSTRUMENTATION FOR WELL POINT TO INCLUDE:
    A. VACUUM GAGE ON WELL CASING
    B. FLOW RATE AND TOTALIZER ON WELL DISCHARGE
    C. WATER LEVEL SENSOR AND RECORDER
13. DEPENDING ON WASTE CONDITION AND INSTALLATION METHOD STEEL WELL POINT MAY BE REQUIRED.
14. ALL WELLS INSTALLED WITH TWO ELECTRODES (REBAR) WITHIN WELL FILTER PACK. SECOND ELECTRODE IS A SPARE.

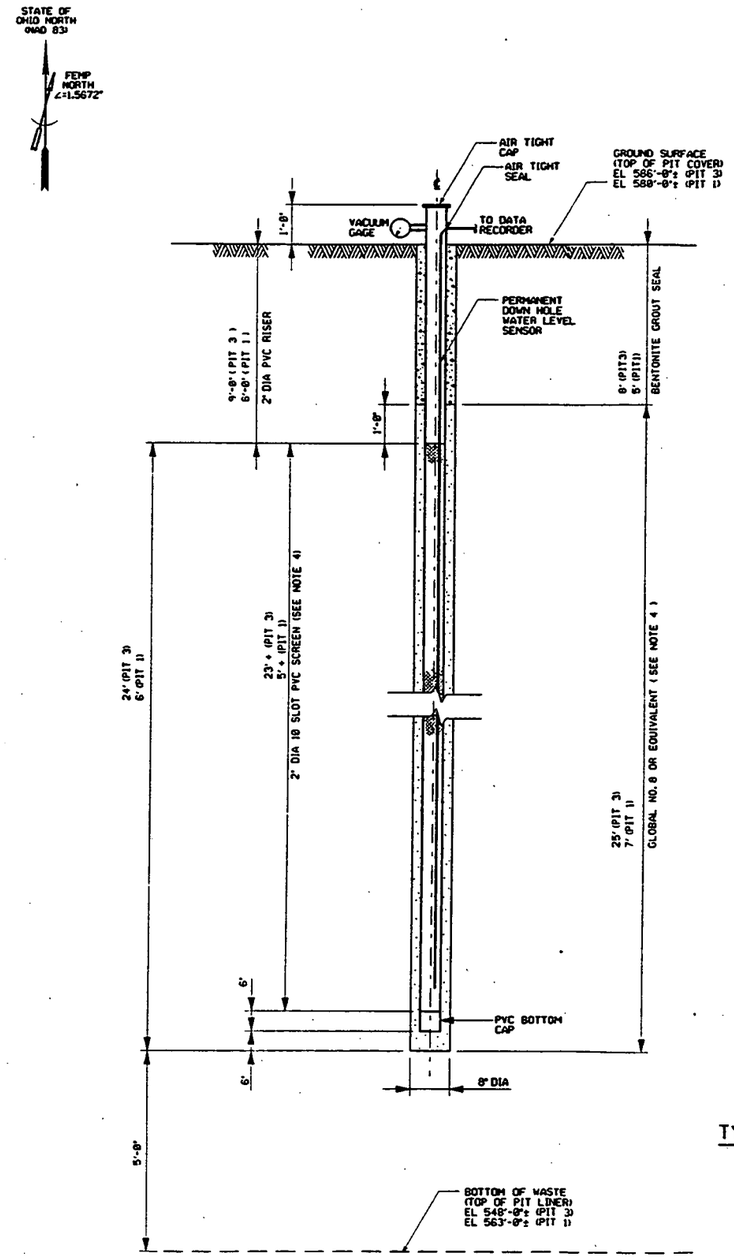
LEGEND

⊕	DRIVEN WELL POINT
⊙	WELLS UTILIZED FOR SPACING TEST (PHASE 2)
⋈	THROTTLE / SHUTOFF VALVE
DW1-2	DEWATERING WELL, PIT 1, WELL NO. 2

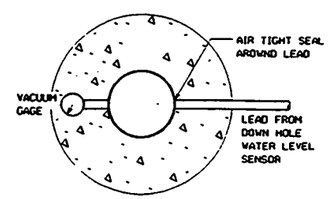
GENERAL ARRANGEMENT PLAN
PHASE 1 - COMPARATIVE WELL TEST

FIGURE 4-4

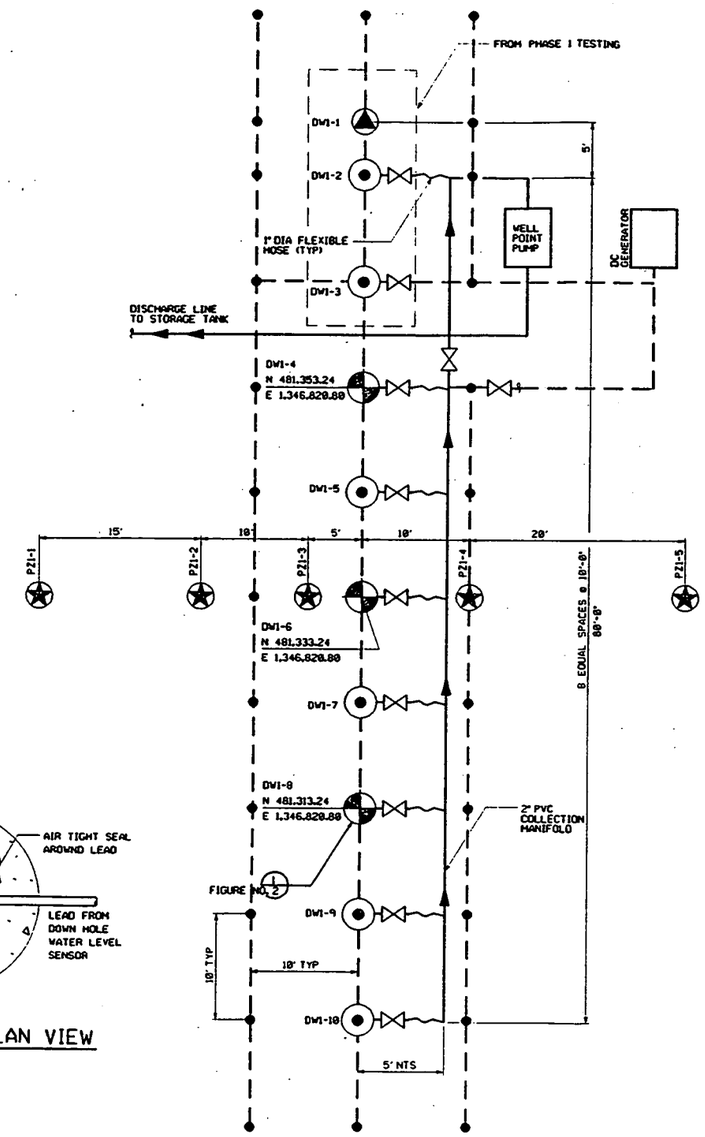
P019/CRU1



COMBINED WATER TABLE AND VACUUM PIEZOMETER
TYPCAL (PITS 1 AND 3)



TYP PIEZOMETER PLAN VIEW



GENERAL ARRANGEMENT
WELLS, EQUIPTMENT, PIPING
(INSTALLATION IN PIT 1)

NOTES

1. LOCATE WELL POINT PUMP, E-O SYSTEM, DC POWER SUPPLY AND AC GENERATOR AS SHOWN ON FIGURE NO. 7.
2. WELLPOINT DW1-1, AND WELLS DW1-2 AND DW1-3 EXIST FROM PHASE 1 TESTING.
3. FOR PHASE 3 GENERAL ARRANGEMENT, SEE FIGURE NO. 7.
4. IF ENCRUSTATION IS CONSIDERED TO BE A POSSIBLE PROBLEM THE SLOT SIZE CAN BE INCREASED UP TO 20 SLOT. IF 20 SLOT IS USED, SAND PACK EQUIVALENT TO GLOBAL NO. 7 SHOULD BE USED.
5. ALL WELLS ARE INSTALLED WITH TWO ELECTRODES (REBAR) WITHIN FILTER PACK. SECOND ELECTRODE IS A SPARE.

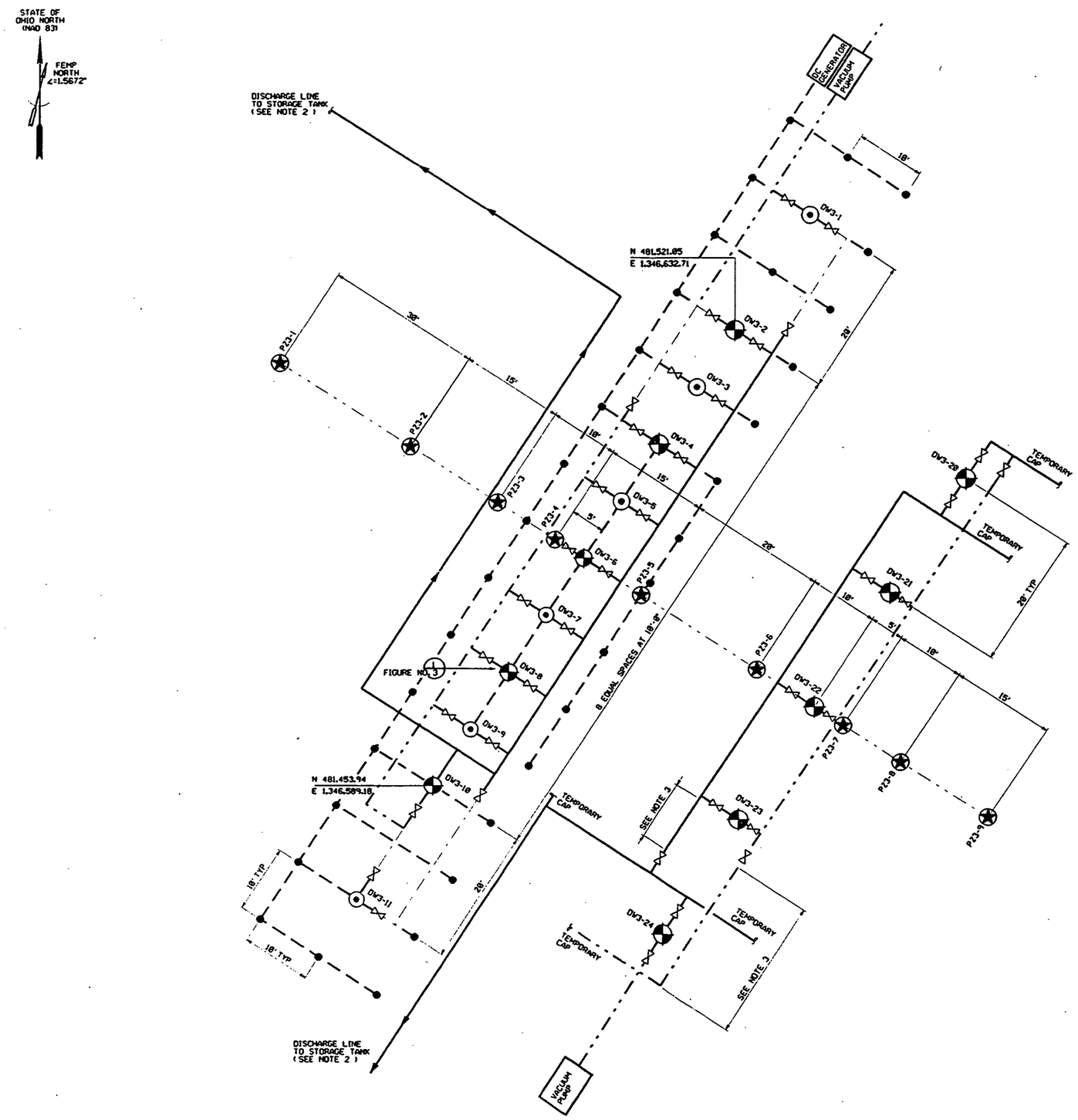
LEGEND

- WELLS NOT PART OF THE PATTERN EXPECTED FOR THE FINAL DEWATER TESTING SYSTEM (PHASE 3), THEY ARE PHASE 1 OR 2 WELLS.
- WELLS ASSUMED TO BE IN FINAL DEWATERING TEST ARRAY (PHASE 3)
- COMBINED VACUUM AND WATER TABLE PIEZOMETER
- DRIVEN WELL POINT FROM PHASE 1 TESTING
- THROTLE / SHUTOFF VALVE
- ANODE
- INSULATED ELECTRICAL CONDUIT
- DW DEWATERING WELL
- PZ COMBINATION PIEZOMETER

GENERAL ARRANGEMENT
PHASE 2
WELL SPACING TEST
FOR PIT 1

FIGURE 4-5

P019/CRU1



NOTES

ELECTRICAL NOTES:

1. LOCATE WELL POINT PUMP, E-O DC SUPPLY, AND DATA LOGGER AT APPROXIMATE LOCATIONS SHOWN OUTSIDE OF APPROXIMATE DEWATER ZONE BOUNDARY.
2. FOR GENERAL LAYOUT AND EQUIPMENT ARRANGEMENT, SEE FIGURE NO. 8
3. THIS SECTION TO BE REMOVED WHEN PHASE 2 WORK IS COMPLETE.

LEGEND

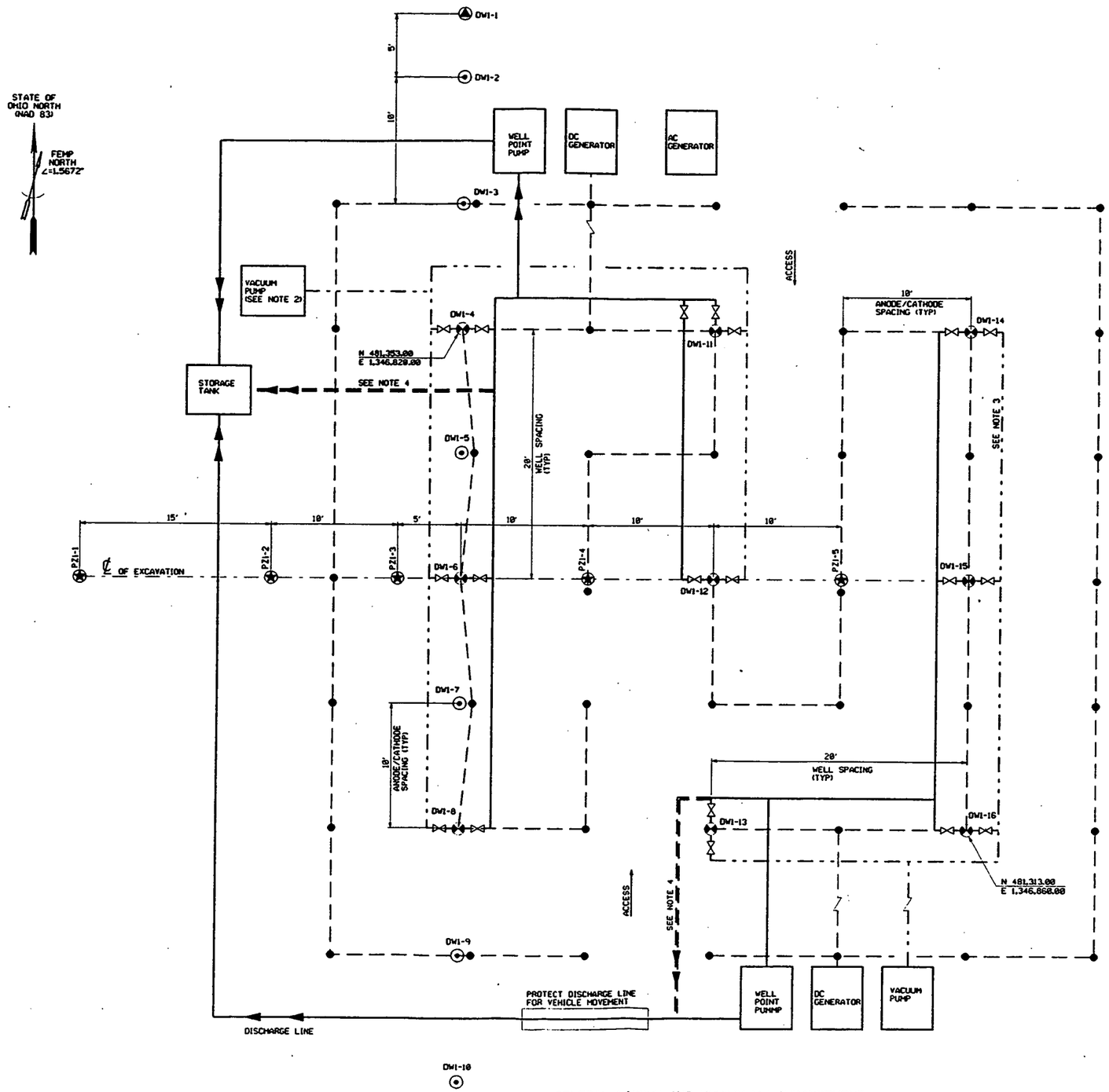
- WELL NOT PART OF THE PATTERN EXPECTED FOR THE FINAL DEWATER TESTING SYSTEM (PHASE 3 I, THEY ARE FOR WELL SPACE TESTING PURPOSES.
- DEWATERING WELLS PART OF PHASE 3 FULL INSTALLATION SYSTEM
- COMBINED VACUUM AND WATER TABLE PIEZOMETER WELLS
- THROTTLE / SHUTOFF VALVE
- ANODE
- DW DEWATERING WELL
- PZ COMBINATION PIEZOMETER
- INSULATED ELECTRICAL CONDUIT
- SECTIONS OF HEADERS BETWEEN VALVES TO BE REMOVED PRIOR TO PHASE 3.
- VACUUM HEADER
- DISCHARGE HEADER

GENERAL ARRANGEMENT
PHASE 2
WELL SPACING TEST
FOR PIT 3

P019/CRU1

FIGURE 4-6

000691



GENERAL LAYOUT AND EQUIPMENT ARRANGEMENT
WELL POINT ARRAY - PIT 1

P019/CRU1

NOTES

1. NO. 5 REBAR IS INSTALLED TO THE FULL DEPTH OF EACH WELL. WITHIN THE FILTER PACK ANNULUS OF EACH WELL.THIS REBAR THEN PERFORMS THE FUNCTION OF A CATHODE AT EACH WELL.
2. VACUUM PUMP LOCATION IF DOWN HOLE PUMP IS EVENTUALLY SELECTED FOR PHASE 3 TESTING.
3. VACUUM HEADER SHOWN FOR DOWN HOLE PUMP OPTION IF SELECTED.
4. THIS SECTION OF DISCHARGE HEADER IS REQUIRED ONLY IF DOWN HOLE PUMP OPTION IS SELECTED.

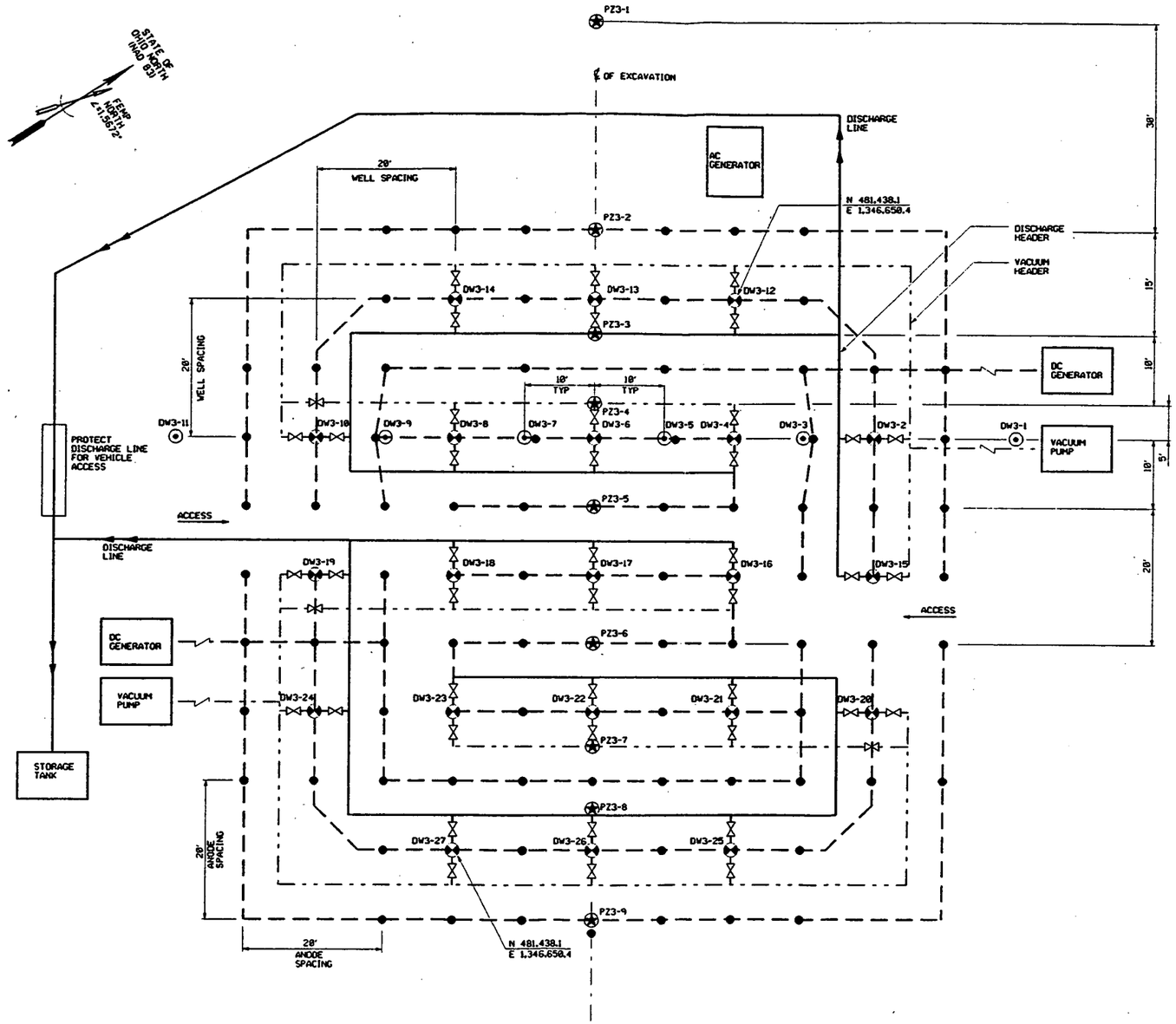
LEGEND

- DRIVEN WELL POINT
- COMBINED VACUUM AND WATER TABLE PIEZOMETER
- WELL (PHASE 3)
- WELLS UTILIZED FOR SPACING TEST (PHASE 2)
- THROTTLE / SHUTOFF VALVE
- ANODE
- VACUUM HEADER
- INSULATED ELECTRICAL CONDUIT
- DISCHARGE HEADER
- OPTIONAL SECTION OF DISCHARGE HEADER TO BE INSTALLED IF DOWN HOLE PUMP OPTION IS USED.
- DWI-2 DEWATERING WELL, PIT 1, WELL NO. 2
- PZI-1 COMBINED VACUUM AND WATER TABLE PIEZOMETER, PIT 1, NO. 1

GENERAL ARRANGEMENT PLAN
PHASE 3

FULL INSTALLATION TESTING WELLS.
FOR PIT 1

FIGURE 4-7



GENERAL LAYOUT AND EQUIPMENT ARRANGEMENT
WELL ARRAY - PIT 3

NOTES

1. WELLS HAVE PVC CASING AND SCREENS.
2. NO. 5 REBAR INSTALLED TO THE SAME DEPTH AS THE WELL AND PLACED IN THE FILTER PACK OF EACH WELL. ACTS AS A CATHODE. ALL WELLS HAVE 2 ELECTRODES EACH INSTALLED WITHIN THE FILTER PACK. THE SECOND ELECTRODE IS A SPARE.

LEGEND

⊙	WELLS UTILIZED FOR SPACING TEST (PHASE 2)
	DEWATERING WELL
	COMBINED VACUUM AND WATER TABLE PIEZOMETER
	THROTTLE / SHUTOFF VALVE
●	ANODE
— — —	INSULATED ELECTRICAL CONDUIT
- - - -	VACUUM HEADER
———	DISCHARGE HEADER
DW	DEWATERING WELL
PZ3-1	COMBINED VACUUM AND WATER TABLE PIEZOMETER, PIT 3, NO. 1

GENERAL ARRANGEMENT PLAN
PHASE 3

FULL INSTALLATION TESTING
FOR PIT 3

FIGURE 4-8

P019/CRU1

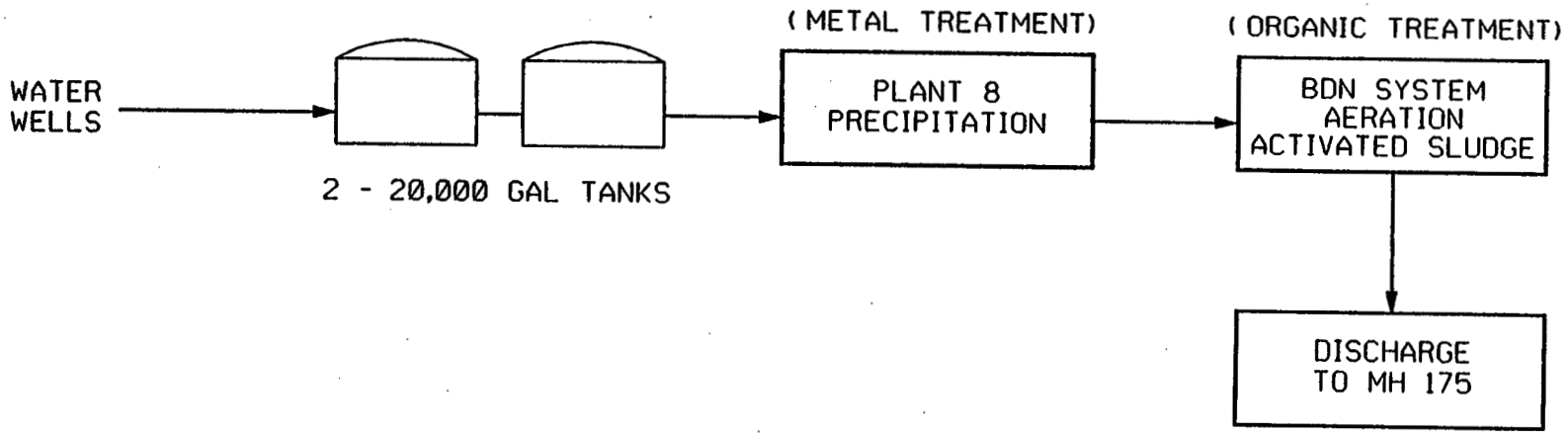


Figure 4-9

DEEP WATER TREATMENT

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SECTION 5
DRY EXCAVATION

5.1 DRY EXCAVATION TEST DESCRIPTION AND OBJECTIVES

Dry (post-dewatering) excavation activities include excavation of a dry trench in Waste Pit 1 and excavation of a ramp in Waste Pit 3. (The dryness of the waste will depend on the success of the dewatering.) The trench in Waste Pit 1 will be completed and backfilled before the ramp in Waste Pit 3 is started. The dry trench and ramp will be excavated to help characterize conditions necessary for planning the full-scale excavation. Locations for the two proposed excavations are provided in Figure 5-1.

The objective of these excavations is to provide data on:

- The degree of success of the waste dewatering program
- Whether tracked equipment can be driven directly on a ramp in Waste Pit 3
- The angle of repose for the dewatered waste
- Slope steepness comparisons between the wet (pre-dewatered) excavations and dry (post-dewatered) excavations

Coatings and surfactants will be applied to the waste stockpiles to test each surfactant's ability to contain the waste by avoiding windborne emissions.

5.2 WASTE PIT 1 DRY TRENCH EXCAVATION

5.2.1 Waste Pit 1 Dry Trench Excavation Experimental Design and Procedures

The dry trench excavation in Waste Pit 1 must be excavated so as not to damage the dewatering wells that will continue operation around the perimeter of the excavation. The locations of the proposed trench and the surrounding dewatering wells are illustrated in Figure 5-1.

5.2.1.1 Deactivate Inner Wells

The dry trench excavations are centrally located in the midst of an array of dewatering wells. Prior to starting the trench excavation, the inner wells shall be deactivated. The remaining wells will keep the dewatered area free of inflow from the surrounding pit area. Following deactivation of the inner wells,

the pumps with attached wiring, piping, and connections shall be removed and salvaged. Plastic well casings will be left in place and demolished as the excavation proceeds.

5.2.1.2 Stockpile Areas

Stockpile pads shall be sloped to drain back toward the excavation. One or two waste pads may be needed, depending on the slopes that can be obtained in the excavation. Excavated stockpile materials will include both cap and waste. Containment berms will be made with straw bales lined up to form a barrier. The bales will be covered with 6-mil plastic sheeting.

5.2.1.3 Excavation

After lining the pad areas and constructing containment berms, the capping can be removed. The thickness of the cap in Waste Pit 1 ranges from approximately 6 inches to 2 feet. Capping will be stripped down until there is a definite appearance of waste or sludge-like material. Excavation progress will be continually monitored to ensure that contaminated waste or sludge is not mixed with excavated capping. All stockpiled areas shall be covered with plastic sheeting or a dust control agent will be applied (see Attachment D, Dust Suppressant Testing) when excavations are not in progress.

In Waste Pit 1, the waste is deeper than 15 feet, so the excavation will not penetrate into the waste pit liners. For dry trenching at Waste Pit 1, an attempt should be made to excavate down to 15 feet deep while maintaining nearly vertical side walls. The initial attempt to excavate down to 15 feet in waste will depend upon the strength or stability of excavated waste as demonstrated while excavating. If the waste holds at steep slopes, a 14-foot by 28-foot trench shall be the maximum size of excavation. If the side walls immediately collapse, the remaining trench excavation would be carried to a depth of 10 feet or to a depth determined by the field operations managers. In this case, where the waste begins to slough, the trench walls will be laid to a slope that the waste can maintain. Since the wall slopes will be flatter in a sloughing condition of the waste, an area no greater than 30 feet by 30 feet will be disturbed.

5.2.1.4 Reclamation

Following trench excavation the waste will be backfilled into the trench. The sludge must be compacted with the backhoe bucket as it is placed in the trench. When the waste stockpile is backfilled down to the

plastic liner, the liner will be disposed of in the trench. Next, the cap material will be placed on the waste and compacted with the excavation equipment. The disturbed areas will then be seeded and straw will be dispersed over the seeded areas.

5.2.1.5 Equipment Decontamination

When salvageable equipment is no longer needed for the DEEP project, gross decontamination will be performed at the project site, and the equipment will then be transferred to the FEMP Decontamination Facility for further decontamination.

5.2.2 Waste Pit 1 Dry Trench Equipment

Equipment:

- Large backhoe
- Front-end loader or tractor-loader
- Mobile lift platform
- Generator
- Submersible electric sump pump
- Lighting
- Electrical cable
- Video camera
- TV monitor

Supplies:

- 6-mil plastic sheeting for liner
- Lightweight plastic (tarp) for covering waste stockpile
- Timber ties and mats
- Orange plastic hazard fencing and fence posts
- Grass seed
- Straw bales
- Dust control agents and application equipment

5.3 WASTE PIT 3 RAMP EXCAVATION

5.3.1 Waste Pit 3 Ramp Excavation Experimental Design and Procedures

A "full-sized" ramp will be excavated into Waste Pit 3 sludge to determine if tracked excavation equipment can be operated on sludge. The proposed ramp excavation is illustrated in Figure 5-1 and is located in the southeast portion of Waste Pit 3, near the Clearwell.

The ramp itself is 20 feet wide and will be excavated at -12°. Cap thickness varies; it is thinnest in the southeast part of the excavation and thickens to the northwest. The planned excavation contains 750 cy, consisting of 550 cy of cap and 200 cy of sludge. An attempt will be made to extend the excavation 3 feet down into the sludge where a 30-foot diameter circular pit floor will be excavated. It is presumed that slopes in the overlying clay capping could be carried at 2V to 1H while slopes in the weaker sludge would stand at 1V to 2H. If conditions are favorable to driving tracked equipment on the waste, then the ramp will be excavated an additional 3 to 5 feet into the waste.

The initial excavation will terminate along the outside perimeter of the dewatering wells. Observations will be made to evaluate slope stability. The excavation will continue in a northwest direction through the perimeter dewatering wells for 50 feet. The plan is to visually observe the equipment's ability to excavate wet waste. The excavation must extend 50 feet such that the excavation is outside of the perimeter wells' radius of influence which is assumed to be 20 feet. The additional quantities for excavation extension beyond the dewatering wells is 520 cy cap and 335 cy waste sludge, for a total of 855 cy waste and cap material. The waste in the wet area of the ramp is assumed to be stable at a 1V to 3H slope. See Figure 5-2 for ramp extension into undewatered waste.

5.3.1.1 De-activate Inner Wells

The proposed ramp excavation is placed in the midst of 27 dewatering wells. The inner wells will be deactivated before beginning the excavation. Pumps and all attached wiring, piping, and connections shall be removed and salvaged. The remaining peripheral wells will continue operation, reducing water inflow to the excavation. After the initial excavation is complete, exterior perimeter wells will be deactivated. All plastic casings will be left in place and demolished as the excavation proceeds.

5.3.1.2 Stockpile Areas

At the ramp excavation, the stockpile pads shall be graded to drain to the excavation. Some grading may be needed to remove vegetation and to smooth the surface. Containment berms will be made with straw bales lined up to form a barrier.

5.3.1.3 Excavation

Capping will be trammed up the ramp and dumped at the stockpile area. The ramp is extended down as successive cuts into capping are made. The excavation will extend down 3 feet into waste, revealing its underfoot condition. Then, if waste conditions are favorable for tracked equipment, the ramp excavation will extend an additional 3 to 5 feet into the waste. Waste will be excavated using the tracked loader-excavator. The loader will tram its load up the ramp and out of the excavation and over to a stockpile. A small "Bobcat" loader may be used to place the waste in the main stockpile.

5.3.1.4 Reclamation

Following the ramp excavation, the waste will be backfilled into the trench. The sludge must be compacted with the tractor loader as it is backfilled. Next, the cap material will be placed on the waste and compacted with the excavation equipment by driving on the disturbed areas. The disturbed areas will then be seeded and straw will be dispersed over the seeded areas.

5.3.1.5 Equipment Decontamination

When salvageable equipment is no longer needed for the DEEP project, gross decontamination will be performed at the project site, and the equipment will then be transferred to the FEMP Decontamination Facility for further decontamination.

5.3.2 Waste Pit 3 Ramp Excavation Equipment

Equipment:

- Tracked loader-excavator
- Rubber-tired front-end loader
- Large backhoe
- Generator
- Submersible electric sump pump
- Electrical cable
- Video camera
- TV monitor

Supplies:

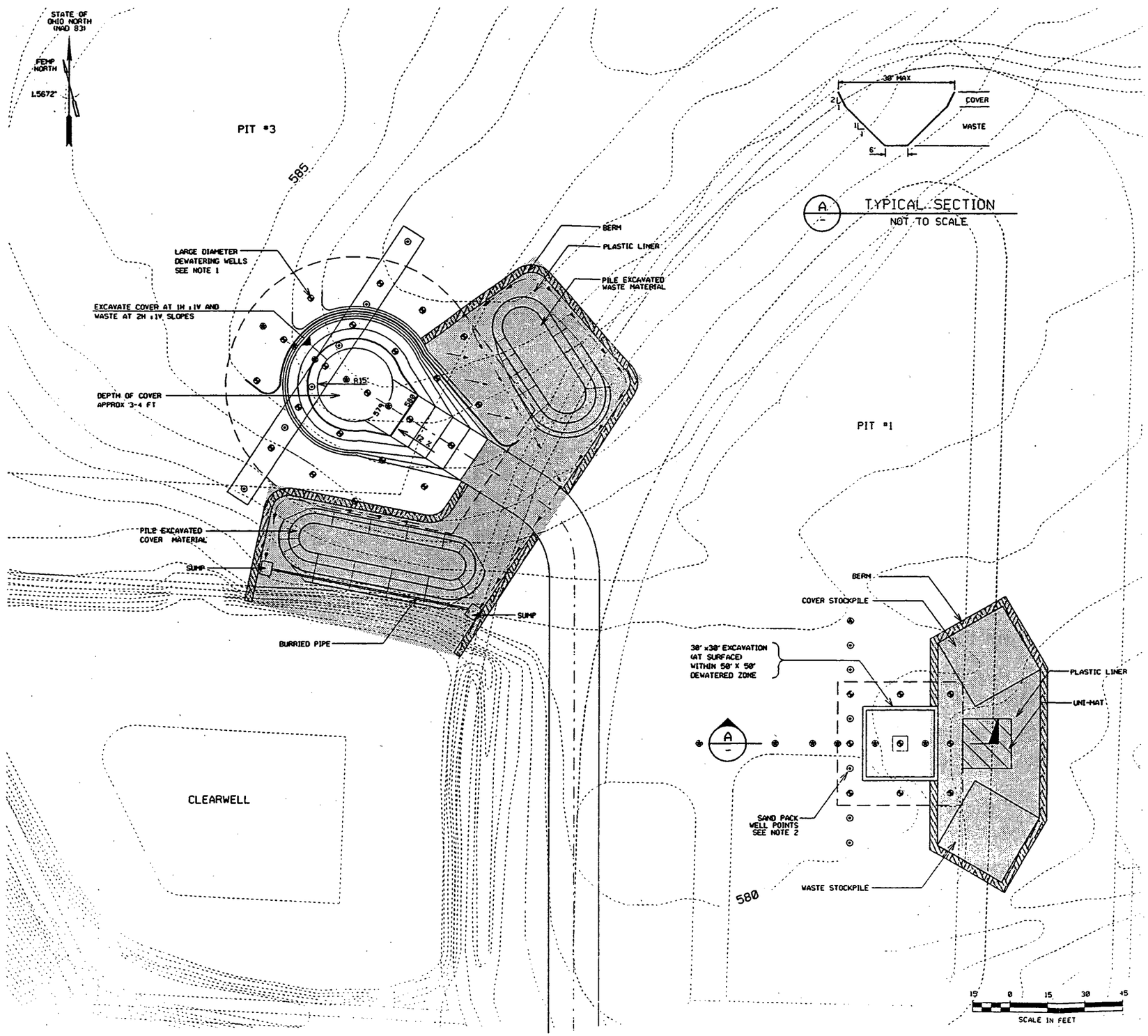
- Lightweight plastic tarp for covering stockpiles
- Orange plastic hazard fencing and fence posts
- Grass seed
- Straw bales

- Dust control agents and application equipment

5.4 DRY EXCAVATION DATA COLLECTION, ANALYSIS, INTERPRETATION, AND REPORTING

The Field Operations Manager or Lead Geologist will be responsible for analyzing and interpreting dry excavation field data during and following actual field activity. Dry excavation data will be reported in the dry excavation test report. Field log entries will document observations of the work-in-progress. Refer to Table 1-3 for a discussion of dry excavation technique, test purpose, test input and interpretation. Field log entries will include, but are not limited to:

- Angle of repose of the waste
- Amount (depth) of water in the trench
- Waste strata description (colors, texture, etc.)
- Approximate trench depth, as determined by the boom length
- Wall stability following contact with equipment
- Waste strength
- Ability of coatings and surfactants to contain the waste in waste stockpiles.



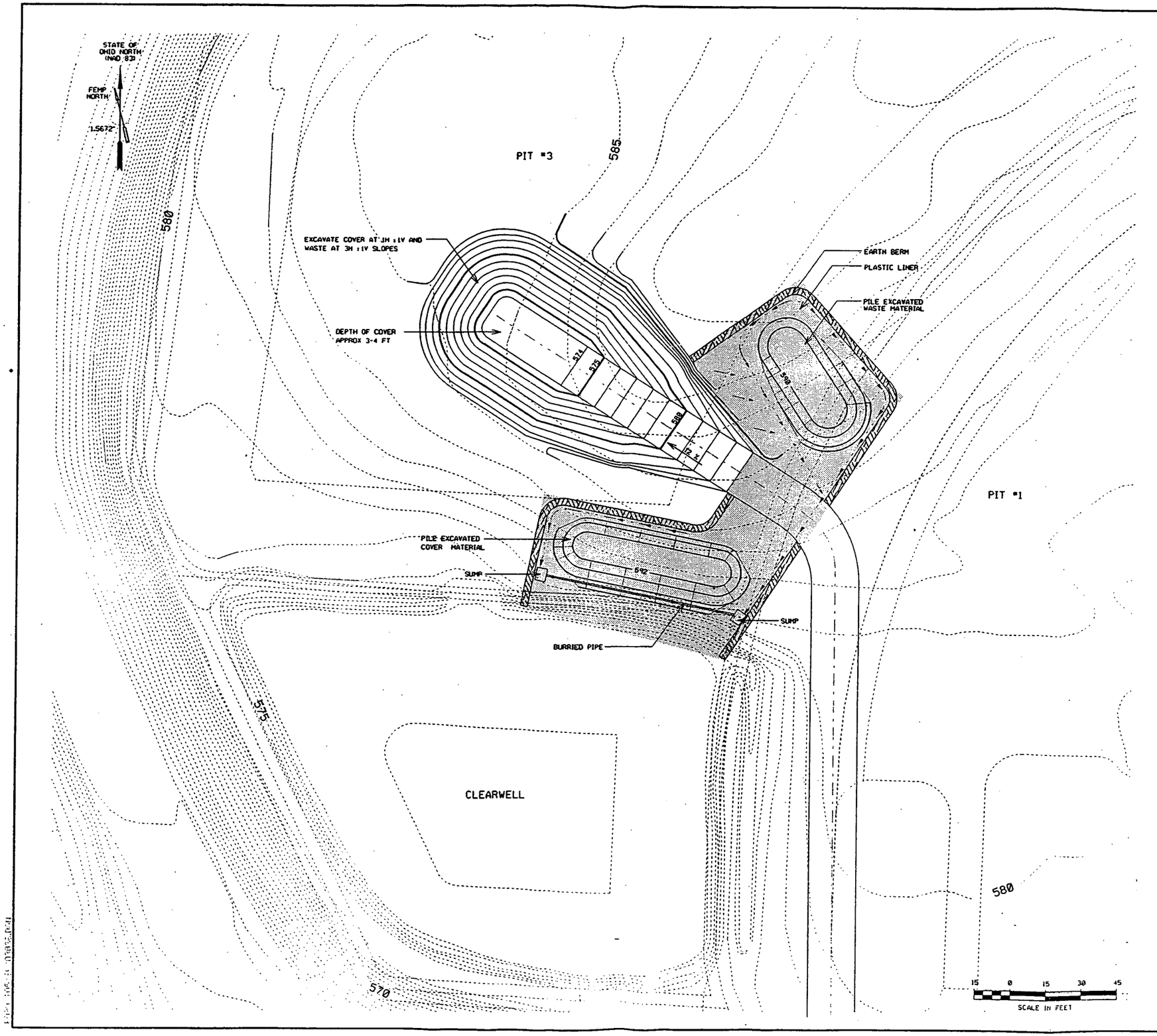
1. DEWATERING WELLS WITHIN THE LIMIT OF EXCAVATION SHALL BE REMOVED PRIOR TO THE START OF EXCAVATION.
2. SAND PACK WELL POINTS WITHIN THE LIMIT OF EXCAVATION SHALL BE REMOVED RIOR TO THE START OF EXCAVATION.

LEGEND

- DEWATERING WELL
- COMBINED VACUUM AND WATER TABLE PIEZOMETER
- WELLS UTILIZED FOR SPACING TEST (PHASE 2)
- DRIVEN WELL POINT
- PLASTIC LINER
- DEWATERING TEST AREA

WASTE PITS 1. & 3
DEWATERING TEST SYSTEMS & DRY EXCAVATION

FIGURE 5-1



WASTE PIT 3
RAMP EXTENSION

FIGURE 5-2

SECTION 6
SUPPORTING DOCUMENTATION

This section includes documentation that supports all the treatment technologies identified in this work plan for the Dewatering Excavation Evaluation Program (DEEP), Including:

- Data Management
- Health and Safety
- Community Relations
- Management and Staffing
- Schedule
- Reports

6.1 DATA MANAGEMENT

This section describes the procedures for recording observations and raw data in the field or laboratory for the Dewatering Excavation Evaluation Program (DEEP). The data management procedures are designed to ensure that data generated throughout the project are recorded and maintained efficiently, accurately, and in a manner that can be reproduced. All data management procedures are in accordance with the Sitewide CERCLA Quality Assurance Project Plan (SCQ).

Daily logs (preprinted, sequentially numbered forms) will be kept to provide a written record of activities and measurements conducted in the field on a given date, in compliance with the Appendix J of the SCQ. Logs that will be utilized during this project include:

- Field Activity Log
- Monitoring Well Development Form
- Well Completion Log
- Sample Collection Log
- Surface Water/Groundwater Sample Collection Log
- Lithologic Log

Data generated from cone penetrometer testing, wet excavation and dewatering testing will be of an observational nature and recorded only on Field Activity Logs. Field personnel will be trained in the correct procedure for visual classification and completion of accurate log forms. Soil borings and

geotechnical testing will include Field Activity Logs, along with appropriate laboratory documentation, as specified in the SCQ and the Project-Specific Plan (PSP).

Originals of all field records will be maintained in the project central file with copies provided to the CRU1 Project Manager. Copies will be stored separately from the originals for documentation of work activities in the event the originals are destroyed, lost, or stolen. Samples of the daily log forms that will be used for the DEEP are shown in Attachment F.

6.2 HEALTH AND SAFETY

The Health and Safety Plan for the DEEP is contained in Attachment A. This health and safety plan addresses hazards associated with the DEEP.

6.3 COMMUNITY RELATIONS

Public involvement in the decision-making process is an integral part of remediation of the Fernald site. A site-wide Community Relations Plan has been developed to describe the activities that the U.S. Department of Energy (DOE) will undertake to ensure a full program of public participation. In addition to the community relations activities required under the Comprehensive Environmental Response, Compensation and Liability Act, the Superfund Amendments Reauthorization Act, and the National Oil and Hazardous Substances Pollution Contingency Plan, the DOE will initiate additional activities to obtain feedback from stakeholders on cleanup alternatives and technologies being considered. These activities will include briefings to key stakeholders at public meetings and workshops, updates in the monthly Fernald newsletter, fact sheets, and other informational sessions.

Copies of this work plan and other materials relevant to Operable Unit 1 are available for public inspection as part of the FEMP Administrative Record, located at the following address:

Public Environmental Information Center
10845 Hamilton-Cleves Highway
Harrison, Ohio, 45030
The phone number is (513) 738-0164.

6.4 MANAGEMENT AND STAFFING

This section identifies key management and technical personnel, and defines specific project roles and responsibilities for managing and implementing the Dewatering and Excavation Evaluation Program (DEEP) for Operable Unit 1. The line of authority is presented in the organization chart featured in Figure 6-1. Staff identified in this organization chart are employees of the Fernald Environmental Restoration Management Corporation (FERMCO) and support DOE, the lead agency responsible for remediating Operable Unit 1 and for the DEEP. The work will be performed by FERMCO employees and subcontractors, as needed. Descriptions of the key technical responsibilities identified in Figure 6-1 follow.

CERCLA/RCRA Unit (CRU) 1 Director: Responsible for all CRU1 activities, including project performance, schedule, budget, and resources. Provides guidance and support to projects. Provides project status information to senior management, client, and regulatory officials.

CRU1 Health & Safety Manager: Responsible for the overall CRU1 Health and Safety Program. Reviews and approves the DEEP Health and Safety Plan. Performs inspections to assure compliance with health and safety requirements.

DEEP Project Manager: Responsible for overall project performance. Reviews project plans, evaluates project against budget and schedule, and coordinates activities with the client.

DEEP Assistant Project Manager: Assists the project manager with project reviews, budgets and schedules. Provides technical oversight of field operations and directs excavation activities.

Quality Assurance (QA) Officer: Responsible for establishing and preparing QA requirements for the project. Performs audits and surveillances.

DEEP Health and Safety Officer: Responsible for preparing the project specific health and safety plan. Continually evaluates field activities to assure worker safety. Coordinates field support for

radiological control, fire safety, industrial hygiene, and construction safety. Conducts project safety meetings.

Field Operations Lead/Lead Geologist: Coordinates field activities, obtains work permits and provides oversight of field personnel; responsible for oversight of geotechnical tests.

Regulatory Compliance Lead: Responsible for the preparation of the Regulatory Compliance Plan and integrating environmental requirements.

Engineering Lead: Responsible for developing project requirements, preparing project-specific work plans, and performing data evaluation.

Safety Analysis Lead: Responsible for coordinating the development of the integrated safety and environmental hazard assessment.

Public Affairs Lead: Responsible for preparing the Community Relations Plan and information releases.

Laboratory Support Lead: Responsible for coordinating sample shipping, laboratory scheduling and laboratory contract management.

Cost and Scheduling Lead: Responsible for preparing project cost updates and evaluations. Updates and tracks project schedules.

6.5 SCHEDULE

As shown in Figure 6-2, the DEEP geotechnical, wet excavation/slurry, and dewatering field work will begin simultaneously. Boring and other support field work will begin approximately two months later, with dry excavation scheduled to begin as the wet excavation/slurry and dewatering field work end. The entire project is scheduled for completion one year after start-up.

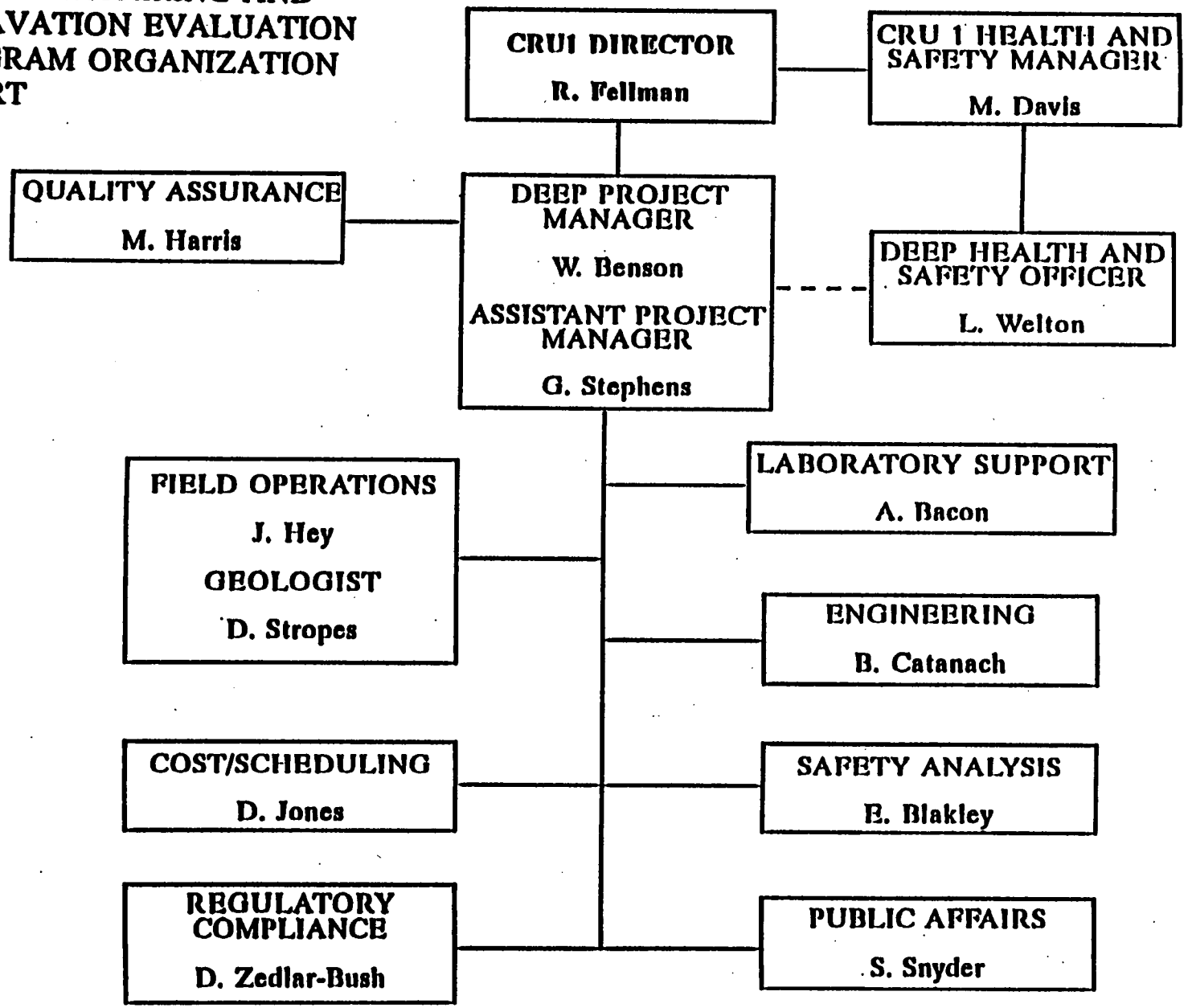
6.6 REPORTS

A report will be prepared to document each of the tests identified in this Treatability Work Plan. In accordance with CERCLA guidance for conducting treatability studies, the report will be submitted to:

- USEPA Office of Research and Development
  Risk Reduction Engineering Laboratory Treatability Data Base
  Risk Reduction Engineering Laboratory
  26 West Martin Luther King Drive
  Cincinnati, Ohio 45268

Figure 6-1

CRU1 DEWATERING AND EXCAVATION EVALUATION PROGRAM ORGANIZATION CHART



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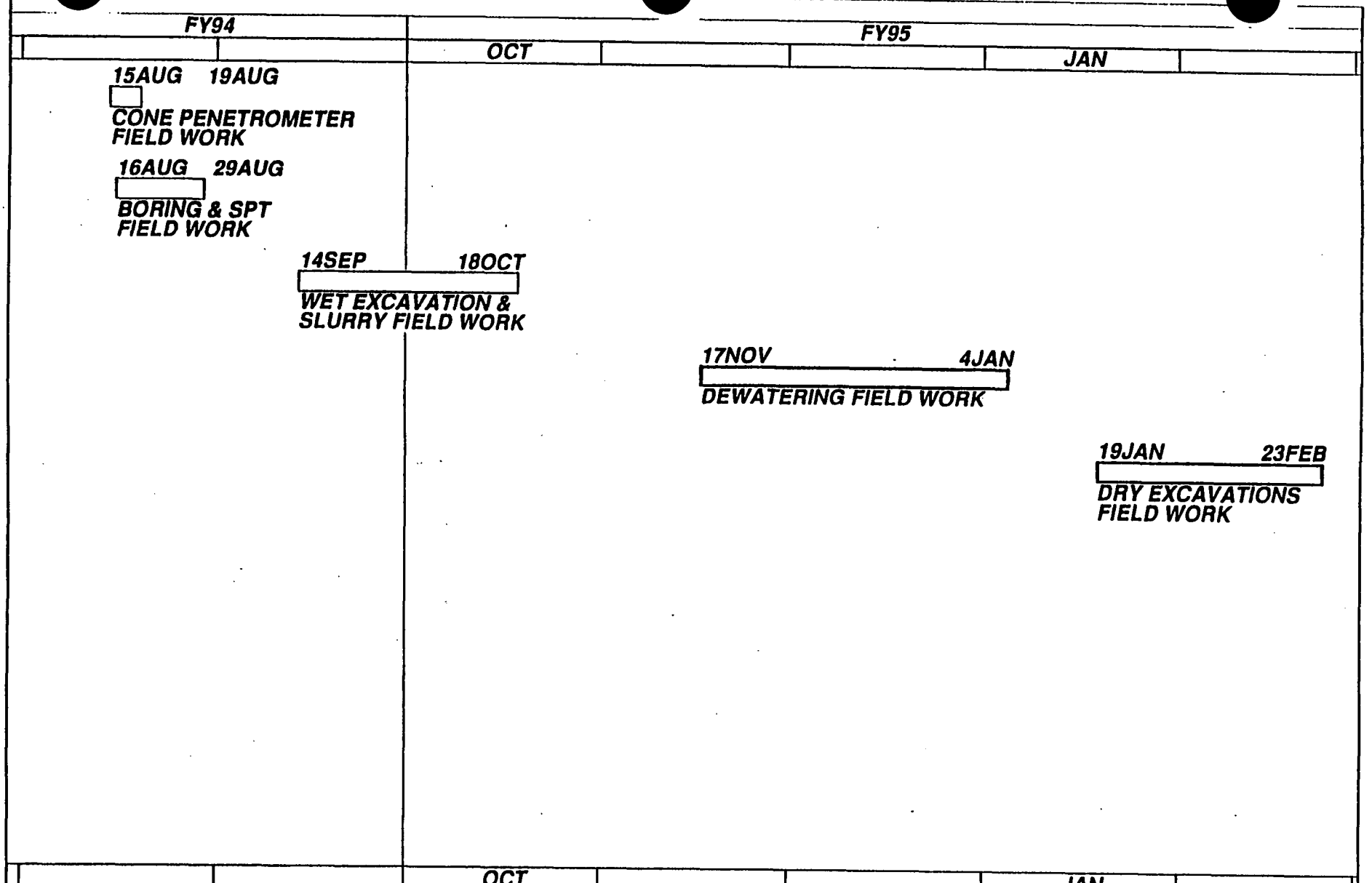

Figure 6-2

Plot Date 14JUN94 Data Date 31MAY94 Project Start 1JAN88 Project Finish 6APR95 (c) Primavera Systems, Inc.	start finish Activity Bar Early Dates Critical Activity Progress Bar ◇ /P Milestone Flag Activity	OU 1 FY 94-99 BASELINE D.E.E.P. FIELD STUDY Sheet 1 of 1	Date / Revision / Checked / Approved

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ATTACHMENT A

CERCLA/RCRA UNIT 1
PROJECT SPECIFIC HEALTH AND SAFETY PLAN
FOR DEWATERING EXCAVATION EVALUATION PROGRAM

Fernald Environmental
FERMCO
Restoration Management Corporation

FERNALD ENVIRONMENTAL

RESTORATION MANAGEMENT CORPORATION

CERCLA/RCRA UNIT 1 (CRU1)

PROJECT SPECIFIC HEALTH AND SAFETY PLAN FOR DEWATERING EXCAVATION EVALUATION PROGRAM

JANUARY 1995

REVISION 2

EMERGENCY PHONE NUMBER ON-SITE 738-6511 RADIO: "CONTROL"

APPROVALS:

Robert Fellman — 1/12/95
Robert Fellman, CRU1 Director — Date

Daryl C. Mills — 1/12/95
Daryl Mills, Construction Safety and Health Manager — Date

Mike Davis — 1-12-95
Mike Davis, FERMCO Health and Safety Officer — Date

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Attachment H, Acknowledgement Form H-1

1.0 INTRODUCTION

The provisions of this Project Specific Health and Safety Plan (PSHSP) are to be used during all work conducted under CERCLA/RCRA Unit 1 (CRU1) Dewatering, Excavation Evaluation Program (DEEP). Compliance with this plan is required of all personnel who enter the work area associated with this project.

All personnel entering the work area (Waste Pits 1, 2, 3) will be required to be oriented on the requirements of this PSHSP and the Project Specific Health and Safety Requirements Matrix (PSHSRM) (Attachment A). All personnel must sign an Acknowledgement Form (Attachment H) stating they have been oriented on the requirements of this plan, understand, and will abide by the provisions of this plan. The form will be controlled by the Health and Safety Officer during the work and then forwarded to Document Control as part of the project files.

1.1 WORK AREA CHARACTERIZATION

Waste Pits 1, 2, and 3 were all lined with clay removed from the Burn Pit and are contained with berms and a soil cap. A map of the DEEP work area is shown in Attachment F.

1.1.1 Waste Pit 1

The majority of materials placed in Waste Pit 1 were dry solids, including general sump sludge, depleted slag, trailer cake, depleted residues, graphite/ceramics, thorium waste, and uranyl ammonium phosphate (UAP) filtrate. Drums, some containing material, are known to be in the pit.

1.1.2 Waste Pit 2

The materials placed in Waste Pit 2 consisted of general sump sludge, depleted slag, trailer cake, UAP filtrate, depleted residues, mixed oxide raffinates and graphite/ceramics.

1.1.3 Waste Pit 3

The materials placed in Waste Pit 3 consisted of general sump sludge, raffinate, trailer cake, slag leach, water treatment sludge, and thorium wastes.

1.1.4 Sampling Data

Air monitoring was conducted during geotechnical soil borings. The monitoring was conducted for volatile organic compounds (VOCs), radon and radionuclides. VOCs detected during the sampling were benzene, toluene and methyl methacrylate. These compounds were found in very low levels.

Radon monitoring results never exceeded 20 pCI/L during geotechnical sampling activities. The radon results from the geotechnical sampling activities were compared with radon levels collected throughout the FEMP site. The comparison showed no additional radon exposer to employees working on the Waste Pits.

1.2 WORK DESCRIPTION

The major tasks to be completed during the performance of DEEP are as follows:

- Site Mobilization - This will involve site preparation, moving on the site, and any work required to start the project.

- Slug testing - Perform at existing wells in Waste Pits 1, 2, and 3 for a total of 9 locations.

- Soil Borings - Eleven borings will be drilled in Waste Pits 1, 2, and 3. They will range from 15 to 35 feet deep. These borings will be for retrieving soil samples using a split barrel sampler.

- Wet Excavations - This involves excavating seven wet trenches and conducting a waste reslurrying and pumping test.

- Waste material removal - Approximately 45 cubic yards (15 cubic yards per pit for Waste Pits 1, 2, and 3) will be excavated and put in metal boxes and stored.

- Waste reslurrying and pumping test - Consists of lowering a slurry pump into an excavation, reslurrying the waste, and pumping it into a holding tank.

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- Dewatering tests - Dewatering wells will be a conventional well point or a drilled and cased well. Two pumping methods will be tested on these wells.

- Dry excavations - A dry trench will be excavated in Waste Pit 1 and a ramp will be excavated into Waste Pit 3. These will be excavated after the waste has been dewatered. The trench in Waste Pit 1 will be completed before the ramp in Waste Pit 3 is started.

- Reclamation - Following completion of each trenching and ramping activities, the waste will be back-filled into the trench. The plastic sheeting used to contain the spoil pile will be disposed of in the trench. The cap material will be replaced on the waste and compacted. The disturbed areas will be regraded and reseeded.

- Equipment decontamination - When salvageable equipment is no longer needed for the DEEP project, any gross decontamination will be removed from the equipment while it is in the field. After the equipment is fully decontaminated, it will be released for off-site use.

- Derived Waste - Material or equipment no longer needed or salvageable will be disposed of properly following site procedures for the waste generated.

2.0 ORGANIZATION STRUCTURE AND KEY PERSONNEL RESPONSIBILITIES

2.1 MANAGER, CONSTRUCTION SAFETY & HEALTH - Daryl Mills.
Responsible for the oversight of activities in construction safety and health. Laurie Hagen is the alternate for Daryl Mills for this project.

2.2 DEEP HEALTH AND SAFETY OFFICER - Mike Davis. Responsible for maintaining DEEP health and safety programs. Acts as the single point of contact for all environmental, safety, industrial hygiene, fire and radiological issues/concerns. Laurie Hagen is the alternate for Mike Davis for this project.

2.3 CRU1 PROJECT DIRECTOR - Robert T. Fellman. Responsible for providing direction toward the development of the PSHSP and for providing signature approval to the final document. William Benson is the alternate for Robert Fellman for this project.

2.4 DEEP PROJECT MANAGER - William M. Benson. Responsible for overall project performance. Reviews project plans, evaluates project against budget and schedule, and coordinates activities with the client. Greg Stephens is the alternate for William Benson for this project.

2.5 DEEP ASSISTANT PROJECT MANAGER - Gregory W. Stephens. Responsible for assisting the project manager with project reviews, budgets, and schedules. Provides technical oversight of field operations and will direct excavation activities. William Benson is the alternate for Greg Stephens for this project.

2.6 FIELD OPERATIONS LEAD - James T. Hey. Coordinates field activities, obtains work permits, and provides oversight of field personnel. Greg Stephens is the alternate for James Hey.

2.7 SUBCONTRACTORS
Subcontractors performing work covered by this PSHSP shall provide the names of individuals who will be assigned the following duties during project work covered by this PSHSP. These names shall be provided to the DEEP project management prior to the start of work.

Subcontractor Project Manager _____

Subcontractor Health and Safety Officer _____

Subcontractor Site Supervisor In Charge _____

A Subcontractor Health and Safety Officer (HSO) shall be named and approved by the FERMCO Health and Safety Officer (HSO) before the start of the project. This person shall be responsible for ensuring the subcontractor's compliance with all health and safety requirements, including those listed in this PSHSP. The Subcontractor HSO shall report all safety concerns and incidents to the FERMCO HSO.

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3.0 SITE CONTROL

3.1 WORK AREA REQUIREMENTS

The following work areas will be established or encountered during the activities associated with DEEP.

3.1.1 Radiological Areas

All drilling and excavations will be performed inside a radiologically Contamination Area. Entrances to and perimeters of radiological areas will be defined by yellow snow fencing. All radiological areas will be identified by sign having the standard radiological symbol, the trifoil, on a yellow background.

The following lists the types of radiological areas to be encountered during performance of activities covered by this PSHSP:

The following areas will be encountered in the performance of the work in or around the Waste Pits:

- Controlled Area
- Radioactive Material Area
- Fixed Contamination Area
- Soil Contamination Area
- Contamination Area

The following areas may be created during excavation or sampling activities in the Waste Pits:

- Airborne Radioactivity Area
- High Contamination Area

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

3.1.2 Exclusion Zones

An exclusion zone is any area, room or enclosure where the activities being conducted present an additional safety hazard and requires additional PPE or training. Exclusion zones will be established

around drill rigs during drilling activities and around all excavations. When an Exclusion Zone contains radiological contamination, the zone will be controlled as a "radiological controlled area".

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4.0 TRAINING

There are three categories of training on site. The type of work to be conducted and the location of the work will determine the category of training the employee requires. Most training requires an annual refresher course.

Training requirements specific to each task to be performed are outlined in the PSHSRM (see Attachment A).

4.1 HAZARD COMMUNICATION

4.1.1 Material Safety Data Sheets

Material Safety Data Sheets (MSDSs) for all products or chemicals to be used on the job by the subcontractor shall be provided to the FERMCO HSO for review prior to the product or chemical arriving on site. The FERMCO HSO will forward the MSDS to FERMCO IH. It is recommended that MSDSs be submitted at least one week prior to planned use.

A complete set of MSDSs for all chemicals used on this project shall be maintained and prominently posted by the subcontractor in a central location on FEMP property.

MSDSs for site materials determined to present a hazard for work covered by this PSHSP are included in Attachment E for use by the subcontractor to comply with the Subcontractor's Written Hazard Communication Program. Additional MSDSs are available through the FERMCO HSO.

4.1.2 Job Briefings/Safety Meetings

A pre-work/kick off safety meeting will be conducted by the FERMCO HSO with the DEEP Project Manager, FERMCO Construction Contracts Manager, Subcontractor Site Supervisor, and Subcontractor Health and Safety Officer. This meeting will satisfy the requirements for the PSHSP safety briefing.

All personnel involved in this project shall be given a PSHSP safety briefing prior to receiving authorization to begin work. This PSHSP safety briefing shall include review of this PSHSP and

PSHSRM. The Subcontractor Health and Safety Officer shall brief his personnel. The FERMCO HSO will conduct the briefing for FERMCO personnel.

As a minimum, safety meetings shall be held weekly. The safety meetings will be conducted by the Field Operations Lead, Subcontractor Health and Safety Officer, or designee. Written documentation detailing the briefings and attendance sheets will be maintained as part of the project. File copies shall be forwarded to the FERMCO HSO for review.

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

4.2 RECORDS

Documentation of training classes, craft/operator certifications, and equipment operator experience records from sources other than the FEMP shall be submitted to the FERMCO HSO for review and approval.

4.3 VISITORS

Anyone accessing the work area with the sole purpose of observation or viewing the activities in progress (hands-off inspection) is considered a "visitor." Visitors cannot operate equipment or oversee/supervise any work activity.

Visitors shall be orientated to the hazards of the site and the control measures through the same means as all other project personnel. Visitors will comply with the training requirements specified for the activities in progress.

Visitors who need to enter a radiologically posted area must have authorization from the Manager of Radiological Control.

Visitors who need to enter the Waste Pit 1, 2, and 3 work area during DEEP activities must have authorization from the FERMCO HSO.

5.0 MEDICAL MONITORING AND SURVEILLANCE

5.1 REQUIREMENTS

All personnel will be required to participate in the FEMP medical monitoring program, except for visitors and vendor services representatives on site for short durations. If examinations are to be conducted by medical personnel other than FEMP personnel, the subcontractor must receive prior authorization relative to protocols and a list of providers from the FEMP Medical Department.

Medical monitoring requirements specific to each task to be performed are included in Attachment A.

5.1.1 Bioassay Requirements

Personnel who must enter the work area for DEEP are required to participate in the FEMP bioassay program.

The following outlines the bioassay requirements for this project action.

- Baseline urine samples will be required for all subcontractors and other support personnel who are not active participants in the FEMP bioassay program.
- Baseline fecal sampling is required for all project personnel who must access the posted Contamination/Airborne Radioactivity Area at Waste Pits 1, 2 and 3.
- Follow-up fecal samples from all field personnel will be required for radiological incidents involving personnel contaminations, or when radiological conditions indicate a potential for inhalation or ingestion of thorium-bearing residues.
- All personnel will be required to participate in the periodic urine sampling program, submit incident urine samples, and report to the In-vivo facility for whole-body counting when directed by the Medical Department and/or Radiological Control personnel.
- All participants will submit a final "completion of campaign" urine sample after the project is finished.
- Incident initial (end of shift) and post (start of next shift) urine samples will be required upon the occurrence of any airborne or personnel contamination event.
- If any confirmed positive results occur, a 24-hour follow-up sample will be initiated by Dosimetry for the affected individual.

5.2 RECORDS

The FERMCO Medical Services Department shall maintain a copy of all medical records.

6.0 HAZARD ASSESSMENT

This section addresses the potential health, safety, and environmental hazards associated with the conduct of the activities covered by this PSHSP.

Potential hazards to workers may originate form the chemical, physical, radiological, and safety hazards present in the project area.

6.1 RADIOLOGICAL ISSUES

Radiological analyses of the Wastes Pits indicate that the following radioisotopes are of primary concern:

- Uranium and its daughters
- Thorium 230 (limiting isotope)
- Radon

Uranium is a radioactive material, and in its soluble forms, is highly toxic to the kidneys. Soluble uranium compounds such as uranyl nitrate, uranyl fluoride and uranyl acetate are absorbed through the skin. Non-soluble forms of uranium, such as uranium octaoxide (black oxide), uranium dioxide (brown oxide), uranium tetrafluoride (green salt), and uranium trioxide (orange oxide) are not absorbed through the skin, but constitute a radioactive inhalation hazard to the lungs. Most of the uranium compounds found in the Waste Pits 1, 2, and 3 are of the non-soluble type.

Thorium is also a radioactive material which was deposited in the Waste Pits as mixed oxide (cold) raffinates. These raffinates are residues of the refinery processes and contain high levels of Thorium-230. Thorium-230 is the main isotope of concern because of the fact that it is much more hazardous than Uranium (internally).

Radon is a colorless, odorless, and very dense gas. It is formed during the uranium and thorium decay chain. Radon is inhalation hazard because it decays by alpha emissions. Radon deposited in human lungs and has been linked to increased incidence of lung cancers.

6.2 INDUSTRIAL HYGIENE ISSUES

There are two types of chemical hazards associated with the Waste Pits: metals (particulates) and volatile organic compounds (VOCs). These chemical hazards are discussed below.

6.2.1 Metals / nuisance particulates

Inhalation and ingestion are the primary routes entry for metals and nuisance particulates. The material in the Waste Pits is know to be saturated with water (sludge). As long as the Waste Pit material is not allowed to dry, inhalation is not a concern. Ingestion of pit material is the primary concern. A description of the known metals and their effects on humans are discussed below.

6.2.1.1 Nuisance Particulates

Nuisance particulates are inert dusts considered to be relatively harmless unless exposure is severe; therefore, nuisance particulates are not regulated by their chemical composition. Excessive exposure to even low toxicity dusts may cause skin, eye and upper respiratory tract irritation.

6.2.1.2 Arsenic, Inorganic

Arsenic is a shell gray metal in its pure form. It is a human carcinogen and an acutely toxic poison if ingested. Soluble trivalent forms, such as arsenic trioxide, may cause skin and mucous membrane irritation. Acute inhalation effects are rare and chiefly inflammation. Chronic inhalation effects may include perforation of the nasal septum, weight loss, nausea, diarrhea, hair loss, skin discoloration/lesions, and loss of sensation from peripheral nerves.

6.2.1.3 Barium, Soluble

Barium is a silver-white malleable metal in its pure form. Alkaline barium compounds may cause local irritation to the eyes, nose, throat and skin. Barium presents a hazard when ingested or inhaled. Acute exposure symptoms may include vomiting, diarrhea, irregular pulse and muscular paralysis. Chronic exposure to barium sulfate may lead to a benign pneumoconiosis.

6.2.1.4 Beryllium

Beryllium in its pure form is a gray metal. Beryllium is a suspected human carcinogen. Acute inhalation exposure may cause a nonproductive cough, shortness of breath and some weight loss. Chronic inhalation exposure may lead to respiratory symptoms, weakness, fatigue and weight loss.

6.2.1.5 Cobalt

Cobalt is a silver-gray, hard, brittle, magnetic metal. Cobalt is mildly irritating to the eyes and skin. Inhalation of cobalt may cause an asthma-like disease with cough and dyspnea. Vomiting, diarrhea and a sensation of hotness may occur after ingestion or inhalation of excessive amounts of cobalt.

6.2.1.6 Lead, Inorganic

Lead is a bluish-gray metal when pure and may be brightly colored yellow or orange when present in its various oxides. Lead is a toxin to the blood-forming organs. Early symptoms of exposure may include loss of appetite, insomnia, irritability and muscle/joint pains, followed by anemia. Lead is also listed a possible human carcinogen of the lungs and kidneys. Routes of entry are inhalation and ingestion.

6.2.2 Organic Vapors

Low levels of various classes of organic compounds were identified during analysis of pit material. Identified compounds include: chlorinated solvents, aromatics, ethers, ester and alcohols. Sampling conducted during geotechnical boring in the Waste Pits identified the following volatile organic compounds in low levels.

6.2.1.1 Volatile Organic Compounds

Volatile organic compounds are organic chemicals that readily change from a liquid form to a vapor. Organic compounds are a health concern, because they are absorbed by the body and may cause tissue damage. The hazard associated with organic compounds varies based on the type of compound, the level of exposure, the length of exposure and the health of the exposed worker.

6.2.2.2 Benzene

Benzene is a clear, colorless liquid with a solvent odor. It is a confirmed human carcinogen causing leukemia, Hodgkin's disease and lymphomas. It causes sever eye and moderate skin irritation. Exposure to benzene is mostly through inhalation. Acute exposure causes confusion, dizziness pressure over the forehead and tightening of leg muscles.

6.2.2.3 Methyl Methacrylate

Methyl methacrylate is a colorless liquid. It is moderately toxic by inhalation and causes sleep effects, excitement, decrease in blood pressure. It is a very dangerous fire hazard when exposed to heat or flame. It has an LEL of 2.1%.

6.2.2.4 Toluene

Toluene is a colorless liquid with a benzene like odor. It is a poison by inhalation and causes hallucinations, motor activity changes. It is a very dangerous fire hazard when exposed to heat or flame. It has an LEL of 1.27%.

6.2.3 Biological Hazards

Employees must take precautions when near or handling any biological hazard (plant or animal life hazard). Additionally, the following safety precautions should be observed:

- Avoid contact with poison ivy and poison oak
- Be on the lookout for bees' nests and snakes when working in or near wooded areas or tall grass.
- During the summer, persons working in high weeds or brush must watch for ticks on their skin and clothing. Wear long sleeve shirts and pants taped at the ankles.
- Check body and clothing for possible ticks and remove them before they have a chance to bite. (Persons with a tick fastened to the skin must remove the tick to a glass jar and take it and themselves to the Medical Department for observation.

6.2.4 Temperature Extremes

6.2.4.1 Heat Stress

Heat stress may affect personnel performing activities with or without protective clothing when working in high ambient temperatures. Plenty of water, use of cooling devices, rest breaks and careful attention by the supervisor shall be used as control measures. Personnel shall become aware of symptoms of heat stress and be able to recognize these symptoms in oneself and in other workers. Symptoms of heat stress include: muscle cramps, fatigue, weakness, loss of coordination, nausea and in the later stages, hot dry skin (absence of sweating), delirium and seizures.

The FERMCO HSO, Subcontractor Health and Safety Officer or their designee shall review heat stress recognition and prevention at a regularly scheduled safety meeting.

When ambient temperatures exceed 80°F, FERMCO IH shall be contacted to review and/or add control measures to minimize heat stress (i.e., cool vests).

6.2.4.2 Cold Stress

Tasks may be conducted when temperatures could present a potential cold stress hazard. Personnel shall become aware of symptoms of cold stress and be able to recognize these symptoms in oneself and in other workers. The FERMCO HSO, Subcontractor Health and Safety Officer, or their designee, shall review the recognition and prevention of cold stress at a regularly scheduled safety meeting. A cold weather safety briefing will be required of all workers on this project.

During cold weather, special care should be taken to dress appropriately for anticipated weather conditions. Specific attention will be given to the hands and feet to prevent frostbite. Medicated skin lotions are provided in all restrooms at the FEMP and should be applied to face and hands to reduce changes of windburn and frostbite. Chap-stick or protective creams should be applied to lips to avoid chapping. When equivalent chill temperature drops below 0^0 F, FERMCO IH shall be contacted to review and/or add control measures to minimize cold stress.

6.3 SAFETY ISSUES

Safety is a top priority at the FEMP; accordingly, all employees are advised of their rights and responsibilities under the U.S. Department of Energy (DOE) Order 5483.1A and the Occupational Safety and Health Act. These rights and responsibilities are included as Attachment G.

6.3.1 Physical Hazards

6.3.1.1 Noise

Personnel in areas where noise levels exceed 85 dBA are required to utilize hearing protection provided by their supervisor.

Noise levels exceeding 85 dBA may be created during operation of heavy equipment and portable power tools. If workers have to raise their voice to be heard, noise levels may have exceeded 85 dBA level.

6.3.1.2 Lifting

All personnel should know their lifting limits and the proper way(s) to lift. The object to be lifted should be limited by factors such as the route and distance to be traveled, the amount of time required and the center of gravity necessary to handle the load safely.

A worker shall not lift more than 50 pounds without assistance from another person or mechanical help.

6.3.1.3 Equipment Operation Safety

The use of heavy equipment (drilling rig, backhoe, front end loader) on the Waste Pits may cause a possible sinking hazard due to the soft sub-surface conditions. A pre-placement inspection along the anticipated route of travel shall be performed prior to movement to locate soft areas. Vehicles are to be watched during moves for excessive sinking into the pit surface is noted, operators will be instructed to back off and re-evaluate the situation. It may be necessary to use a material such as "Unimat," timbers, or other similar material.

Follow these basic safety practices when working around heavy equipment.

- Minimize personnel working around operating heavy equipment.
- All mobile equipment shall be supplied with an electronic back-up alarm.
- All operators will be qualified to operate their machines.
- Equipment will be inspected at the beginning of each shift, prior to use, and the inspection results will be recorded on a daily check sheet to ensure that all safety equipment and devices are fully operational.

6.3.1.4 Drilling and Boring Operations

All drilling equipment shall be inspected by the Safety and Fire Technicians prior to being allowed on site. Damaged, defective, or out of compliance equipment must be repaired or replaced. No

personnel shall climb more than six feet above ground level on the drill mast unless they are protected by a body harness and lanyard, and are tied off on a structural member of the rig above their head.

A minimum of two people shall be present at the drill rig during all operations. Before starting daily drilling operations the drilling crew shall perform an equipment safety inspection which shall include testing of the drilling kill switch for proper operation. A minimum of five feet shall be maintained on all sides of the drilling equipment for emergency access.

6.3.1.5 Excavation Activities

Due to the inherent instability of land fills and given the wide variety of buried waste, special consideration must be given to operations requiring excavations in the Waste Pits. The possibility of encountering soft, unstable contents is high; therefore, certain precautions must be taken. No personnel shall be allowed closer than 10 feet to the trench/excavation edge unless they are adequately tied off or positioned on a boom-type manlift. Under no circumstances, will personnel be allowed to enter a trench or excavation.

Vibration of support equipment (portable lighting, generators) could contribute to the collapse of pit walls. Location of this equipment is to be kept at least 10 feet away from the trench walls.

Although calculations show that the 10 foot limit is well out of the possible ranges of soil movement should the soil collapse into the trench, the project manager, supervisors, operators, as well as all observers shall, when approaching a trench, be alert and on guard for possible pending failure of the trench walls. Imminent failure may be preceded by increasing number, propagation and widening of tension cracks at the surface; these cracks running more or less parallel to the trench. Imminent failure may also be indicated by accelerating rate of falling or dribbling debris from the inside trench walls, indicating movement of the adjoining soil mass into the trench.

6.3.1.6 Electrical Power

All electrical generators shall be grounded as per the manufacturers' recommendations.

Ground fault circuit interrupters (GFCIs) are required on all 120V, 15 and 20 Amp services. The GFCI shall be placed at the source of the electrical power to protect both the cord and the equipment connected.

All temporary wiring and lighting shall conform to site policy.

All flexible cords (extension cords) shall be approved (UL listed) cord sets and be of a type rated for hard usage and damp locations. Only purchased cord assemblies will be permitted. No field repair of cords is permitted. All cords shall be protected from damage by vehicles and equipment.

No work shall be permitted within ten (10) feet of any live exposed electrical device, unless a written work plan is approved by the FERMCO HSO or the personnel involved are electrically qualified for such work.

6.3.1.7 Sanitation

An adequate supply of potable water shall be provided on the site. The containers used to dispense drinking water shall be capable of being tightly closed and equipped with a tap. Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not for any other purpose. All drinking water locations within a radiological controlled area shall be reviewed by FERMCO Radiological Control and IH personnel prior to use.

Personnel shall be provided adequate access to toilet facilities. Adequate washing facilities shall be provided to employees engaged in operations where hazardous substances are encountered. There shall be made available an adequate emergency eyewash station near the work area.

6.3.1.8 Power Tools

- Proper eye and face protection shall be provided and worn while using all hand and power tools.
- The proper strength tool will be used as specified for each job.
- Tools and machines will be disconnected from their power source before making adjustments or attachment changes.

- Guards or safety devices will not be removed. Ensure that blade guards are in place and working properly.
- All fuel-powered tools will be shut off before refueling.
- Air-powered tools must have safety clips or retainers on all hose connections.
- Manufacturer's safe operating pressures will not be exceeded for any fittings.
- All portable electrically-connected power equipment shall be protected by ground fault circuit interrupters (GFCI).
- All tools shall be inspected by supervision before using. Defective tools will not be used.

6.3.1.9 Illumination

Activity work areas shall be lighted to not less than five (5) foot candles per ft^2.

6.3.1.10 Hand Tools

- Proper eye and face protection shall be provided and worn while using all hand tools.
- All tools shall be inspected by supervision before using. Defective tools will not be used.
- Only tools designed for the application in mind will be used. The proper strength tool will be used as specified for each job. The use of handle extensions or cheater bars is prohibited.

6.3.1.11 Lock and Tag (Energy Control)

Energized systems must be locked and tagged out prior to working on the system. Systems requiring lock and tag are electrical, steam, air, fire protection, process and non-process systems. Personnel working in the energy path shall be trained per FERMCO SSOP-0719 and install their own lock and tag at each lockout/tagout location. An energy isolation plan (EIP) may be required for work on energized systems. EIPs shall be submitted to CRU1 safety for review and approval.

6.3.1.12 Slips, Trips and Falls Cold Weather

Prevent slips, trips, and falls in cold weather by wearing snowboots or cleats. Clean and deice work areas of snow and ice when feasible.

6.3.2 Fire Protection

Drill holes and excavations will be monitored by FERMCO for volatile compounds. Should an explosive atmosphere be detected all work will stop and FERMCO ERT contacted.

Storage, use or transfer of flammable and/or combustible liquids shall be in accordance with NFPA 30, Flammable and Combustible Code, or approved by FERMCO Fire Protection. Flammable or combustible liquids with a flash point of 140° F. or less (i.e., gasoline, diesel fuel, solvents, etc.) shall be handled in Factory Mutual Approved safety cans with operable flame arrester and self-closing lid(s). All safety cans shall be properly marked with the name of the liquid contents. A label identifying the hazard of the material shall be affixed to the container.

Not more than 25 gallons of flammable/combustible liquid shall be stored in a room outside of an approved storage cabinet.

Flammable liquids shall be kept in closed containers when not actually in use.

6.3.3 DRUM AND CYLINDER HANDLING

The potential exist that intact containers (drums, cylinders) will be found during excavation of the Waste Pits. Should this occur, the Field Operations Lead and the FERMCO HSO shall be contacted. Unless orientation of the container does not allow safe removal, the container will be removed from the excavation and over-packed.

6.4 NUCLEAR SAFETY

No criticality safety concerns exist with disturbance of the pit material because of the low uranium concentration in the Waste Pits.

For pumping activities, it is not credible that water removed from these pits during the dewatering activities could contain enough U235 to cause an inadvertent nuclear criticality during precipitation of the heavy metals prior to processing the water.

The gravitational settling done as part of the waste reslurry and pumping test may lead to an increase in concentration of uranium in the settled sludge. Sludge samples will be collected from the tank and analyzed for uranium to determine if a hazard exist.

7.0 HAZARD CONTROL

7.1 ADMINISTRATIVE/ENGINEERING CONTROLS

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

- Containment of radiologically contaminated equipment
- Control of trench exposures by use of manlift and distance limitations.
- Control of environmental insults by the use of wetting agents, tamps, drainage control and area monitoring.

The following administrative controls shall be used to control physical, chemical and radiological hazards during project activities:

- PSHSP for CRU1 DEEP
- FERMCO Work Permits.
- Subcontractor's Hazard Communication Program.
- FERMCO Auditable Safety Record
- FERMCO Integrated Preliminary Hazard Assessment

7.2 PERSONAL PROTECTIVE EQUIPMENT/RESPIRATORY PROTECTION

The level of personal protective equipment (PPE) and respiratory protection to be worn by field personnel involved with task activities is defined on an activity basis in Attachment A. When the PPE required by the matrix states that anti-Cs are required for work in contamination areas, anti-Cs include: disposable protective clothing with booties, shoe covers and hood for dry work, disposable water resistant protective clothing with shoe covers and hood (i.e., Durafab Comfort Guard 200, Frham Cool Suit or other approved materials) for wet work conditions, latex rubber shoe covers worn over disposable shoe covers and latex or vinyl surgical gloves. Wrists and ankles shall be taped. The Field Operations Lead or when applicable the subcontractor Health and Safety Officer will be responsible for ensuring that all personnel are wearing the required PPE as specified by this PSHSP.

Modification to the protective equipment ensembles may be necessary for specific operations or when unexpected conditions arise. In these cases, changes will be made based on review of specific hazards, weather, work conditions, operating requirements and air monitoring at the work area.

The up-grading of respiratory protection and PPE may be done by the FERMCO HSO. The down-grading of respiratory protection and PPE can be done by the FERMCO HSO only after consulting with the Subject Matter Expert (IH or Radiological Engineering) for the hazard being controlled. With the written approval of the FERMCO HSO, substitution of some PPE items may be appropriate.

8.0 DECONTAMINATION

8.1 SITE DECONTAMINATION REQUIREMENTS

Tools, materials, or equipment that becomes contaminated, either radiologically or chemically, will be decontaminated by the subcontractor. FERMCO will provide instructions for decontamination which may consist of steam cleaning, dry brushing or washing with appropriate liquids.

Area decontamination of chemical and radioactive materials should be done with a combination of scraping to remove the gross contamination at the control point to Waste Pits 1, 2 and 3, and the pressure spraying of the heavy equipment at the Waste Pit 6 concrete decontamination pad. After all visible contamination is removed, the equipment will be transferred to the FEMP Decontamination Facility for final cleaning and swipe survey for free release. Gross contamination will be removed from small items such as tools, pumps, etc., and they will be wrapped in plastic for transfer to the Decontamination Facility for final cleaning and survey for release.

8.1.1 Personal Decontamination Requirements

Upon leaving the work area, workers will be instructed by the Radiological Control Technicians (RCTs) and/or Industrial Hygiene (IH) technicians on how to frisk, in which containers to place disposable and launderable PPE, and what to do if personal radioactive contamination is detected.

Personal contamination on the skin, or on the inner personal company-issued clothing, shall require contact with Radiological Control Technician immediately. Detection of a count rate above background with an appropriate field portable monitoring instrument "frisker" should alert personnel of possible contamination.

Contaminated personnel may have to initiate a bioassay analysis for assessing internal radiation dose from possible inhalation, ingestion, or absorption of radioactive materials. The need to initiate a bioassay analysis and the scope of the analysis, will be determined by the FERMCO HSO with input from Radiological Engineering.

8.1.2 Equipment Decontamination Requirements

Equipment for the decontamination of radiological hazards shall be kept available in the area surrounding the controlled areas (Contamination Reduction Zone). Equipment must be monitored by a RCT prior to its removal from a radiologically controlled area.

Thorium-230 is a pure alpha particle emitter; therefore, each piece of equipment must be smeared and counted on a special instrument before it can be "free released."

8.2 CHEMICAL DECONTAMINATION REQUIREMENTS

In case of body contact with a hazardous material, nonpermeable PPE should be doffed with extreme caution to prevent cross contamination of the skin. Contaminated inner clothing shall be removed and the affected body area shall be washed thoroughly (15 minutes minimum) in a safety shower or eye bubbler provided by the subcontractor. Involved personnel shall report immediately to Medical Services or summon aid (phone 738-6511 or radio Control) as needed. Notification shall be made to the appropriate supervisor as soon as possible.

Questions concerning chemical contamination and potential exposure should be directed to FERMCO Industrial Hygiene at 738-6207.

9.0 EMERGENCY/CONTINGENCY PLANS

9.1 REPORTING

9.1.1 EMERGENCY NUMBERS- ON-SITE EMERGENCIES

NAME	FEMP TELEPHONE NO.	RADIO	
		Construction	Site
Ambulance	738-6511	Control Ch7	Control
Hospital			
Fire			
Security			
Emergency Response			
Assistant Emergency Duty Officer (AEDO)	738-6295/6431	Control Ch7	Control
Accountability Center	738-6202	517	Control

9.1.2 SITE NOTIFICATION PROCEDURES

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

- Phone - 738-6511
- Radio to "Control"

Any injury, no matter how minor, shall be reported to Medical Department for evaluation and treatment. The injured employee shall be accompanied to the Medical Department by the supervisor in charge or designee. The CRU1 Project Director and the FERMCO HSO shall be notified as soon as possible after the injury has occurred.

Employees working on-site will be notified of emergency conditions by the plantwide alarm system and by radio announcements. This announcement follows the sounding of the site alarm horn signal, 3-3.

9.1.3 What to Report

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

- Serious Injury
- Injury Complicated by Contamination
- Chemical/Radiation Release
- Chemical Splash (Eye and Skin)
- Any Fire
- Major Property Damage
- Unusual Occurrence(s)

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

The following information must be given to the Communication Center operator:

- Name
- Badge number
- Location where emergency has occurred
- Nature of the emergency
- Unusual conditions (smoke, vapors, odors)
- Current status of the emergency

9.2 EVACUATION ROUTES/ACCOUNTABILITY

9.2.1 Rally Point Accountability

Should a situation require an emergency evacuation of the work area, all equipment should be turned off (if possible) and left in place. On-site personnel should immediately proceed to the nearest established Rally Point (Rally Point #6 for waste pit area) as identified on the map found in Attachment C.

9.2.2 In-Place Accountability

When In-Place Accountability is required, an employee shall contact their supervisor and report their current position. The supervisor in charge or Subcontractor Health and Safety Officer shall report the names of any unaccounted personnel to Construction Management within 10 minutes.

9.3 EMERGENCY EQUIPMENT

9.3.1 FEMP Site Equipment

The Medical Department is staffed and equipped to handle most types of medical emergencies that would occur during a task. The medical facility is staffed with Emergency Medical Technicians (EMTs) and is equipped with an ambulance to transport the injured person to the nearest off-site hospital should extended or specialized treatment be necessary.

The Medical Department is located at the east end of the first floor of the ES&H Building (Building 53). The location of the Medical Department and the most direct path to the facility from the work area can be seen in Attachment D.

9.4 EMERGENCY RESPONSE

The Emergency Response Team (ERT) will handle all on-site emergencies. Any request for emergency help should be requested by telephone (738-)6511 or on any radio frequency by calling "CONTROL."

9.4.1 Medical Emergencies

The Medical Department and emergency site ambulance shall serve as the first-aid person, as they can respond within 3-4 minutes to site emergencies. The subcontractor may also have a trained first-aid person at the worksite.

9.4.2 Fire Emergencies

During drilling or excavation in the Waste Pits, the potential exist that adverse chemical reactions could occur (i.e., fumes, smoke, fire, etc.). Should this occur, the operator will, backfill the excavation to stop the reaction. If the operator judges that s/he is in imminent danger from fumes, smoke, or spreading fire, s/he shall immediately vacate the equipment.

In either case, the operator shall proceed to notify both the subcontractor Health and Safety representative or Field Operations Lead, and the FERMCO HSO. The FERMCO HSO will contact the Assistant Emergency Duty Officer (AEDO) and Emergency Response Team (ERT) (if necessary). Re-entry requirements will be determined by a joint decision of the CRU1 Project Director and Health and Safety representatives.

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

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

The Emergency Response Team (ERT) will also respond to all on-site fire emergencies. For any fire emergency at FEMP, call (738-)6511.

9.4.3 Explosion Emergency

When an explosion has occurred the following actions are to be taken:

- Evacuate work area
- Proceed to the nearest rally point
- If qualified, render first aid to any injured personnel
- Instruct all persons in transit to avoid the work area and surrounding area
- Contact CONTROL by radio or phone (6511)
- Call for medical assistance if necessary
- Report to supervisor for accountability

9.4.4 Chemical Emergency

9.4.4.1 Splashes

Flush the affected area with clean water for 15 minutes. Report to FERMCO Medical Services.

9.4.4.2 Personal Contamination

When contaminated with a corrosive or caustic material, flush the affected area with clean water for 15 minutes. Report to the Medical Department.

All instances of personnel chemical contamination shall be reported to Industrial Hygiene, the FERMCO HSO, Field Operations Lead and the AEDO.

9.4.5 Radiological Emergencies

9.4.5.1 Releases

Evacuate the release area. The supervisor in charge, AEDO, Radiological Control Technicians, and FERMCO HSO shall be notified of the release.

9.4.5.2 Personal Contamination

Contamination should be avoided where possible by making minimum contact with the contaminant. All instances of personnel radiological contamination must be reported to Radiological Control, FERMCO HSO, Field Operations Lead and the AEDO.

9.4.6 Weather Limitations/Adverse Conditions

9.4.6 Weather Limitations/Adverse Conditions

Any outside work will be suspended if warnings for high winds, lightning or tornados are sounded. Any operations utilizing cranes, drill rigs or personnel working on elevated steel type work will be suspended if wind velocity reaches 30 MPH.

9.4.7 Accident Investigation

Any injury or accident shall require the supervisor to complete an accident report. For injuries and illness, a "Supervisors Report of Injury" shall be completed within 24 hours of the event and forwarded to the Medical Department services and to the Construction Contract Manager. Should a serious accident/injury occur, the involved area should not be disturbed until approved by the FERMCO HSO.

10.0 CHANGES TO THE PSHSP

This PSHSP for CRU1 DEWATERING EXCAVATION EVALUATION PROGRAM is based on information available at the time of preparation. It is important that this plan be routinely reassessed by supervision, project management and the FERMCO HSO.

Unexpected conditions/events may arise which require reassessment of the health and safety issues. The up-grading of respiratory protection and PPE may be done by the FERMCO HSO. The down-grading of respiratory protection and PPE can be done by the FERMCO HSO only after consulting with the Subject Matter Expert (IH and Rad Engineering) for the hazard being controlled. Amendments to this plan are not required for such changes in activity; however, written documentation of the change must be made for approval by the FERMCO HSO.

Unplanned operations and/or changes in work scope shall require a review and may require an amendment to the PSHSP. All amendments are to be reviewed by the CRU1 Construction Manager and must be approved by the CRU1 Director, FERMCO HSO and the Manager, Occupational Safety and Health Compliance.

10.1 CONTROL OF HEALTH & SAFETY PLAN

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

CRU1 Project Director, Robert T. Fellman
FERMCO Health and Safety Officer, Michael S. Davis
DEEP Project Manager, William M. Benson
Industrial Hygiene, Dave Jackson
Industrial Hygiene Technicians, Jack Patrick
Medical Department, Doran Christensen
Fire Protection Manager, Steve Wentzel
Radiological Permitting, Judy Hitt

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

10.2 REVIEW OF CONTENTS

This Project Specific Health and Safety Plan will be reviewed on a quarterly basis, as a minimum, by the FERMCO HSO for currency and applicability to job tasks. Required revisions (only affected pages) will be submitted to ES&H Document Control for update and distribution.

ATTACHMENT A
PROJECT SPECIFIC HEALTH AND SAFETY REQUIREMENTS MATRIX

HEALTH AND SAFETY REQUIREMENTS MATRIX

Project: OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP)

The requirements listed in Section 1.0 of this matrix apply to all activities addressed on this matrix

ACTIVITY (TASKS)	HAZARD IDENTIFICATION	FREQUENCY AND TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONNEL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING AND SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE AND ENGINEERING CONTROL MEASURES	PERMITS	DECONTAMINATION AND DISPOSAL PROCEDURE
1. GENERAL PROJECT MINIMUM REQUIREMENTS A. ACCESS WASTE PITS 1, 2 AND 3 NOTE: THESE GENERAL REQUIREMENTS APPLY TO ALL SECTIONS OF THIS MATRIX.	• Personal injury • Uranium contamination • Thorium contamination Not all hazards are specified on this matrix	• Thermoluminescent Dosimeter (TLD)	The minimum protection required • Safety glasses with rigid side shields (ANSI Z87.1 listed) • Steel toed, leather safety shoes (ANSI Z41 listed) • Smock • Boot covers • Disposable gloves	• Site GET • Site Worker • Rad Worker II • 24 Hrs. Supervised Field Experience • 8 Hr. Supervisor's Training for supervisors • OSHA Out Reach training for supervisors • Respirator training and fit test • Orientation of PSHSP and Requirements Matrix • Orientation on Project Specific MSDSs	• Medical surveillance exam: baseline, annual and termination • Initial, annual and termination in-vivo exam (whole body count) • Initial, every 60 days, and termination urinalysis. • Initial fecal sample	• Personnel shall be required to attend a pre-work kickoff/safety meeting, including a complete review of the PSHSP and this matrix.	FERMCO Work Permit General area Radiological Work Permit (RWP)	• Personnel and material monitoring required to exit Contamination area • FERMCO supplies bags and containers for disposition of contaminated waste
B. ACCESS TO WASTE PITS 1, 2 AND 3 DURING WORK ACTIVITIES NOTE: THESE GENERAL REQUIREMENTS APPLY TO ALL SECTIONS OF THIS MATRIX.	• Airborne radiological hazard (uranium, thorium)	• General Area and breathing zone air sampling (Rad Con)	• FERMCO issued clothing • Anti-Cs for wet or dry. Taped to prevent loose fitting • Full face respirator with combination cartridge (magenta and yellow) • Disposable boot covers and rubber shoe covers • Hood • Surgical gloves					• Shower at lunchtime and end of day
	• Exposure to heavy metals (arsenic, barium, beryllium, cobalt, lead)	• Personal and area sampling will be conducted by FERMCO IH if material found in dry condition.						
	• Exposure to volatile organic compounds (benzene, toluene and methyl methacrylate)	• Personal air sampling by FERMCO IH						

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HEALTH AND SAFETY REQUIREMENTS MATRIX

Project: OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP)

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B. ACCESS TO WASTE PITS 1, 2 AND 3 DURING WORK ACTIVITIES (continued) NOTE: THESE GENERAL REQUIREMENTS APPLY TO ALL SECTIONS OF THIS MATRIX.	• Heat stress	• Contact FERMCO IH when ambient temperature reaches 80°F • Physiological monitoring of workers	• Cool (ice) vest	• Hot Weather Safety Briefing	• Medically approved to work in high heat areas	• Work/rest regimen • Drinking water supply at work site (approval required by FERMCO IH and Red Engineering)		
	• Cold stress	• Contact FERMCO IH when ambient temperature reaches 0°F	• Medicated skin barrier creams for skin and lips	• Cold Weather Safety Briefing		• Work/rest regimen • Heated break areas • Change out of wet gloves or clothe		
	• Biological hazards (ticks, chiggers, poison ivy)				• Notify medical of sensitivity to insect bites • Report stings and bites to FERMCO medical	• Keep grass mowed • Insect repellent • Tape openings of pants and shirt		
	• Exposure to radon	• FERMCO has conducted monitoring in the area and results are well below exposure limits • FERMCO will conduct monitoring during excavations				• Monitoring station has visible alarm (yellow flashing light) if activated leave area and contact CRU1 HSM of Project Supervisor		

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B. ACCESS TO WASTE PITS 1, 2 AND 3 DURING WORK ACTIVITIES (continued) NOTE: THESE GENERAL REQUIREMENTS APPLY TO ALL SECTIONS OF THIS MATRIX.	• Working in a remote location			• All personnel shall know the cel 738-6511 or "Control" on the radio for emergency assistance		• Radio communication or cellular phone available at all times during work hours • Buddy system • Personnel notified of emergency conditions by plant alarm system and radio announcements		
	• Night work	• FERMCO IH will measure light levels				• Provide adequate auxiliary lighting		
	• Use of portable generators and gas powered equipment			• Operator familiar with owners manual		• Use GFCI on all electrical systems • Refuel only when cool • Fire extinguisher in area		
2. SITE MOBILIZATION A. OPERATION of HEAVY EQUIPMENT	• Driving on Waste Pits (sinking into pit)			• Qualified operator		• Pre survey of route to be driven • Spotter • Use of Unimat		
	• Personal injury					• Back up alarm		
B. SET UP OF WORK AREA	• Personal injury		• Leather gloves			• Personnel shall not lift more than 50 lbs. without assistance		
3. SLUG TESTING AND SOIL BORINGS	• Rotating equipment / drill rig		• Leather gloves • Hard hat	• Qualified operator		• Machine guards in place • Kill switch • Daily inspection of drill rig	Penetration Permit	

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HEALTH AND SAFETY REQUIREMENTS MATRIX

Project: OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP)

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3. SLUG TESTING AND SOIL BORINGS (continued)	• Elevated noise levels		• Hearing Protection	• Workers exposed to noise levels greater than 85 dBA 8 Hr TWA shall have hearing conservation training	• Workers exposed to noise levels greater than 85 dBA 8 Hr TWA shall be in Hearing Conservation Program	• Post areas where hearing protection required		
	• Sealing soil samples (melting paraffine)		• Leather gloves	• Fire watch person shall be trained for duty		• Fire extinguisher • Fire watch shall ensure the area is free of fire hazard	Flame Permit	
4. DEWATERING WELL INSTALLATION A. DRILLING	• Moving parts: personal injury		• Leather palm gloves • Hard Hat within exclusion zone	• Qualified operator		• Kill switch on drill rig • Pre start up equipment inspection • All manufacture's guards in place • Authorized personnel in exclusion zone (drillers, safety personnel, sampling personnel)		
B. WELL INSTALLATION	• Elevated loads			• Qualified operator		• Restricted access to exclusion zone		
	• Grouting (Volclay grout)			• Review of MSDS				
	• Manual lifting					• Personnel not to lift more than 50 lbs without assistance		

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HEALTH AND SAFETY REQUIREMENTS MATRIX

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4. DEWATERING WELL INSTALLATION (continued) C. REMOVAL OF PUMPS	• Electrical shock			• Energy Control or Lock and Tag training for all personnel involved in energy control (4 hr)		• Lock and tag all energy sources that personnel will be working in the path of energy		
5. RESLURRY and PUMP TEST	• Leaks in piping					• Test piping prior to use		
	• Elevated loads					• No personnel under elevated load		
	• Use of electric pumps					• Inspect electrical cords before use • Flag electrical cord location • Use GFCI		
	• Transport of water from pits to Plant 8 (spills)			• Employees trained on piping system		• Stop spill if feasible • Contact AEDO and CRU1 project personnel • Placard truck		
	• Work near open trench		• Safety harness and retrictible life line			• Barricade area (10 feet on each side of trench) • No personnel inside of barricaded area unless safety harness with retrictible life line is used		

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6. EXCAVATIONS	• Operation of heavy equipment			• Qualified operator		• Back up alarm • Daily safety inspection • Barricade swing radius • Use of seat belts		
	• Trench collapse					• Barricade area (10 feet of each side of trench) • No vibrating equipment located within 10 ft of trench (generators, light towers) • No personnel inside of barricaded area		
	• Operation/use of man lift to observe trench		• Safety harness and lanyard	• Qualified operator		• 100 % tie off in manlift • Inspection of harness and lanyard before use		
	• Elevated noise levels	• FERMCO IH will conducted monitoring as required	• Hearing Protection	• Workers exposed to noise levels greater than 85 dBA 8 Hr TWA shall have hearing conservation training	• Workers exposed to noise levels greater than 85 dBA 8 Hr TWA shall be in Hearing Conservation Program	• Post areas where noise levels are 85 dBA or greater		
	• Unearth derby or ingot					• Put in waste stockpile and cover with pit material. Return to pit when close trench • Inform project management of finding		

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HEALTH AND SAFETY REQUIREMENTS MATRIX

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6. EXCAVATIONS (continued)	• Unearth intact drum					• Leave drum in place and contact project management.		
	• Unearth intact cylinder					• Contact project management and AEDO.		
	• Adverse chemical reaction or fire in trench					• Backfill trench if no imminent danger. • If imminent danger alert affected personnel and leave area • Contact AEDO and CRU1 Project Management.		
	• Use of surfactant	• FERMCO may conduct exposure monitoring based on material used		• Review MSDS • Operatro trained in operation of Hydro-seeder		• FERMCO CRU1 HSM review of MSDS • Contact CRU1 HSM prior to use of material		
7. RECLAMATION	• Operation of heavy equipment			• Qualified operator		• Back up alarm • Barricade swing radius • Use of seat belts		
8. DECONTAMINATION AND DEMOBILIZATION	• Use of high pressure washer		• Face shield • Leather palm or rubber gloves					

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ATTACHMENT B
PERSONNEL AND ENVIRONMENTAL MONITORING AND ACTION LEVELS

Reprinted from DOE RADIOLOGICAL CONTROL MANUAL

Table 2-2 Summary of Contamination Values

NUCLIDE (See Note 1)	REMOVABLE (dpm/100 cm^2) (See Note 2)	TOTAL (FIXED + REMOVABLE) (dpm/100 cm2) (See Note 3)
U-natural, U-235, U-238 and associated decay products	1,000 alpha	5,000 alpha
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-129	20	500
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-125, I-126, I-131, I-133	200	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above. Includes mixed fission products containing Sr-90.	1,000 beta-gamma	5,000 beta-gamma
Tritium organic compounds, surfaces contaminated by HT, HTO and metal tritide aerosols	10,000	10,000

Notes:

1. The values in this Table apply to radioactive contamination deposited on, but not incorporated into the interior of the contaminated item. Where contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for the alpha-and beta-gamma-emitting nuclides apply independently.

2. The amount of removable radioactive material per 100 cm2 of surface area should be determined by swiping the area with dry filter or soft absorbent paper while applying moderate pressure and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. For objects with a surface area less than 100 cm2, the entire surface should be swiped, and the activity per unit area should be based on the actual surface area. Except for transuranics, Ra-228, Ac-227, Th-228, Th-230, Pa-231 and alpha emitters, it is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual contamination levels are below the values for removable contamination.

3. The levels may be averaged over 1 square meter provided the maximum activity in any area of 100 cm2 is less than three times the values in Table 2-2.

Reprinted from DOE RADIOLOGICAL CONTROL MANUAL
Table 2-4 Criteria for Posting Contamination, High Contamination and Airborne Radioactivity Areas

AREA	CRITERIA	POSTING
Contamination	Contamination levels (dpm/100 cm2) > 1 time but < 100 times Table 2-2 values	"CAUTION, CONTAMINATION AREA"
High Contamination	Contamination levels (dpm/100 cm2) >100 times Table 2-2 values	"DANGER, HIGH CONTAMINATION AREA" "RWP Required for Entry"
Fixed Contamination	Removable contamination levels < Table 2-2 removable values and total contamination levels > Table 2-2 total values	"CAUTION, FIXED CONTAMINATION"
Soil Contamination	Contaminated soil not releasable in accordance with DOE 5400.5	"CAUTION, SOIL CONTAMINATION AREA"
Airborne Radioactivity	Concentrations (μCi/cc) > 10% of any DAC value (see note 1 below)	"CAUTION, AIRBORNE RADIOACTIVITY AREA" "RWP Required for Entry"

Note 1: Derived Air Concentration (DAC) values for use with Table 2-4 are found in 10 CFR 835.

EXPOSURE ASSESSMENT AND AIR MONITORING PLAN
FOR THE DEEP WET TRENCH EXCAVATION

..Sampling Strategy

A. Activities to be Sampled

Any time Waste Pit material is exposed, personnel could be exposed to various Volatile Organic Compounds (VOCs). The VOCs that are known to be present are benzene, methyl methacrylate and toluene.

If the Waste Pit material is dry, personnel could be exposed to various heavy metals. Past soil sampling has shown that the material in the Waste Pits is saturated with water.

Additional exposure could occur during application of surfactant(s) to control dust release. This work may be sampled based on product information contained in the material safety data sheets (MSDSs) for the surfactants used.

B. Contaminants of Concern

During drilling activities in the Waste Pits benzene, toluene and methyl methacrylate were detected.

C. Available Historical Sampling Data

Since excavation in the Waste Pits has never been conducted no air sample data for this activity is available. Sampling has been conducted during drilling/sampling activities in the Waste Pits which showed very low levels of VOC contaminants. The sample results for this activity are located in Attachment A.

D. Monitoring for Unplanned Contaminants

During the trench activities direct reading instrumentation will be used. This equipment will detect a majority of VOCs. All personal samples will be analyzed for all VOCs with a boiling points between 100 and 137 degrees F.

Industrial Hygiene (IH) will review and evaluate MSDSs for the surfactant(s) to be used. If information on the MSDS indicates a material to be used contains a hazardous component, IH will evaluate the amount of product to be used and the duration of worker exposure to that product to determine whether air monitoring should be performed during the use of that product. When the decision is made to conduct air monitoring for the product/material to be used, an IH Pre-Sample Worksheet will be completed to provide IH Technicians with the guidance required to conduct air monitoring.

II. Monitoring Methods and Frequency

A. General Area Air Sampling Planned During Project Work

Volatile Organic Compounds (VOCs)

During all excavation activities and anytime waste pit material is handled, direct reading area sampling will be conducted. Direct reading instrumentation will be located in the following areas:

1. Cab of the back-hoe
2. Basket of the man-lift
3. Up and down wind of the excavation

Alarm limits for the instrumentation will be TWA (10 ppm), STEL (50 ppm) and Peak (100 ppm). Should an alarm be activated personnel will leave the area until additional sampling by IH can be conducted.

Should the alarm on the area PID be activated, IH will conduct the following sampling:

1. Verify the reading with MicoTip PID unit.
2. Use Drager tube for benzene and toluene

Heavy Metals and Nuisance Dust

Any time that Waste Pit material is uncovered, air sampling for total dust will be conducted upwind and downwind of the excavation. If Waste Pit material is found to be dry or sample results exceed:

- 5 mg/m^3 for Waste Pits 1 or 2
- 0.3 mg/m^3 for Waste Pit 3

then sampling for the following heavy metals will be conducted, arsenic, beryllium, cadmium, and lead will be conducted.

B. Personal Air Sampling During Project Work

Personal air samples will be collected on the back-hoe operator, the spotter for the back-hoe, the environmental sample tech and any other person that spends more than 4 hours at the work site. The breathing zone sample will be collected using OSHA method # 7. The samples will be collected by drawing air through a charcoal tube at 200 cc/min. The sample is to be collected during the entire work day (during breaks the sample will be removed from the worker and placed in a clean area).

Personal air samples will also be collected when direct reading instrument records the following values:

a. TWA $\geq$ 5 ppm
b. STEL $\geq$ 25 ppm
c. Peak $\geq$ 50 ppm

Should these levels be reached a charcoal tube will be collected on personnel working in the area as soon as possible and during the next work day.

If Waste Pit material is found to be dry or area sample results exceed:

- 5 mg/m^3 for Waste Pits 1 or 2

- 0.3 mg/m^3 for Waste Pit 3

then personnel sampling for the following heavy metals will be conducted, arsenic, beryllium, cadmium, and lead will be conducted.

III. Results and Action Levels

A. Permissible Exposure Limits (PEL)

1.	benzene:	1 ppm 8-hour TWA 5 ppm STEL
2.	methyl methacrylate	100 ppm 8-Hr TWA
3.	toluene:	50 ppm 8-Hr TWA 150 ppm STEL
4.	volatile organic compounds (VOCs)	10 ppm 8-Hr TWA 50 ppm STEL 100 ppm Peak
5.	arsenic	0.01 mg/m^3 8-Hr TWA
6.	beryllium	0.002 mg/m^3 8-Hr TWA 0.005 mg/m^3 Ceiling
7.	cadmium	0.005 mg/m^3 8-Hr TWA
8.	lead	0.05 mg/m^3 8-Hr TWA
9.	nuisance dust	10 mg/m^3 8-Hr TWA

B. Action Levels: Perimeter

1.	benzene:	0.5 ppm. When airborne concentrations of benzene exceed 0.5 ppm outside the established exclusion zone, the exclusion zone will be expanded until airborne concentrations fall below the action limit.
2.	methyl methacrylate	50 ppm. When airborne concentrations of methyl methacrylate exceed 50 ppm outside the established exclusion zone, the exclusion zone will be expanded until airborne concentrations fall below the action limit.
3.	toluene	25 ppm. When airborne concentrations of toluene exceed 25 ppm outside the established exclusion zone, the exclusion zone will be expanded until air borne concentrations fall below the action limit.
4.	VOCs	10 ppm. When airborne concentrations of VOCs exceed 10 ppm outside the established exclusion zone, the exclusion zone will be expanded until airborne concentrations fall below the action limit.

5.	arsenic	0.01 mg/m^3. When airborne concentrations of arsenic exceed 0.5 mg/m^3 outside the established exclusion zone, the exclusion zone will be expanded until airborne concentrations fall below the action limit.
6.	beryllium	0.002 mg/m^3. When airborne concentrations of beryllium exceed 0.01 mg/m^3 outside the established exclusion zone, the exclusion zone will be expanded until airborne concentrations fall below the action limit.
7.	cadmium	0.005 mg/m^3. When airborne concentrations of cadmium exceed 0.025 mg/m^3 outside the established exclusion zone, the exclusion zone will be expanded until airborne concentrations fall below the action limit.
8.	lead	0.05 mg/m^3. When airborne concentrations of lead exceed 2.5 mg/m^3 outside the established exclusion zone, the exclusion zone will be expanded until airborne concentrations fall below the action limit.
9.	nuisance dust	10 mg/m^3. When airborne concentrations of arsenic exceed 500 mg/m^3 outside the established exclusion zone, the exclusion zone will be expanded until airborne concentrations fall below the action limit.

C. Action Levels: Worker Protection

<u>Level D Protection</u>

No level D protection will be worn when the trenches in the Waste Pits is open.

<u>Level C Protection</u>

< 50 ppm benzene
< 500 ppm methyl methacrylate
< 250 ppm toluene
< 50 ppm VOCs
< 0.5 mg/m^3 arsenic
< 0.01 mg/m^3 beryllium
< 0.0025 mg/m^3 cadmium
< 2.5 mg/m^3 lead
< 500 mg/m^3 nuisance dust

Personnel working inside the exclusion zone will be required to wear full face air purifying respirator equipped with combination organic vapor and HEPA filter cartridges and surgical or nitrile gloves. This level of protection will be sufficient if air borne concentrations do not exceed the levels in the first column. If levels exceed the levels in the first column then PPE will be upgraded to level B

<u>Level B Protection</u>

> 1000 ppm benzene > 5000 ppm methyl methacrylate > 2500 ppm toluene > 500 ppm VOCs < 10 mg/m^3 arsenic < 2 mg/m^3 beryllium < 5 mg/m^3 cadmium < 100 mg/m^3 lead < 1000 mg/m^3 nuisance dust	Personnel working inside the exclusion zone will be required to wear full face air supplied respirators operated in the pressure demand mode and equipped with an emergency escape bottle and surgical or nitrile gloves. This level of protection will be sufficient if airborne concentrations do not exceed the levels in the first column. If levels exceed the levels in the first column then activities will be suspended. Engineering controls will be enacted to avoid prolonged use of this levels of PPE.

Level A Protection

Should air borne levels exceed those stated above then activities will be suspended and engineering controls implemented to control exposure.

D. Data Reporting and Documentation

All real-time monitoring collected by IH will be recorded on Direct Reading Instrument Survey Sheets.

Personal air sampling data collected by IH will be recorded on Air Sample Input Worksheets.

Initial results of real-time air monitoring will be provided to the supervisor in charge.

Final results of personal air monitoring will be provided to the sampled worker with a copy being provided to FERMCO Medical Services for inclusion in the worker's medical exposure file.

After completion of sampling in support of project work, a final report will be prepared by IH to provide the monitoring information to the DEEP Project manager for inclusion with project files.

IV. Quality Assurance

A. Calibration Requirements

Personal air sampling pumps will be calibrated before and after use each day.

Area air sampling pumps will be calibrated before and after use each day.

Direct reading instrumentation will be calibrated before and after use each day.

Drager tube samples will be collected using a Drager pump which has been calibrated in the last six months.

Drager tubes used for sampling will not have surpassed the manufacturer's expiration date marked on the storage box.

B. Sample Chain of Custody

After removing the charcoal tube sample from the sampled employee, the sample will be in the possession of the sampling technician until it is taken back to the IH Technicians area in the ES&H building. The sampling technician will post calibrate the sampling pump, complete the Air Sample Input Worksheet and Site-Wide Analysis Request/Custody Record form, then place the sample into a locked refrigerated sample box. A second IH Technician who has the key for the lock sample box will take possession of the sample(s) and deliver them to the Sample Processing Lab (SPL) at Building 15 where the sample will be signed over to SPL personnel to be prepared for off site shipment.

C. Sample Blanks

A blank sample will be included for every 10 samples.

D. Special Sample Storage/Handling Requirements

Charcoal tubes will be stored at 35 degrees F.

V. Approval Signatures

_____

_____

David L. Jackson, IH Manager

TABLE 2
RESULTS OF PERSONAL EXPOSURE MONITORING FOR VOCs
DURING GEOTECHNICAL INVESTIGATION OF WASTE PITS 1, 2 AND 3

LOCATION	BADGE # JOB	SAMPLE # DATE	JOB DESCRIPTION	8-hour TWA (ppm)		
				BENZENE PEL = 1 ppm AL = 0.5 ppm	TOLUENE PEL = 100 ppm	METHYL METH-ACRYLATE PEL = 100 ppm
WASTE PIT 1	72523 Driller assistant	36181 10-4-94	Handling of drilling equipment	ND (<0.01)	ND (<0.01)	ND (<0.01)
	8363 Sample tech	36180 10-4-94	Handling of samples and decon of equipment	ND (<0.01)	ND (<0.01)	ND (<0.01)
	70413 Driller assistant	36183 10-5-94	Handling of drilling equipment	ND (<0.01)	t 0.01	t 0.01
	8852 Geologist	36182 10-5-94	Classification of geotechnical borings	ND (<0.01)	t 0.026	ND (<0.01)
WASTE PIT 2	70413 Driller assistant	36119 10-5-94	Handling of drilling equipment	ND (<0.01)	ND (<0.01)	ND (<0.01)
		36220 10-6-94		ND (<0.01)	t 0.005	ND (<0.01)
	8503 Sample tech	36221 10-6-94	Handling of samples and decon of equipment	ND (<0.01)	t 0.001	ND (<0.01)
WASTE PIT 3	72523 Driller assistant	36223 10-7-94	Handling of drilling equipment	ND (<0.01)	t 0.01	ND (<0.01)
	8363 Sample tech	36222 10-7-94	Handling of samples and decon of equipment	ND (<0.01)	ND (<0.01)	ND (<0.01)

TABLE 2
RESULTS OF PERSONAL EXPOSURE MONITORING FOR VOCs DURING GEOTECHNICAL INVESTIGATION OF WASTE PITS 1, 2 AND 3

LOCATION	BADGE # JOB	SAMPLE # DATE	JOB DESCRIPTION	8-hour TWA (ppm)		
				BENZENE PEL = 1 ppm AL = 0.5 ppm	TOLUENE PEL = 100 ppm	METHYL METH-ACRYLATE PEL = 100 ppm
	8363 Sample tech	36234	Handling of samples and decon of equipment	ND (<0.01)	ND (<0.01)	ND (<0.01)
	8379 Sample Tech	36235 10-10-94	Handling of samples and decon of equipment	ND (<0.01)	t 0.007	ND (<0.01)
WASTE PIT 3 (continued)	8363 Sample tech	36241 10-11-94	Handling of samples and decon of equipment	ND (<0.01)	ND (<0.01)	ND (<0.01)
	60048 Driller	36249 10-12-94	Operation of drill rig	t 0.015	t 0.007	ND (<0.01)

ND = Non Detectable
t = Trace

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TABLE 1
RESULTS OF DIRECT INSTRUMENT READINGS
DURING GEOTECHNICAL INVESTIGATION OF WASTE PITS 1, 2 AND 3

LOCATION	DATE	BADGE # JOB	JOB DESCRIPTION	VOCs		
				TWA AL = 10ppm	STEL AL = 50ppm	PEAK AL = 100ppm
WASTE PIT 1	10-5-94	60048 Driller	Operation of drill rig	0	0	0.4
	10-5-94	8503 Sample tech	Handling of samples and decon of equipment	0	0	1.4
	10-6-94	8363 Sample tech	Handling of samples and decon of equipment	0	0	1.6
	10-6-94	72526 Driller assistant	Handling of drilling equipment	0	0	5.0
WASTE PIT 2	10-5-94	60048 Driller	Operation of drill rig	0	0	0.4
	10-5-94	8503 Sample tech	Handling of samples and decon of equipment	0	0	1.4
	10-6-94	8363 Sample tech	Handling of samples and decon of equipment	0	0	1.6
	10-6-94	72526 Driller assistant	Handling of drilling equipment	0	0	5.0
WASTE PIT 3	10-6-94	8363 Sample tech	Handling of samples and decon of equipment	0	0	1.6
	10-6-94	72526 Driller assistant	Handling of drilling equipment	0	0	5.0
	10-7-94	60048 Driller	Operation of drill rig	0	0	1.6
WASTE PIT 3 (continued)	10-7-94	8852 Geologist	Classification of geotechnical borings	0	0	1.7

TABLE 1
RESULTS OF DIRECT INSTRUMENT READINGS
DURING GEOTECHNICAL INVESTIGATION OF WASTE PITS 1, 2 AND 3

LOCATION	DATE	BADGE # JOB	JOB DESCRIPTION	VOCs		
				TWA AL=10ppm	STEL AL=50ppm	PEAK AL=100ppm
	10-10-94	70413 Driller assistant	Handling of drilling equipment	0	0	3.2
	10-10-94	8852 Geologist	Classification of geotechnical borings	0	0	2.1
	10-11-94	8503 Sample tech	Handling of samples and decon of equipment	0	0.3*	1.3
	10-11-94	60048 Driller	Operation of drill rig	0	0.2*	1.3
	10-12-94	8363 Sample tech	Handling of samples and decon of equipment	0	0	1.2

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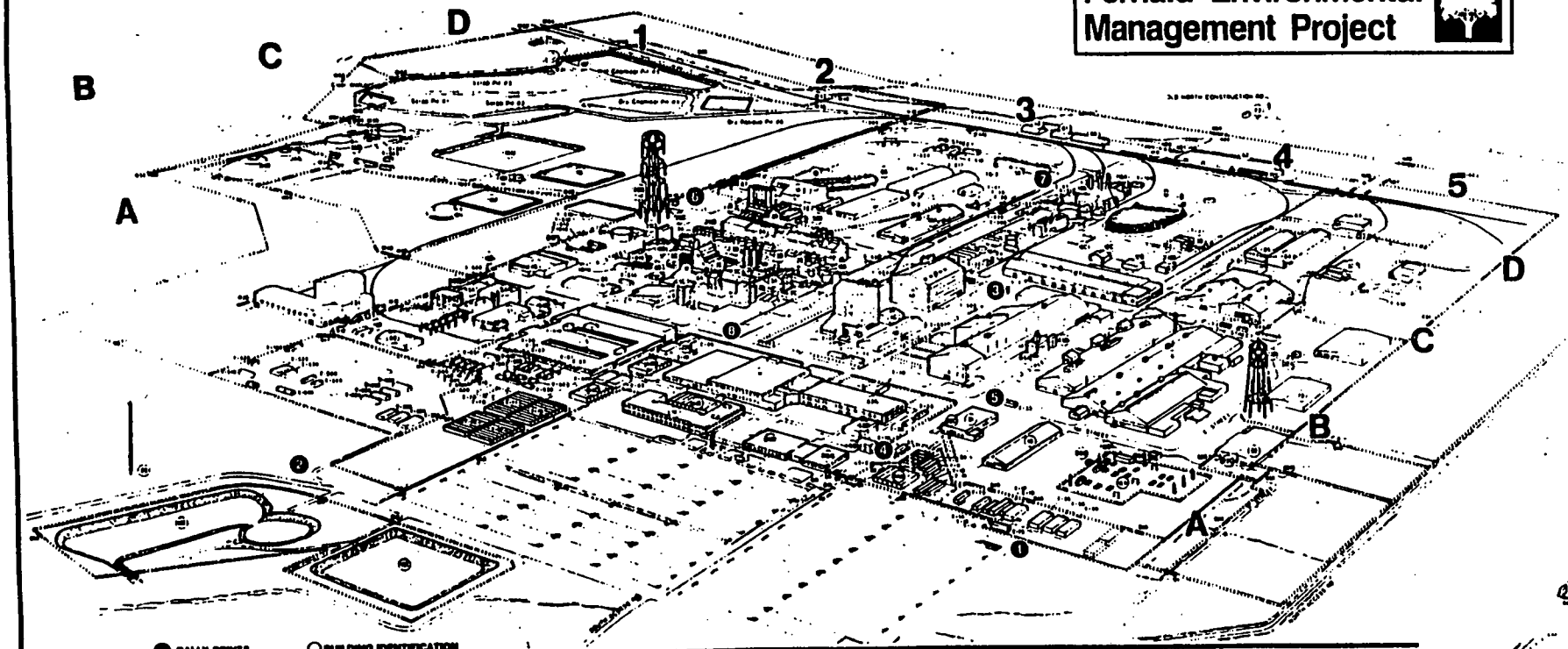
ATTACHMENT C
FEMP RALLY POINTS

Fernald Environmental Management Project



RALLY POINTS

BUILDING IDENTIFICATION

Bldg. No.	Grid Location	Bldg. Name	Bldg. No.	Grid Location	Bldg. Name	Bldg. No.	Grid Location	Bldg. Name	Bldg. No.	Grid Location	Bldg. Name	Bldg. No.	Grid Location	Bldg. Name
60	C-1	Cafeteria	186	D-4	Special Products Plant	194	C-3	High Service Storage Tank	254	A-4	Main Electrical Service House	346	A-3	U.F. to U.F. Reduction Facility I
10	C-1	Production Plant	188	D-4	Solid Plant	196	C-3	Raw Water Tank Farm	256	A-4	Security Building	348	B-4	Feed Plant Warehouse
13	C-1	Plant 1 Storage Building	189	D-4	Solid Plant Maintenance Building	198	C-4	Feed Plant Administration Tank Farm	258	A-4	Product Production Building	350	B-4	Solid Recycling Plant
15	C-1	Old Refinery Plant	190	D-4	Storage Building	200	C-4	Pump Station and Power Center	260	C-3	Chemicals Warehouse	352	B-4	Solid Recycling Pelletizer
16	C-1	Lime Handling Building	192	D-4	Maintenance Building (Main)	202	C-4	Water Plant	262	D-3	Drum Storage Warehouse	354	B-3	CP Storage Warehouse
20	C-1	Salt Lime Handling Building	194	D-4	Cylinder Storage Building	204	C-4	Cooling Towers	264	D-3	Engine House - Garage	56	D-3	Quonset #1
22	C-1	Water Treatment Building	196	A-4	Lyndon Storage Building	206	C-4	Electrical Storage Tank (Potable H2O)	57	D-3	Maintenance Storage	61	D-3	Quonset #2
24	C-1	Boiler Operations Building	198	A-4	Plant Water Well Building	208	A-3	Well House #1	59	D-3	Quonset #3	63	D-3	Quonset #4
26	C-1	NaOH Storage and Pump House	200	A-4	Plant Water Maintenance Building	210	A-3	Well House #2	65	D-4	K-25 Storage Tank - North	67	D-4	K-2 Warehouse
28	C-1	NaOH Storage Building	202	A-4	Sump Pump House	212	A-3	Well House #3	66	D-4	K-25 Storage Tank - South	69	D-4	Thorium Warehouse
30	C-1	Cooling Building	204	A-4	Administration Building	214	D-4	Process Water Storage Tank	68	C-1	Metal Chips Storage Tank - North	71	C-3	Chips Plant 5 Warehouse
32	C-1	Cooling Tower	206	A-4	Laboratories	216	D-4	Lime Slurry Pits	70	C-1	Metal Chips Storage Tank - South	73	C-3	Chips Reprocessing Building
34	C-1	Salt Towers	208	A-3	Main Electrical Service	218	D-4	Gas Meter Building	72	D-4	Propane Storage	75	C-3	Plant 1 Thorium Warehouse
36	C-1	Well Rehabilitation Building	210	A-4	Maintenance Building	220	A-4	Emergency Lift Station	74	D-3	Compressor Building	77	A-3	Plant Product Warehouse
38	C-1	Sedimentation Plant Recovery	212	A-4	Storage Lagoon	222	A-4	Trash Dump	76	D-3	Propane Storage Building	79	C-3	Decontamination Building
40	C-1	Sedimentation Building	214	C-3	Cafeteria Annex	224	D-3	Water Storage Tower	78	D-3	Industrial Building Services Road House	81	C-3	General In-Process Storage Warehouse
42	C-1	Refinery Annex	216	C-3	Cafe Pre Retail Store	226	D-3	Rainwater Storm House	80	A-3	Trailer Complex - G Pad - East	83	C-3	Drum Storage Building
44	C-1	Grounds Equipment	218	C-3	Administration Towers	228	C-4	Rainwater Storm Pump Station	82	A-3	Trailer Complex - I Pad - South	85	C-3	Free Stripper Training Center Building
46	C-1	Plant 4 Warehouse	220	C-3	Steam Heater Production Station	230	-	Chlorination Building	84	A-3	Trailer Complex - I Pad - North	87	C-3	Finished Products Warehouse
48	C-1	Plant 4 Maintenance Building	222	D-1	Pit 5 Sludge Dam	232	-	NH 0175	86	A-3	Trailer Complex - H-Pad	89	D-3	New D&D Facility
50	C-1	Motion Production Plant	224	C-1	Chemical Pump House	234	A-3	Storage Lot Storage Building	88	A-3	Plant Engineering Building	91	D-3	Plant 6 Warehouse
52	C-1	Assembly Fabricating Plant	226	C-1	DOW Ethylene Transmission Facility	236	-	N.V. Organization Building	90	A-3	Heavy Equipment Garage	93	D-3	Plant 6 Warehouse
54	C-1	Plant 7	228	D-3	Methanol Tank	238	-	Operator Control Building	91	A-3	U.F. to U.F. Production Facility II	95	C-3	Plant 6 Warehouse
56	C-1	Refinery Plant	230	D-3	Lime Hydrate Tank	240	D-3	Plant Potable - to D Tank Replacement	92	A-3	Occupational Safety & Health Building	97	D-3	Research & Engineering Warehouse
58	C-1	Maintenance Building	232	C-3	High Service Tank	242	D-3	Electrical Water Storage Tank	93	A-4	Air Lock Building			Inspection Area
59	C-1	Rotary Kiln/Drum Reconditioning Building												

May 1993

Recycled and Recyclable

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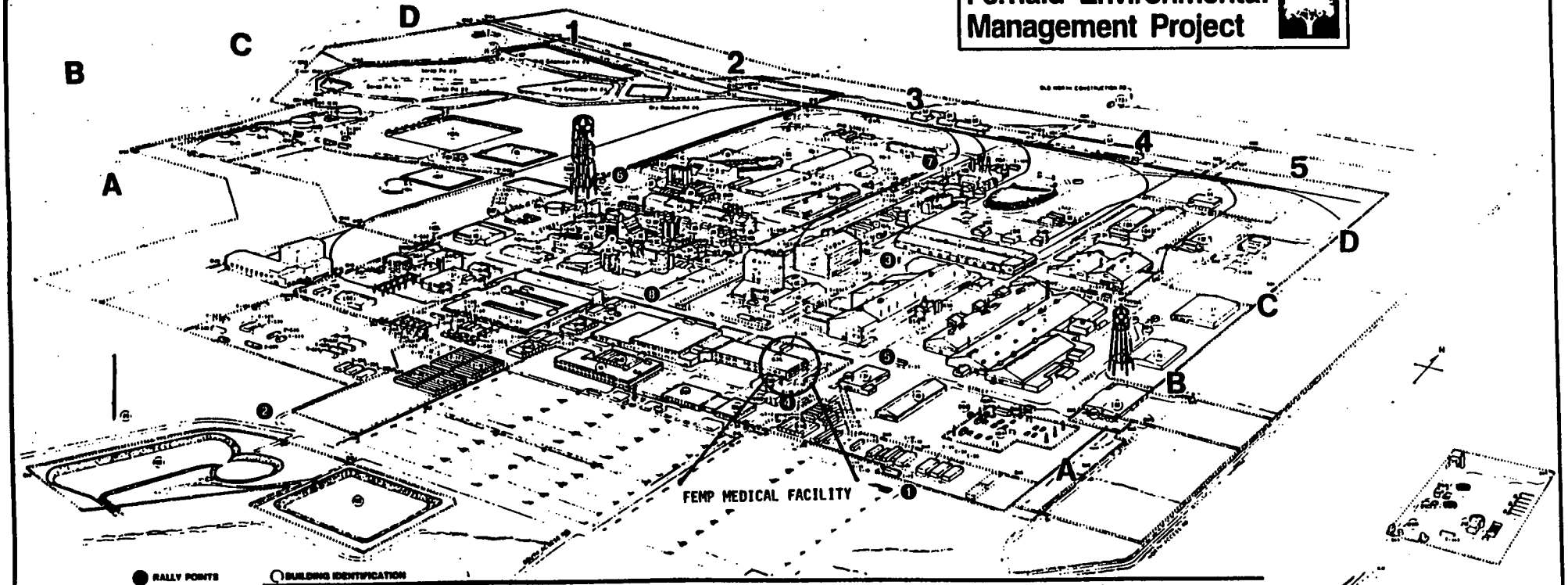
ATTACHMENT D
LOCATION OF FEMP MEDICAL FACILITY

Fernald Environmental Management Project



RALLY POINTS

BUILDING IDENTIFICATION

Number	Grid	Name	Number	Grid	Name	Number	Grid	Name	Number	Grid	Name	Number	Grid	Name
10	C-3	Storage	180	B-4	Special Products Plant	181	B-3	Main Storage Tank	364	A-3	Main Electrical Substation	364	A-3	UF6 to UF4 Reduction Facility I
12	C-3	Production Plant	181	B-4	Special Plant	182	C-4	Main Water Tank Farm	365	A-4	Security Building	365	A-3	Pilot Plant Warehouse
13	C-3	Plant 1 Storage Building	182	B-4	Special Plant Administration Building	183	C-4	Main Water Administration Tank Farm	366	A-4	Human Resources Building	366	A-4	Scrap Recycling Plant
24	B-3	Ore Refinery Plant	183	B-4	Service Building	184	C-4	Pump Station and Power Center	367	C-3	Chemical Warehouse	367	B-4	Scrap Recycling Pilot Plant
25	B-3	Lime Handling Building	184	B-4	Decontamination Building (Main)	185	B-4	Water Plant	368	C-3	Drum Storage Warehouse	368	B-3	CP Storage Warehouse
26	B-3	Lime Handling Building	185	C-4	Contractor Storage Building	186	C-4	Cooling Towers	369	A-3	Engine House - Garage	61	D-3	Quonset 61
27	B-3	Metal Storage Building	186	C-4	Laundry Storage Building	187	B-4	Water Storage Tank (Potable H2O)	37	C-3	Engine House - Garage	62	D-3	Quonset 62
28	C-3	Metal Storage and Repair House	187	C-4	Pilot Plant Well Field	188	B-3	Well House #1	370	B-3	K-65 Storage Tank - North	63	D-3	Quonset 63
29	C-3	Maintenance Building	188	A-3	Pilot Plant Maintenance Building	189	B-3	Well House #2	371	B-3	K-65 Storage Tank - South	64	D-3	K-2 Storehouse
30	C-3	Chemical Building	189	A-3	Spring Pump House	190	B-3	Well House #3	372	C-3	Waste Oxide Storage Tank - North	65	D-3	Tailings Warehouse
31	C-3	Control House	19	A-3	Decontamination Building	191	B-3	Well House #4	373	C-3	Waste Oxide Storage Tank - South	66	D-3	Oxide Plant 5 Warehouse
32	C-3	Acid Tanks	19	A-3	Laboratories	192	B-3	Process Water Storage Tank	374	B-3	Pilot Plant Annex	67	C-3	Drum Reconditioning Building
33	C-3	Acid Railroad Building	190	A-3	Main Electrical Station	193	B-3	Lime Slurry Pile	37	B-3	Pilot Plant Warehouse	68	C-3	Plant 1 Titanium Warehouse
34	C-3	Expansion Footer Repository	191	A-3	Electrical Substation	194	B-3	Sea Water Basin	375	B-3	Incinerator Building	69	D-3	Pilot Plant Warehouse
35	C-3	Expansion Building	192	C-3	Scrap Lagoon	195	B-3	Sewerhead Lift Station	376	B-3	Incinerator Building	70	C-3	Decontamination Building
36	C-3	Refinery Bldg	193	C-3	Contract Farm	196	A-3	Truck Scale	377	B-3	Storage Building	71	C-3	Contractor Storage Warehouse
37	C-3	Dryer Tank Farm	194	C-3	Cold Pilot Storage Bldg	197	B-3	Meteorological Tower	378	B-3	Maintenance Building Supervisor Read House	72	C-3	Drum Storage Building
38	B-4	Plant 4 Warehouse	195	B-4	Decontamination Trailer	198	C-3	Removed Stack House	379	A-3	Trailer Complex - 5-Plex - East	73	C-3	Fire Station Training Tower Building
39	B-4	Plant 4 Maintenance Building	196	B-4	Steam Water Separation Basin	199	C-3	Removed Engine Building	380	A-3	Trailer Complex - 5-Plex - South	74	C-3	Finished Products Warehouse
40	B-4	Metals Production Plant	197	C-1	Pit 5 Storm Gate	200	-	Construction Building	381	A-3	Trailer Complex - 5-Plex - North	75	D-3	New D&D Facility
41	B-4	Metals Fabricating Plant	198	C-1	Contract Parking House	201	-	Sewage Lift Station Building	382	A-3	Trailer Complex - 10-Plex	76	B-3	Plant 6 Warehouse
42	B-4	Plant 7	199	B-3	BDN Effluent Treatment Facility	202	B-3	UV Disinfection Building	383	B-3	Pilot Engineering Building	77	B-3	Plant 6 Warehouse
43	B-4	Radioactive Plant	19	B-3	Sewerhead Tank	203	B-3	Chlorine Contact Building	384	B-3	Heavy Equipment Garage	78	B-3	Plant 6 Warehouse
44	B-4	Radioactive Building	190	B-3	Low Service Tank	204	B-3	Pump House - HP Fire Protection	385	A-3	UF6 to UF4 Reduction Facility II	79	B-3	Plant 6 Warehouse
45	B-4	Rotary Kiln/Drum Reconditioning Building	191	B-3	High Service Tank	205	B-3	Elevated Water Storage Tank	386	A-3	Occupational Safety & Health Building	80	B-3	Remaining 6 Warehouse Materials Area
											In-Line Building			

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ATTACHMENT E
WORK AREA MATERIAL SAFETY DATA SHEETS (MSDSs)

All MSDSs will be submitted by the subcontractor MSDSs for the Waste Pits are Included

10999

CHEM REPORT
05/23/1986

CHEM ID	CHEM NAME
***	
* 007440-61-1	URANIUM

ENTRY INFORMATION
05/23/1986

PREPARER	REVIEWER	ENTRY DATE	REVISED
***			
* D. AVERILL	J. BROWER	02/13/1985	05/16/1986

DOE CHEMICAL HAZARDS EMERGENCY MANAGEMENT SYSTEM
05/23/1986

HEALTH AND SAFETY INFORMATION AUTHORITY

CHEMICAL NAME OR SYNONYM
***
* URANIUM
* URANIUM METAL
* U238
* URANIUM METAL PYROPHORIC
* 7440-61-1

TWA .2 mg/m3 Se .6 STEL

DOT

DISPOSAL

RECOVERY FOR REPROCESSING IS THE PREFERRED METHOD FOR HANDLING WASTE URANIUM. SHIP TO LISCENCED RECOVERY FACILITY. SCRAP URANIUM SHOULD BE COVERED WITH OIL.

DECOMPOSITION PRODUCTS

THERMAL DECOMPOSITION - URANIUM OXIDES.

ENVIRONMENTAL EFFECTS

NO CRITERIA SET, BUT EPA HAS SUGGESTED A PERMISSIBLE CONCENTRATION IN WATER OF 3 UG/L BASED ON HEALTH EFFECTS.

EMERGENCY PROCEDURES

PERSONS NOT WEARING PROTECTIVE EQUIPMENT AND CLOTHING SHOULD BE RESTRICTED FROM AREAS OF SPILLS UNTIL CLEANUP HAS BEEN COMPLETED. IF URANIUM MATERIALS ARE SPILLED, 1. VENTILATE AREA OF SPILL. 2. COLLECT SPILLED MATERIAL IN MOST CONVENIENT AND SAFE MANNER AND DEPOSIT IN SEALED CONTAINERS FOR RECLAMATION. LIQUID CONTAINING URANIUM OR INSOLUBLE COMPOUNDS SHOULD BE ABSORBED IN VERMICULITE, DRY SAND, EARTH, OR A SIMILAR MATERIAL. URANIUM CHIPS OR TURNINGS WHICH ARE SPILLED SHOULD BE COVERED WITH OIL.

FIRST AID

WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER. GET MEDICAL ATTENTION. CONTACT LENSES SHOULD NOT BE WORN WHEN WORKING WITH THIS CHEMICAL. SKIN EXPOSURE - PROMPTLY WASH CONTAMINATED SKIN USING SOAP OR MILD DETERGENT AND WATER. IF IRRITATION IS PRESENT AFTER WASHING, GET MEDICAL ATTENTION. INHALATION - IF A PERSON BREATHES IN LARGE AMOUNTS OF URANIUM MOVE THE EXPOSED PERSON TO FRESH AIR AT ONCE. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP THE AFFECTED PERSON WARM AND AT REST. GET MEDICAL ATTENTION IMMEDIATELY . SWALLOWING - GIVE THE PERSON LARGE QUANTITIES OF WATER IMMEDIATELY. AFTER THE WATER HAS BEEN SWALLOWED, TRY TO GET THE PERSON TO VOMIT BY TOUCHING THE BACK OF THE THROAT WITH A FINGER. DO NOT MAKE AN UNCONSCIOUS PERSON VOMIT. GET MEDICAL ATTENTION IMMEDIATELY.

FIRE HAZARD

URANIUM IS A DANGEROUS FIRE HAZARD IN THE FORM OF A SOLID OR DUST WHEN EXPOSED TO HEAT OR FLAME. IT IS A MODERATE EXPLOSION HAZARD IN THE FORM OF DUST WITH A MINIMUN EXPLOSIVE CONCENTRATION OF 60 GRAMS/CU.M. EXTINGUISH WITH DRY POWDER, DRY SAND, OR GRAPHITE. DONOT USE

CARBON DIOXIDE.

HEALTH HAZARD

HIGHLY TOXIC AND RADIOACTIVE.
URANIUM AND/OR IT INSOLUBLE COMPOUNDS ARE TOXIC IF THEY ARE INHALED SWALLOWED, OR IF THEY COME IN CONTACT WITH THE EYES OR SKIN. URANIU METAL AND ITS INSOLUBLE COMPOUNDS ARE LESS TOXIC THAN THE SOLUBLE COMPOUNDS. IT IS WEAKLY RADIOACTIVE AND IS PRINCIPALLY AND ALPHA PARTICLE EMITER. IT IS NOT A SIGNIFICANT EXTERNAL RADIATION HAZARD. IT POSES AN INTERNAL RADIATION AND CHEMICAL HAZARD. EXPOSURE MAY CAUSE AN INCREASE IN CANCER OF THE LYMPHATIC AND BLOOD-FORMING TISSUES IN MAN. PROLONGED CONTACT WITH THE SKIN MIGHT CAUSE RADIATION DAMAGE TO THE SKIN AND/OR SKIN RASH (DERMATITIS). PROLONGED INHALATION HAS CAUSED DAMAGE TO THE LUNGS OF ANIMALS. URANIUM IS HIGHLY TOXIC TO THE KIDNEYS AND LIVER.

CHEMICAL INCOMPATIBILITIES

CONTACT WITH CO2 MAY CAUSE FIRE.
URANIUM METAL IS INCOMPATIBLE WITH HALOGENS. U POWDER IGNITES IN FLORINE AT ROOM TEMPERATURE, IN CHLORINE AT 150-180 DEGREES C, AND IN IODINE VAPOR AT 260 DEGREE C. MAY EXPLODE OR IGNITE IN BRF3 AND CCL4. URANIUM REACTS EXPLOSIVELY WITH NITRIC ACID, AND DINITROGEN TETRAOXIDE. U METAL GLOWS AND PRODUCES HEAT IN AMMONIA, SULFUR VAPOR, AND IN CONTACT WITH SELENIUM.

MEDICAL RECCOMMENDATIONS

SPECIAL ATTENTION SHOULD BE GIVEN TO THE BLOOD, LUNGS, KIDNEY, AND LIVER IN PREEMPLOYMENT MEDICAL EXAMS. PERIODIC MEDICAL EXAM SHOULD INCLUDE A CHEST X-RAY, URINALYSIS, COMPLETE BLOOD COUNT AND CHEMISTRY.

PHYSICAL DESCRIPTION

A HARD, SILVERY WHITE RADIOACTIVE METAL

PROTECTION MEASURES

GOOD ENGINEERING CONTROLS SHOULD BE USED TO REDUCE ENVIRONMENTAL CONCENTRATIONS TO THE PERMISSIBLE EXPOSURE LEVEL (PEL). ABOVE THE PEL RESPIRATORY PROTECTION MUST BE WORN. AT A CONCENTRATION OF 2.5 MG/M3 OR LESS WEAR FUME RESPIRATOR OR HIGH EFFICENCY PARTICULATE RESPIRATOR APPROVED FOR RADIONUCLIDES, A SUPPLIED-AIR RESPIRATOR, OR A SCBA. EMPLOYEES SHOULD WEAR IMPERVIOUS CLOTHING, GLOVES, AND GOGGLES TO PREVENT SKIN CONTACT WITH URANIUM. EATING AND SMOKING SHOULD NOT BE PERMITTED IN AREAS WHERE SOLIDS OR LIQUIDS CONTAINING URANIUM OR INSOLUBLE COMPOUNDS ARE HANDLED, PROCESSED, OR STORED. EMPLOYEES WHO HANDLE URANIUM SHOULD WASH THEIR HANDS THOROUGHLY WITH SOAP OR MILD DETERGENT AND WATER BEFORE EATING, SMOKING OR USING TOILET FACILITIES.

SAMPLING METHODS

NO STANDARD MEASUREMENT METHODS FOR URANIUM OR INSOLUBLE COMPOUNDS HAVE BEEN PUBLISHED BY NIOSH. MAY BE SAMPLED AND USING A CELLULOSE ESTER FILTER AND ANALYZED BY ATOMIC ABSORPTION.

SHIPPING INFORMATION

SHIP AS URANIUM METAL, PYROPHORIC. LABEL AS RADIOACTIVE AND FLAMMABLE SOLID.

STORAGE RECOMMENDATIONS

STORE AS RADIOACTIVE MATERIAL. KEEP FROM EXPOSURE TO AIR, MOISTURE, CO2, HALOGENS, ACIDS, AMMONIA, SULFUR. SCRAP URANIUM SHOULD BE COVERED WITH O

USE

URANIUM METAL HAS LIMITED USES IN ALLOYS AND PHOTOELECTRIC TUBES. URANIU COMPOUNDS ARE USED AS FUEL IN NUCLEAR REACTORS, IN PLUTONIUM PRODUCTION, IN THE ARE PRODUCTION OF OTHER RADIOACTIVE ISOTOPES, AND AS FEEDS FO GASEOUS DIFFUSION PLANTS.

CHEMICAL CATEGORIES
05/23/1986

CATEGORY	CLASS NAME	CLASS CODE

***		
* CARCINOGEN	HUMAN	
* CHEMICAL	ACTINIDE METAL	U
* HAZARD CODE	REACTIVITY	3
* HAZARD CODE	HEALTH	3
* HAZARD CODE	FIRE	3
* HEALTH HAZARD	KIDNEY TOXIN	
* PHYSICAL HAZARD	PYROPHORIC	
* PHYSICAL HAZARD	RADIOACTIVE	
* TRANSPORTATION	RADIOACTIVE AND FLAMMABLE SOLID	UN2979

CHEM NAME* URANIUM

CHEMICAL ATTRIBUTES
05/23/1986

ATTRIBUTE	VALUE	UNITS	QUALITY	COMMENTS
***				
* IGNITION TEMP	150.000	TO 175C		SOLID
* CHEM FORMULA			U	
* MOL WEIGHT	238.030	G/MOL		
* PHYSICAL STATE			SOLID	AT 20 - 25 C
* HALF LIFE	4.500	10E9 YEARS		
* IGNITION TEMP	20.000	C	MINIMUM	DUST CLOUD
* MELTING POINT	1133.000	C		
* BOILING POINT	3818.000	C		
* SPECIFIC GRAVITY	19.050		WATER=1	AT 25 C
* SOLUBILITY			INSOLUBLE	IN WATER
* EXPOSURE LIMIT	0.250	MG/CU.M	PEL	AS U
* EXPOSURE LIMIT	0.200	MG/CU.M	TLV	AS U

SELECTED MATERIALS THAT ARE RELATED TO OR CONTAIN THE SUBSTANCE
05/23/1986

CHEM NAME* URANIUM

***
* URANIUM COMPOUNDS
* URANIUM DICARBIDE
* URANIUM DIOXIDE
* URANIUM HEXAFLUORIDE
* URANIUM HYDRIDE
* URANIUM OCTAOXIDE
* URANIUM OXYFLUORIDE
* URANIUM TETRAFLUORIDE
* URANYL FLUORIDE
* URANYL NITRATE

Material Safety Data Sheet

Associated General Contractors of America
1957 E Street N.W.
Washington D.C. 20006
202-393-2040

Product: CADMIUM METAL

MSDS No: AGCA / AGCA 19
Revision: B
Date: March 28, 1989

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: CADMIUM METAL 10894

Description: Silver-white, malleable elemental metal.

Other Designations: Cadmium Anodes, Cd, GE Material B10C11, ASTM B440.

CAS: 007 440 439

Available from many suppliers, including:

Manufacturer: ASARCO Inc.
120 Broadway
New York, NY

Phone: (801) 262-2459 (Emergency Phone)

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	Percent:	Exposure Limits:
Cadmium	>99.8	8-hr. TWA fume 0.1 mg/m3*, dust 0.2 mg/m3* or 0.05 mg/m3** Human, Inhalation TCLo 88 µg/m3/8.6 yrs. (systemic effect) Rat, Intramuscular TDLo 14 mg/kg (carcinogenic effects)

*Current OSHA TLV as developed by ANSI.
**ACGIH TLV (1980) for fume, salt, dust. NIOSH has recommended a 10-hr.TWA of 0.04 mg/m3 with a 15 min. ceiling of 0.2 mg/m3. TLV set at level to prevent systemic effects of chronic cadmium poisoning. The massive metal is usually safe unless metal fume is formed (heating) or soluble cadmium compounds are formed (acid reaction or corrosion).

SECTION III. PHYSICAL DATA

Appearance & Odor: Silvery white, bluish, lustrous metal; no odor.

Boiling point: 767°C (1415°F)
Vapor pressure: At 394°C, mm Hg: 1
Water solubility (%): Insoluble
Specific gravity (H2O=1): 8.6
Melting point: 320.9°C

Viscosity @ 340°C, cp: 2.37
Atomic Weight: 112.41
Brittle temperature: 80°C

MSDS AGCA 19 continues on page 2

Associated General Contractors of America
1957 E Street N.W.
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Product: CADMIUM METAL

MSDS No: AGCA / AGCA 19
Revision: B
Date: March 28, 1989

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): Not applicable. Limits: LEL %: *

Unusual fire or explosion hazards: Cd dust will burn with evolution of CdO fumes; it is a weak fire and explosion hazard.

Special fire-fighting procedures: Firefighters must wear self-contained breathing apparatus and full protective clothing.

*Flammability limits in air: dust cloud. Autoignition temp.: 570°C (cloud), 250°C (dust layer).
*Through 74 μm sieve; cloud can be ignited by 4.0J spark.

SECTION V. REACTIVITY DATA

Material is* stable Hazardous polymerization cannot occur

Chemical incompatibilities: At red heat it oxidizes in air to CdO. Finely powdered metal can be pyrophoric. Heat treatment, welding, or soldering of cadmium metal and cadmium coatings will produce toxic CdO and Cd metal fumes.
The sulfide, carbonate & hydroxide are insoluble in water while the halides, nitrate & sulfate are relatively soluble. Cd forms a variety of soluble complexes such as cyanide & amines.

Soluble in acids. Resistant to alkalies.
Ammonium nitrate & powdered Cd may yield an explosive reaction. Tarnishes in moist air. It is incompatible with strong oxidizing agents, elemental sulfur, selenium, tellurium, and hydrazoic acid. Nitryl fluoride passed over a mildly warm Cd metal can produce incandescence.
*Stable at room conditions when dry.

SECTION VI. HEALTH HAZARD INFORMATION

Summary of risks: Exposures to cadmium dust/fume can result in pulmonary irritation, dermatitis, or allergic sensitization. Pneumonitis can occur after excessive inhalation at 0.5 to 2.5 mg/m3. Fatal pulmonary edema* (delayed effects) can result from levels which provide insufficient discomfort for warning; for example, at or above 5 mg/m3 for 8 hrs. or at 40-50 mg/m3 for 1 hr. Symptoms of overexposure can be a dry, burning throat, headache, muscle aches, cough, chest tightness and pain, nausea, chills and fever.

Chronic effect(s): Chronic exposure, low-level fume, may lead to emphysema, anemia, kidney damage, anosemia, and yellow rings around teeth.

First aid:

Eye contact: Flush with running water for 15 minutes, including under eyelids.

Skin contact: Wash contact area well with soap and water.

Inhalation: Remove victim to fresh air. Restore breathing if required; have trained person administer 60-100% oxygen. Contact physician or hospital.

Material Safety Data Sheet

Associated General Contractors of America
1957 E Street N.W.
Washington D.C. 20006
202-393-2040

Product: CADMIUM METAL

MSDS No: AGCA / AGCA 19
Revision: B
Date: March 28, 1989

HEALTH HAZARD INFORMATION continued from page 2

Ingestion: **Contact physician for gastric lavage followed by saline catharsis. Cadmium can be toxic by ingestion. (If physician not readily available, give 2-3 glasses water to drink and induce vomiting.) Obtain medical assistance for treatment, observation, and support as needed.

*Latent period of up to 12 hours.
**Chelating agents used by physicians in cadmium poisoning: Calcium disodium edetate or pencillamine.

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Notify safety personnel of spills. Clean-up personnel need protection against inhalation of dust or fumes. Pick up material using vacuum or wet mopping or sweeping to avoid dusting.

Waste management / Disposal: Recover scrap metal and store in closed container for salvage. When possible, return cadmium materials to supplier for reclamination. Incineration can be a cause of air pollution; proper scrubber needed. Concentrated soluble Cd waste can be precipitated with lime and collected by filtration. Effluent is treated further as needed to reduce Cd concentration to compliance levels. Cadmium compound containing waste to be disposed in an approved chemical landfill of a California Class I type.

Follow Federal, State and Local regulations. Toxic to fish. (Conc. greater than 0.001 mg/L; depends on pH).
(EPA number D006 under RCRA).

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

Goggles: Chemical goggles and/or face shield.

Gloves: Wear rubber gloves and protective coveralls.

Respirator: Approved respirator protection required when heating, grinding, and for operations where dust and/or fume exposure may occur. A self-contained or air supplied respirator can be used up to 2 mg/m3 with a full face piece above 0.4 mg/m3. (Above 2 mg/m3 a positive pressure mode or auxiliary air supply is needed, respectively.)

Other: Special work clothing and laundering recommended. Change work clothing daily; shower after work.

Workplace considerations:

Ventilation: Provide efficient local exhaust ventilation to meet TLV requirements in the workplace.

Associated General Contractors of America
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202-393-2040

Product: CADMIUM METAL

MSDS No: AGCA / AGCA 19
Revision: B
Date: March 28, 1989

SPECIAL PROTECTION INFORMATION continued from page 3

Safety stations:
Provide periodic medical examinations for those regularly exposed, including chest x-ray, vital capacity, and urinalysis. Preclude from exposure those individuals with lung, liver, kidney, and blood ailments until approved by physician.

SECTION IX. SPECIAL PRECAUTIONS

Storage segregation: Store in a dry, low fire-risk area; avoid storage conditions where corrosion can occur. Keep powdered metal in closed containers, protected from physical damage. Use good housekeeping practices to prevent accumulation of dust; use good cleaning techniques, such as vaccuming to keep airborne particulate at a minimum. Use nonsparking tools where cadmium particulate is found.

Engineering controls: Use good hygienic practice in handling cadmium and its compounds. No eating or smoking in work areas.

Other precautions: Toxic effects of Cd are influenced by the presence or absence of other elements, such as Zn & Se. As an elemental material, cadmium is not degradable; but it can be isolated as insoluble salts in secure landfills.

Data source code(s): 1-12, 19, 20, 24-27, 31, 37-40, N.

AGCA provides this MSDS for reference purposes only, no warranty is expressed or implied. Data herein is taken from standard reference sources.

UNITED STATES DEPARTMENT OF ENERGY
MATERIAL SAFETY DATA SHEET

Entry Date: 01/01/1981 Revised Date: 01/01/1981

SECTION I -- IDENTIFICATION

Chem. Name: BERYLLIUM
Chem. Id: 007440-41-7
DOT Class/#: POISON B, FLAMMABLE SOLID/UN1567
Chem. Family: METAL
Chem. Formula: No Info.
Hazard Rating (Scale: 0-4): HEALTH-(4); FIRE-(1); REACTIVITY-(0)
Molecular Weight: 9.010

Synonyms: BERYLLIUM
BERYLLIUM-9
BE
GLUCINIUM
7440-41-7

SECTION II -- HAZARDOUS INGREDIENTS

Components	CAS #	PEL/TLV	Percentage

NO COMPONENT INFORMATION ENTERED FOR THIS MATERIAL.

SECTION III -- PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: 2970.000 C (AT MMHG)
Vapor Pressure: 7.600 MM HG (AT 1910. C)
Vapor Density: No Info.
Evaporation Rate: No Info.
Specific Gravity: 1.848
Melting Point: 1278.000 C
Solubility: No Info. (SLIGHT - INSOL HOT-COLD WATER)
Volatiles by Vol.%: No Info.

Physical Description:

SILVER-GREY METAL

SECTION IV -- FIRE AND EXPLOSION HAZARD INFORMATION

Flash Point	Auto-Ignition Temp.	Flammable Limits
No Info.	1200.000 F	LEL: No Info. UEL: No Info.

Special Hazards:

DO NOT USE WATER. SMOTHER WITH SUITABLE DRY POWDER.

SECTION V -- REACTIVITY INFORMATION

Incompatibility:

AVOID CONTACT WITH ACIDS AND BASES ESPECIALLY WITH PODWER.

SECTION VI -- HEALTH HAZARD INFORMATION

Toxicity and Exposure Limits:

Inhal. Toxicity: 300.000 MG/CU.M
Comments: TCLO
HUMAN, PULMONARY
Dermal Toxicity: No Info.
Oral Toxicity: No Info.
Eye Toxicity: No Info.
Exp. Limit: 0.002 MG/CU.M
Exp. Limit Max.: No Info.
Comments: TLV

Health Effects and Symptoms:

EXPOSURE MAY OCCUR BY INHALATION OF DUST OR FUMES AND BY SKIN CONTACT. SKIN CONTACT WITH BERYLLIUM DUST AND SOLUBLE BERYLLIUM SALTS MAY CAUSE IRRITATION AND SENSITIZATION. EYE CONTACT MAY RESULT IN IRRITATION AND CONJUNCTIVITIS. GRANULOMATOUS,SLOW-HEALING LESIONS MAY RESULT FROM ACCIDENTAL IMPLANTATION OF BERYLLIUM OR CRYSTALS OF A SOLUBLE BERYLLIUM UNDER THE SKIN THROUGH CUTS OR PUNCTURES. ACUTE EXPOSURE BY INHALATION OF DUST OR FUMES MAY CAUSE A COUGH, SUBSTERNAL PAIN, SHORTNESS OF BREATH AND WEIGHT LOSS. AN INTENSE EXPOSURE MAY RESULT IN SEVERE CHEMICAL PNEUMONITIS WITH PULMONARY EDEMA.
SYMPTOMS RESULTING FROM CHRONIC EXPOSURE TO BERYLLIUM MAY BE DELAYED FROM 5 - 10 YEARS FOLLOWING THE LAST EXPOSURE. PULMONARY GRANULOMATOUS DISEASE IS CAUSED BY INHALATION OF BERYLLIUM DUST OR FUMES AND IS CHARACTERIZED BY RESPIRATORY SYMPTOMS, WEAKNESS, FATIQUE AND WEIGHT LOSS. DIAGNOSIS IS BASED IN PART ON CHANGES IN ROUTINE CHEST X-RAYS.
AVOID SKIN CONTACT AND INHALATION OF DUST. TLV IS 0.002 MG/M3.

Medical Recommendations:

PREMPLOYMENT HISTORY AND PHYSICAL EXAMINATIONS SHOULD INCLUDE LONG TERM SYMPTOMS. ACTH AND CORTISONE TREATMENTS HAVE PRODUCE TEMPORARY SEEK MEDICAL HELP FOR ANY EXPOSURE. NO SPECIFIC TREATMENTS ARE GIVEN FOR LONG TERM SYMPTOMS. ACTH AND CORTISONE TREATMENTS HAVE PRODUCE TEMPORARY CHEST X-RAYS, BASELINE PULMONARY FUNCTION TESTS (FVC AND FEV1) AND MEASUREMENT OF BODY WEIGHT. PERIODIC EXAMINATIONS SHOULD INCLUDE SPIROMETRY, MEDICAL HISTORY QUESTIONAIRE DIRECTED TOWARD RESPIRATORY SYMPTOMS, AND A CHEST X-RAY. GENERAL HEALTH, LIVER AND KIDNEY FUNCTION, AND POSSIBLE SKIN EFFECTS SHOULD BE EVALUATED.

Emergency and First Aid Procedures:

AFTER EXPOSURE TO A BERYLLIUM FIRE, PERSONNEL SHOULD BATHE CAREFULLY. ALL EQUIPMENT AND CLOTHING SHOULD BE WASHED DOWN AND CLOTHING SHOULD BE LAUNDERED SEPARATELY FROM OTHER NONCONTAMINATED MATERIAL AND CLOTHING. WASH SKIN AND EYES WITH WATER FOR AT LEAST 15 MINUTES. INHALATION - MOVE EXPOSED PERSON TO FRESH AIR. PERFORM ARTIFICIAL RESPIRATION IF NEEDED. IF INGESTED CONTACT A PHYSICIAN IMMEDIATELY.

SECTION VII -- PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in case material is released or spilled:

IF DUST OR POWDER IS SPILLED, WEAR A SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING. COLLECT DEBRIS IN A MANNER TO PREVENT RE-ENTRAINMENT OF THE AEROSOL. THIS MAY BE A VACUUM WITH A HEPA FILTER AT THE EXHAUST.

Waste Disposal Method:

DISSOLVE IN 6M HYDROCHLORIC ACID AND FILTER. TREAT FILTRATE WITH 6M SODIUM OR AMMONIUM HYDROXIDE. BOIL AND LET PRECIPITATE SETTLE FOR 12 HOURS. FILTER, DRY PACKAGE AND SHIP TO SUPPLIER

Shipping and Transportation:

BERYLLIUM DUST, FLAKES, OR POWDER IS REGULATED BY DOT. LISTED IN OPTIONAL HAZARDOUS MATERIALS TABLE. SHIP AS POISON B MATERIAL.

Precautions to be taken in Handling and Storing:

CONTAINERS OF BERYLLIUM DUST OR POWDER SHOULD BE PROTECTED FROM PHYSICAL DAMAGE. KEEP DRY AND ISOLATE FROM ACIDS, CAUSTICS AND CHLORINATED HYDROCARBONS. SEPARATE FROM OXIDIZING MATERIALS.

Other Precautions:

Environmental Precautions:
AQUATIC TOXICITY TLM96(100-10 PPM).

SECTION VIII -- CONTROL MEASURES

Protection Measures:

WEAR PROTECTIVE GLOVES AND CLOTHING, GOGGLES AND A FACESHIELD. USE ONLY A WELL VENTILATED AREA (FUME HOOD) OR WEAR A SCBA.

Work/Hygienic Practices:

AVOID ALL CONTACT WITH DUST.

0001160

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UNITED STATES DEPARTMENT OF ENERGY
MATERIAL SAFETY DATA SHEET

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Entry Date: 01/01/1981 Revised Date: 01/01/1981

SECTION I -- IDENTIFICATION

Chem. Name: ARSENIC
Chem. Id: 007440-38-2 DOT Class/#: No Info.
Formula: No Info. Chem. Family: No Info.
Hazard Rating (Scale: 0-4): HEALTH-(3); FIRE-(2)
Molecular Weight: No Info.

Synonyms: ARSENIC
ARSENIC,SOLID
ARSENIC COLLOIDAL
METALLIC ARSENIC
ARSENIC BLOCK
GREY ARSENIC
ARSENIC METAL
7440-38-2

SECTION II -- HAZARDOUS INGREDIENTS

Components	CAS #	PEL/TLV	Percentage

NO COMPONENT INFORMATION ENTERED FOR THIS MATERIAL.

SECTION III -- PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: No Info. Specific Gravity: No Info.
Vapor Pressure: No Info. Melting Point: No Info.
Vapor Density: No Info. Solubility: No Info.
Evaporation Rate: No Info. Volatiles by Vol.%: No Info.

Physical Description:

GRAY, SHINY, BRITTLE, METALLIC-LOOKING POWDER.

SECTION IV -- FIRE AND EXPLOSION HAZARD INFORMATION

Flash Point	Auto-Ignition Temp.	Flammable Limits
No Info.	No Info.	LEL: No Info. UEL: No Info.

Special Hazards:

FIRE MAY OCCUR WHEN IN THE FORM OF DUST AND EXPOSED TO HEAT OR FLAME OR BY CHEMICAL REACTION WITH POWERFUL OXIDIZERS.

SECTION V -- REACTIVITY INFORMATION

Conditions to Avoid:

ARSENIC REACTS TO, BROMENE, AZIDE, DIRUBIDIUMACEYLIDE, BROMINETRIFLOURIDE, BROMINE PENTAFLORIDE, CHLORINE TRIFLOURIDE, IODINE PENTAFLOURIDE, ZINC, PALLADIUM,

ALUMINIUM, NITROGEN TRICHLORIDE AND OXIDANTS SUCH AS, SILVER NITRATE, DICHLORINE TRIOXIDE, NITROSYL FLOURIDE, POTASSIUM PERMANGANATE POTASSIUM DIOXIDE AND SODIUM PEROXIDE.

SECTION VI -- HEALTH HAZARD INFORMATION

Toxicity and Exposure Limits:

Inhal. Toxicity: No Info. Dermal Toxicity: No Info.
Oral Toxicity: No Info. Eye Toxicity: No Info.
Exp. Limit: No Info. Exp. Limit Max.: No Info.

Health Effects and Symptoms:

TRIVALENT ARSENIC COMPOUNDS ARE CORROSIVE TO THE SKIN. BRIEF CONTACT HAS NO EFFECT, BUT PROLONGED CONTACT RESULTS IN A LOCAL HYPEREMIA AND LATER VESICULAR OR PUSTULAR ERUPTION. THE MOIST MUCOUS MEMBRANES ARE MOST SENSITIVE TO THE IRRITANT ACTION. CONJUNCTIVA, MOIST AND MACERATED AREAS OF SKIN, THE EYELIDS, THE ANGLES OF THE EARS, NOSE, MOUTH, AND RESPIRATORY MUCOSA ARE ALSO VULNERABLE TO THE IRRITANT EFFECTS. THE WRISTS ARE COMMON SITES OF DERMATITIS, AS ARE THE GENITALIA IF PERSONAL HYGIENE IS POOR. PERFORATION OF THE NASAL SEPTUM MAY OCCUR. ARSENIC TRIOXIDE AND PENTOXIDE ARE CAPABLE OF PRODUCING SKIN SENSITIZATION AND CONTACT DERMATITIS. ARSENIC IS ALSO CAPABLE OF PRODUCING KERATOSES, ESPECIALLY OF THE PALMS AND SOLES. ARSENIC HAS BEEN CITED AS A CAUSE OF SKIN CANCER, BUT THE INCIDENCE IS LOW. THE ACUTE TOXIC EFFECTS OF ARSENIC ARE GENERALLY SEEN FOLLOWING INGESTION OF INORGANIC ARSENICAL COMPOUNDS. THIS RARELY OCCURS IN AN INDUSTRIAL SETTING. SYMPTOMS DEVELOP WITHIN ONE HALF TO 4 HOURS FOLLOWING INGESTION AND ARE USUALLY CHARACTERIZED BY CONSTRICTION OF THE THROAT FOLLOWED BY DYSPHAGIA, EPICASTRIC PAIN, VOMITING, WATERY DIRRHEA, AND BLOOD IN STOOLS AND VOMITUS. INHALATION OF INORGANIC ARSENIC COMPOUNDS IS THE MOST COMMON CAUSE OF CHRONIC POISONING IN THE INDUSTRIAL SITUATION. THIS CONDITION IS DIVIDED INTO THREE PHASES BASED ON SIGNS AND SYMPTOMS. FIRST PHASE, THE WORKER COMPLAINS OF WEAKNESS, LOSS OF APPETITE, SOME NAUSEA, OCCASIONAL VOMITING, A SENSE OF HEAVINESS IN THE STOMACH, AND SOME DIARRHEA. SECOND PHASE, THE WORKER COM- PLAINS OF CONJUNCTIVITIS, A CATARRHAL STATE OF THE MUCOUS MEMBRANES OF THE NOSE, LARYNX, AND RESPIRATORY PASSAGE. CORYZA, HOARSENESS, AND MILD TRACHEOBRONCHITIS MAY OCCUR. PERFORATION OF THE NASAL SEPTUM IS COMMON, AND IS PROBABLY THE MOST TYPICAL LESION OF THE UPPER RESPIRATORY TRACT IN OCCUPATIONAL EXPOSURE TO ARSENICAL DUST. SKIN LESIONS, ECZEMATOID AND ALLERGIC IN TYPE, ARE COMMON. THIRD PHASE, THE WORKER COMPLAINS OF SYMPTOMS OF PERIPHERAL NEURITIS, INITIALLY OF HANDS AND FEET, WHICH IS ESSENTIALLY SENSORY. IN MORE SEVERE CASES, MOTOR PARALYSES OCCUR, THE FIRST MUSCLES AFFECTED ARE USUALLY THE TOE EXTENSORS AND THE PERONEI. IN ONLY THE MOST SEVERE CASES WILL PARALYSIS OF FLEXOR MUSLES OF THE FEET OR OF THE EXTENSOR MUSCLES OF HANDS OCCUR. LIVER DAMAGE FROM CHRONIC ARSENICAL POISONING IS STILL DEBATED, AND AS YET THE QUESTION IS UNANSWERED. IN CASES OF CHRONIC AND ACUTE ARSENICAL POISONING, TOXIC EFFECTS TO THE MYOCARDIUM HAVE BEEN REPORTED BASED ON EKG CHANGES. THESE FINDINGS, HOWEVER, ARE NOW LARGELY LARGELY DISCOUNTED AND THE EKG CHANGES ARE ASCRIBED TO ELECTROLYTE DISTURBANCES CONCOMITANT WITH ARSENICALISM. IHHALATION OF ARSENIC TROXIDE AND OTHER INOR- GANIC ARSENICAL DUSTS DOES NOT GIVE RISE TO RADIOLOGICAL EVIDENCE OF PNEU- MOCONIOSIS. ARSENIC DOES HAVE A DEPRESSANT EFFECT UPON THE BONE MARROW, WITH DISTURBANCES OF BOTH ERYTHROPOIESIS AND MYELOPOIESIS. EVIDENCE IS NOW AVAIL- ABLE INCRIMINATING ARSENIC COMPOUNDS AS A CAUSE OF LUNG CANCER AS WELL AS SKIN

CANCER. THE FEDERAL STANDARD FOR ARSENIC AND ITS COMPOUNDS IS 0.5 MG/M3 OF AIR AS AS. NIOSH HAS RECOMMENDED 0.002 MG/M3 OF AIR AS AS BASED ON ITS CARCINOGENIC EFFECTS. THIS SUBSTANCE WAS FOUND TO BE TERATOGENIC IN MICE. CONSULT THE BNL CARCINOGEN, MUTAGEN, TERATOGEN GUIDE 2.2.1 FOR INFORMATION ON PROPER HANDLING PROCEDURES.

Emergency and First Aid Procedures:

INCASE OF EXPOSURE TO ARSENIC, REMOVE INDIVIDUAL FROM EXPOSURE AND SEEK IMMEDIATE MEDICAL ATTENTION. IF ARSENIC COMES IN CONTACT WITH SKIN, WASH AREA IMMEDIATELY, AND SEEK MEDICAL HELP AT ONCE.

SECTION VII -- PRECAUTIONS FOR SAFE HANDLING AND USE

Shipping and Transportation:

THIS IS A D.O.T REGULATED NOTINAL.
CONSULT SHIPPING DEPARTMENT FOR SHIPPING AND LABELING REQUIREMENTS.

Precautions to be taken in Handling and Storing:

ARSENIC SHOULD BE KEPT IN LOCKED CABINETS.

SECTION VIII -- CONTROL MEASURES

NO CONTROL MEASURES ENTERED FOR THIS MATERIAL.

001482

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915,1916, 1917)

SECTION I

MANUFACTURER'S NAME: NUCLEAR LEAD COMPANY, INC.	EMERGENCY TELEPHONE NO.: (615) 483-8718
ADDRESS (Number, Street, City, and Zip Code): P. O. Box 532, Oak Ridge, Tennessee 37831-0532	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS: Lead (Fabrications/Forms)
CHEMICAL FAMILY	FORMULA: 99.9+%

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL Lead PB	99.9	.05 mg/m3
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F)	2984	SPECIFIC GRAVITY (H_2O=1)	11.35
VAPOR PRESSURE (mm Hg.)	N/A	PERCENT, VOLATILE BY VOLUME (%)	N/A
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE (_____=1)	N/A
SOLUBILITY IN WATER	None		

APPEARANCE AND ODOR: Gray to Silver Metallic No Odor

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used): Non-Flammable	FLAMMABLE LIMITS: N/A	Lel	Uel

EXTINGUISHING MEDIA: No specific agents recommended

SPECIAL FIRE FIGHTING PROCEDURES

If involved in fire, use NIOSH/MSHA approved self contained breathing apparatus and full protective clothing.

UNUSUAL FIRE AND EXPLOSION HAZARDS: None

14801

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE

* Lead - .05mg/M^3

Effects of Overexposure: Prolonged excessive absorption of inorganic lead by ingestion or inhalation of dust and fume is characterized by abdominal pain or what is sometimes referred to as "lead colic", metallic taste in mouth, loss of weight, pain in muscles and muscular weakness. The similarity of symptoms with those of other illnesses require that excessive absorption of lead be verified by medical examination and analysis of biological specimens.

Emergency and First Aid Procedures: Skin: If molten, treat as burn. Eyes: Flush with clean water. If molten, treat as burn.

Inhalation: Remove patient from area to fresh air. Refer to physician.

Ingestion: Water, vomit. Refer to physician.

SECTION VI - REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		
	STABLE	X	

INCOMPATABILITY (Materials to avoid)

Strong Oxidizers, Hydrogen Peroxide. Active Metals: Sodium, Potassium

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	X	

N/A

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

1) When molten, allow to cool (solidify) 2) Clean up using recommended dustless methods (i.e. vacuum, etc.) 3) Place in closed containers.

WASTE DISPOSAL METHOD

This material may have value on a recycled basis. Comply with applicable Federal, State & Local Regulations. If non-recyclable, and hazardous under 40 CFR 261, Subparts B & C, material must be treated or disposed in a facility meeting the requirements of 40 CFR 264 or 265. If recyclable or non-hazardous, material should be recycled or disposed in a facility meeting the requirements of 40 CFR 257.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) If TLV(s) exceeded, see OSHA 29 CFR 1910.1025 (lead) - Table II (ANSI Z88.2 - 1969 NIOSH-BOM approved respirators only).

VENTILATION	LOCAL EXHAUST	SPECIAL
	ANSI Z9. 2-1960 (Fume hood over melting area).	
	MECHANICAL (General)	OTHER
	ACGIH "Industrial Ventilation" 13th Edition.	

PROTECTIVE GLOVES	EYE PROTECTION
(Heat) protective	Goggles, Safety Glasses, &/Or Faceshield.

OTHER PROTECTIVE EQUIPMENT

As required to meet applicable OSHA 1910.1025 when TLV(s) exceeded.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Wash hands after handling. Practice good housekeeping procedures. Activities that generate dust or fume should be avoided.

OTHER PRECAUTIONS

Do not permit smoking, eating, or drinking while handling material. Practice good personal hygiene procedures. Keep melting temperatures as low as possible to minimize the generation of fumes. If TLV(s) exceeded, see OSHA 29CFR 1910-1025.

1)* Note: At or Above the "Action Level" (0.03 mg/M^3 8 hr. TWA) refer to applicable requirements of OSHA 29CFR 1910.1025 (Lead).

Toluene (Toluol)

10211

153-TOL

MATERIAL SAFETY DATA SHEET

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MANUFACTURER'S NAME
THE SHERWIN-WILLIAMS COMPANY
101 Prospect Avenue N.W.
Cleveland, Ohio 44115

EMERGENCY TELEPHONE NO.
(216) 566-2917

DATE OF PREPARATION
1-Jun-91

INFORMATION TELEPHONE NO.
(216) 566-2902

Section I — PRODUCT IDENTIFICATION

PRODUCT NAME AND NUMBERS
Toluene (Toluol)

153-7917	153-7916	153-7970	153-7994
(153-7717)	(153-7746)	153-8222	153-8250
153-7951	153-7989	154-2304	154-2372

Section II — HAZARDOUS INGREDIENTS

CAS No.	Ingredient	% by Weight	ACGIH-TLV	OSHA-PEL	Units	V.P.
108-88-3 §	Toluene.	100	100	100	PPM	22.0
			STEL 150	150	PPM	

§ Ingredient subject to the reporting requirements of the Superfund Amendments and Reauthorization Act (SARA) Section 313, 40 CFR 372.65 C

Section III — PHYSICAL DATA

PRODUCT WEIGHT – 7.18 lb./gal.
SPECIFIC GRAVITY – 0.86
BOILING RANGE – 212-230 °F
VOLATILE VOLUME – 100 %
VOC (Theoretical) – 7.10 lb. 860 gm.

EVAPORATION RATE – Slower than Ether
VAPOR DENSITY – Heavier than Air
MELTING POINT – N.A.
SOLUBILITY IN WATER – N.A.
pH/S – 2 3 0

Section IV — FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION FLASH POINT 40 °F TCC LEL 1.0 UEL 7.0
RED LABEL – Flammable, Flash below 100 °F

EXTINGUISHING MEDIA
Carbon Dioxide, Dry Chemical, Foam

UNUSUAL FIRE AND EXPLOSION HAZARDS
Keep containers tightly closed. Isolate from heat, electrical equipment, sparks, and open flame. Closed containers may explode when exposed to extreme heat. Application to hot surfaces requires special precautions. During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Obtain medical attention.

SPECIAL FIRE FIGHTING PROCEDURES
Full protective equipment including self-contained breathing apparatus should be used. Water spray may be ineffective. If water is used, fog nozzles are preferable. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat.

Section V — HEALTH HAZARD DATA

ROUTES OF EXPOSURE
Exposure may be by INHALATION and/or SKIN or EYE contact, depending on conditions of use. To minimize exposure, follow recommendations for proper use, ventilation, and personal protective equipment.

ACUTE Health Hazards

EFFECTS OF OVEREXPOSURE
Irritation of eyes, skin and respiratory system. May cause nervous system depression. Extreme overexposure may result in unconsciousness and possibly death.

SIGNS AND SYMPTOMS OF OVEREXPOSURE
Headache, dizziness, nausea, and loss of coordination are indications of excessive exposure to vapors or spray mists.
Redness and itching or burning sensation may indicate eye or excessive skin exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
None generally recognized.

EMERGENCY AND FIRST AID PROCEDURES
If INHALED: If affected, remove from exposure. Restore breathing. Keep warm and quiet.
If on SKIN: Wash affected area thoroughly with soap and water. Remove contaminated clothing and launder before re-use.
If in EYES: Flush eyes with large amounts of water for 15 minutes. Get medical attention.
If SWALLOWED: Never give anything by mouth to an unconscious person. DO NOT INDUCE VOMITING. Give several glasses of water. Seek medical attention.

CHRONIC Health Hazards
No ingredient in this product is an IARC, NTP or OSHA listed carcinogen.
Prolonged overexposure to solvent ingredients in Section II may cause adverse effects to the liver, urinary, blood forming, and cardio-vascular systems.
Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage.

Section VI — REACTIVITY DATA

STABILITY – Stable
INCOMPATIBILITY
None known.
HAZARDOUS DECOMPOSITION PRODUCTS
By fire: Carbon Dioxide, Carbon Monoxide
HAZARDOUS POLYMERIZATION – Will Not Occur

Section VII — SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Remove all sources of ignition. Ventilate and remove with inert absorbent.

WASTE DISPOSAL METHOD
Waste from this product may be hazardous as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Waste must be tested for ignitability to determine the applicable EPA hazardous waste numbers.
Incinerate in approved facility. Do not incinerate closed container. Dispose of in accordance with Federal, State, and Local regulations regarding pollution.

Section VIII — PROTECTION INFORMATION

PRECAUTIONS TO BE TAKEN IN USE
Use only with adequate ventilation. Avoid breathing vapor and spray mist. Avoid contact with skin and eyes. Wash hands after using.

VENTILATION
Local exhaust preferable. General exhaust acceptable if the exposure to materials in Section II is maintained below applicable exposure limits. Refer to OSHA Standards 1910.94, 1910.107, 1910.108.

RESPIRATORY PROTECTION
If personal exposure cannot be controlled below applicable limits by ventilation, wear a properly fitted organic vapor/particulate respirator approved by NIOSH/MSHA for protection against materials in Section II.

PROTECTIVE GLOVES
Wear gloves which are recommended by glove supplier for protection against materials in Section II.

EYE PROTECTION
Wear safety spectacles with unperforated sideshields.

Section IX — PRECAUTIONS

DOL STORAGE CATEGORY – 1B

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Contents are FLAMMABLE. Keep away from heat, sparks, and open flame.
During use and until all vapors are gone: Keep area ventilated - Do not smoke - Extinguish all flames, pilot lights, and heaters - Turn off stoves, electric tools and appliances, and any other sources of ignition.
Consult NFPA Code. Use approved Bonding and Grounding procedures.
Keep container closed when not in use. Transfer only to approved containers with complete and appropriate labeling. Do not take internally. Keep out of the reach of children.

OTHER PRECAUTIONS
Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

The above information pertains to this product as currently formulated, and is based on the information available at this time. Addition of reducers or other additives to this product may substantially alter the composition and hazards of the product. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information.

11825 71

BENZENE

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796- 7100

EMERGENCY NUMBER: (201) 796-7100
CHEMTREC ASSISTANCE: (800) 424-9300

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 71-43-2

SUBSTANCE: **BENZENE**

TRADE NAMES/SYNONYMS:
BENZOL; CYCLOHEXATRIENE; BENZOLE; PHENE; PYROBENZOL; PYROBENZOLE; CARBON OIL; COAL TAR NAPHTHA; PHENYL HYDRIDE; BENZOLENE; BICARBURET OF HYDROGEN; COAL NAPHTHA; MOTOR BENZOL; ANNULENE; (6)ANNULENE; RCRA U019; STCC 4908110; UN 1114; B-426; 13065; B-243; B-245-S; B-245; B-411; C6H6;

CHEMICAL FAMILY:
HYDROCARBON, AROMATIC

MOLECULAR FORMULA: C6-H6

MOLECULAR WEIGHT: 78.11

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=1

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: BENZENE PERCENT: >99
CAS# 71-43-2
OTHER CONTAMINANTS: 0.15% NON-AROMATICS; 1 PPM THIOPHENE

EXPOSURE LIMITS:
BENZENE:
1 PPM OSHA TWA; 5 PPM OSHA 15 MINUTE STEL;
0.5 PPM OSHA ACTION LEVEL
10 PPM (30 MG/M3) ACGIH TWA;
ACGIH A2-SUSPECTED HUMAN CARCINOGEN
0.1 PPM (0.32 MG/M3) NIOSH RECOMMENDED 8 HOUR TWA;
1 PPM (3.2 MG/M3) NIOSH RECOMMENDED 15 MINUTE CEILING

10 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING
SUBJECT TO CALIFORNIA PROPOSITION 65 CANCER AND/OR REPRODUCTIVE TOXICITY WARNING AND RELEASE REQUIREMENTS- (FEBRUARY 27, 1987)

PHYSICAL DATA

DESCRIPTION: COLORLESS TO LIGHT YELLOW LIQUID WITH AN AROMATIC ODOR

BOILING POINT: 176 F (80 C) MELTING POINT: 42 F (6 C)

SPECIFIC GRAVITY: 0.8765 @ 20 C VISCOSITY: 0.6468 CP @ 20 C

VOLATILITY: 100% VAPOR PRESSURE: 75 MMHG @ 20 C

EVAPORATION RATE: (BUTYL ACETATE = 1) 5.1 SOLUBILITY IN WATER: 0.18% @ 25 C

ODOR THRESHOLD: 4.68 PPM VAPOR DENSITY: 2.8

SOLVENT SOLUBILITY: ACETONE, ALCOHOL, CARBON DISULFIDE, ACETIC ACID, CARBON TETRACHLORIDE, CHLOROFORM, ETHER, OILS

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.
MODERATE EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME.

VAPOR-AIR MIXTURES ARE EXPLOSIVE ABOVE FLASH POINT.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

DUE TO LOW ELECTROCONDUCTIVITY OF THE SUBSTANCE, FLOW OR AGITATION MAY GENERATE ELECTROSTATIC CHARGES RESULTING IN SPARKS WITH POSSIBLE IGNITION.

FLASH POINT: 12 F (-11 C) (CC) UPPER EXPLOSIVE LIMIT: 7.8%

LOWER EXPLOSIVE LIMIT: 1.2% AUTOIGNITION TEMP.: 928 F (498 C)

FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR STANDARD FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. COOL FIRE-EXPOSED CONTAINERS WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM STORAGE TANK ENDS. FOR MASSIVE FIRE IN STORAGE AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES, ELSE WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF STORAGE TANK DUE TO FIRE (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 27).

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EXTINGUISH ONLY IF FLOW CAN BE STOPPED. USE WATER IN FLOODING QUANTITIES AS A FOG; SOLID STREAMS MAY SPREAD FIRE. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER; APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING HAZARDOUS MATERIALS; KEEP UPWIND. EVACUATE TO A RADIUS OF 1500 FEET FOR UNCONTROLLABLE FIRES. CONSIDER EVACUATION OF DOWNWIND AREA IF MATERIAL IS LEAKING.

WATER MAY BE INEFFECTIVE (NFPA 325M, FIRE HAZARD PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND VOLATILE SOLIDS, 1984)

FIRE FIGHTING PHASES: DRY CHEMICAL, ALCOHOL FOAM OR CARBON DIOXIDE. WATER MAY BE INEFFECTIVE. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL. IF A LEAK OR SPILL HAS NOT IGNITED, USE WATER SPRAY TO DISPERSE THE VAPORS AND TO PROVIDE PROTECTION FOR THE MEN ATTEMPTING TO STOP THE LEAK. WATER SPRAY MAY BE USED TO FLUSH SPILLS AWAY FROM EXPOSURES (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND SUBPART E:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.119
EXCEPTIONS: 49 CFR 173.118

TOXICITY

BENZENE:

IRRITATION DATA: 20 MG/24 HOURS SKIN-RABBIT MODERATE; 15 MG/24 HOURS OPEN SKIN-RABBIT MILD; 88 MG EYE-RABBIT MODERATE; 2 MG/24 HOURS EYE-RABBIT SEVERE.

TOXICITY DATA: 2000 PPM/5 MINUTES INHALATION-HUMAN LCLO; 2 PPH/5 MINUTES INHALATION-HUMAN LCLO; 65 MG/M3/5 YEARS INHALATION-HUMAN LCLO; 100 PPM INHALATION-HUMAN TCLO; 150 PPM/1 YEAR INTERMITTENT INHALATION-MAN TCLO; 20,000 PPM/5 MINUTES INHALATION-MAMMAL LCLO; 10,000 PPM/7 HOURS INHALATION-RAT LC50; 9980 PPM INHALATION-MOUSE LC50; 146,000 MG/M3 INHALATION-DOG LCLO; 170,000 MG/M3 INHALATION-CAT LCLO; 45000 PPM/30 MINUTES INHALATION-RABBIT LCLO; 50 MG/KG ORAL-MAN LDLO: 3306 MG/KG ORAL-RAT LD50; 4700 MG/KG ORAL-MOUSE LD50; 2000 MG/KG ORAL-DOG LDLO; 88 MG/KG INTRAVENOUS-RABBIT LDLO; 2890 UG/KG INTRAPERITONEAL-RAT LD50; 340 MG/KG INTRAPERITONEAL-MOUSE LD50; 527 MG/KG INTRAPERITONEAL-GUINEA PIG LDLO; 194 MG/KG UNREPORTED-MAN LDLO; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS).

CARCINOGEN STATUS: OSHA CARCINOGEN; KNOWN HUMAN CARCINOGEN (NTP); HUMAN SUFFICIENT EVIDENCE, ANIMAL SUFFICIENT EVIDENCE (IARC GROUP-1). THE RELATIONSHIP BETWEEN EXPOSURE TO BENZENE AND THE DEVELOPMENT OF ACUTE MYELOGENOUS LEUKEMIA HAS BEEN ESTABLISHED IN EPIDEMIOLOGICAL STUDIES.

LOCAL EFFECTS: IRRITANT- SKIN, EYE.

ACUTE TOXICITY LEVEL: MODERATELY TOXIC BY INHALATION AND INGESTION.

TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT; BONE MARROW DEPRESSANT. POISONING MAY ALSO AFFECT THE IMMUNE, HEMATOPOIETIC AND NERVOUS SYSTEMS.

AT INCREASED RISK FROM EXPOSURE: PERSONS WITH CERTAIN IMMUNOLOGICAL TENDENCIES.

ADDITIONAL DATA: USE OF ALCOHOLIC BEVERAGES MAY ENHANCE THE TOXIC EFFECTS. USE OF STIMULANTS SUCH AS EPINEPHRINE MAY CAUSE CARDIAC ARRHYTHMIAS.

HEALTH EFFECTS AND FIRST AID

INHALATION:
BENZENE:
IRRITANT/NARCOTIC/BONE MARROW DEPRESSANT/CARCINOGEN.

ACUTE EXPOSURE- CONCENTRATIONS OF 3000 PPM MAY CAUSE RESPIRATORY TRACT IRRITATION; MORE SEVERE EXPOSURES MAY RESULT IN PULMONARY EDEMA. SYSTEMIC EFFECTS ARE MAINLY ON THE CENTRAL NERVOUS SYSTEM AND DEPEND ON EXPOSURE TIME AND CONCENTRATION. NO EFFECTS WERE NOTED AT 25 PPM FOR 8 HOURS; SIGNS OF INTOXICATION BEGAN AT 50-150 PPM WITHIN 5 HOURS; AT 500-1500 PPM, WITHIN 1 HOUR; WERE SEVERE AT 7500 PPM, WITHIN 30-60 MINUTES; AND 20,000 PPM WAS FATAL WITHIN 5-10 MINUTES. EFFECTS MAY INCLUDE NAUSEA, VOMITING, HEADACHE, DIZZINESS, DROWSINESS, WEAKNESS, SOMETIMES PRECEDED BY A BRIEF PERIOD OF EXHILARATION OR EUPHORIA, IRRITABILITY, MALAISE, CONFUSION, ATAXIA, STAGGERING, WEAK, RAPID PULSE, CHEST PAIN AND TIGHTNESS WITH BREATHLESSNESS, PALLOR, CYANOSIS OF THE LIPS AND FINGERTIPS, AND TINNITUS. IN SEVERE EXPOSURES THERE MAY BE BLURRED VISION, SHALLOW, RAPID BREATHING, DELIRIUM, CARDIAC ARRHYTHMIAS, UNCONSCIOUSNESS, DEEP ANESTHESIA, PARALYSIS, AND COMA CHARACTERIZED BY MOTOR RESTLESSNESS, TREMORS AND HYPERREFLEXIA, SOMETIMES PRECEDED BY CONVULSIONS. RECOVERY DEPENDS ON THE SEVERITY OF EXPOSURE. POLYNEURITIS MAY OCCUR AND THERE MAY BE PERSISTENT NAUSEA, ANOREXIA, MUSCULAR WEAKNESS, HEADACHE, DROWSINESS, INSOMNIA, AND AGITATION. NERVOUS IRRITABILITY, BREATHLESSNESS, AND UNSTEADY GAIT MAY PERSIST FOR 2-3 WEEKS; A PECULIAR SKIN COLOR AND CARDIAC DISTRESS MAY PERSIST FOR 4 WEEKS. LIVER AND KIDNEY EFFECTS MAY OCCUR, BUT ARE USUALLY MILD, TEMPORARY IMPAIRMENTS. CHROMOSOMAL DAMAGE HAS BEEN FOUND AFTER EXPOSURE TO TOXIC LEVELS. ALTHOUGH GENERALLY HEMATOTOXICITY IS NOT A SIGNIFICANT CONCERN IN ACUTE EXPOSURE. DELAYED HEMATOLOGICAL EFFECTS, INCLUDING ANEMIA AND THROMBOCYTOPENIA, HAVE BEEN REPORTED, AS HAVE HEMORRHAGES, SPONTANEOUS BLEEDING AND SECONDARY INFECTIONS. IN FATAL EXPOSURES, DEATH MAY BE DUE TO ASPHYXIA, CENTRAL NERVOUS SYSTEM DEPRESSION, CARDIAC OR RESPIRATORY FAILURE AND CIRCULATORY COLLAPSE, OR OCCASIONALLY, SUDDEN VENTRICULAR FIBRILLATION. IT MAY OCCUR WITHIN A FEW MINUTES TO SEVERAL HOURS, OR CARDIAC ARRYTHMIA MAY OCCUR AT ANYTIME WITHIN 24 HOURS. ALSO, DEATH FROM CENTRAL NERVOUS SYSTEM, RESPIRATORY OR HEMORRHAGIC COMPLICATIONS MAY OCCUR UP TO 5 DAYS AFTER EXPOSURE- PATHOLOGIC FINDINGS HAVE INCLUDED RESPIRATORY INFLAMMATION WITH EDEMA AND HEMORRHAGE OF THE LUNGS, RENAL CONGESTION, CEREBRAL EDEMA, AND EXTENSIVE PETECHIAL HEMORRHAGES IN THE BRAIN, PLEURAE, PERICARDIUM, URINARY TRACT, MUCOUS MEMBRANES, AND SKIN.

CHRONIC EXPOSURE- LONGTERM EXPOSURE MAY CAUSE SYMPTOMS REFERABLE TO THE CENTRAL NERVOUS, HEMATOPOIETIC AND IMMUNE SYSTEMS. EARLY EFFECTS ARE VAGUE AND VARIED AND MAY INCLUDE HEADACHE, LIGHT-HEADEDNESS, DIZZINESS, NAUSEA, ANOREXIA, ABDOMINAL DISCOMFORT, AND FATIGUE. SORE, DRY THROAT, WEAKNESS, LETHARGY, MALAISE, DROWSINESS, NERVOUSNESS, AND IRRITABILITY HAVE ALSO BEEN REPORTED. LATER THERE MAY BE DYSPNEA, PALLOR, SLIGHTLY INCREASED TEMPERATURE, DECREASED BLOOD PRESSURE, RAPID PULSE, PALPITATIONS, AND VISUAL DISTURBANCES. DIZZINESS WHEN COLD WATER IS PLACED IN THE EAR AND HEARING IMPAIRMENT HAVE BEEN REPORTED, AS HAVE DIFFUSE CEREBRAL ATROPHY ASSOCIATED WITH ATAXIA, TREMORS AND EMOTIONAL LABILITY. WORKERS EXPOSED TO BENZENE IN COMBINATION WITH OTHER SOLVENTS HAVE EXHIBITED POLYNEURITIS. SEVERAL CASE REPORTS, ONE OF THEM AN ACUTE EXPOSURE, SUGGEST THE POSSIBILITY THAT SYSTEMIC EXPOSURE MAY BE ASSOCIATED WITH RETROBULBAR OR OPTIC NEURITIS. OCCASIONALLY HEMORRHAGES IN RETINA AND CONJUNCTIVA

OCCUR AND RARELY NEURORETINAL EDEMA AND PAPILLEDEMA HAVE ACCOMPANIED THE RETINAL HEMORRHAGES. HEMATOLOGICAL EFFECTS VARY WIDELY AND MAY APPEAR AFTER A FEW WEEKS OR MANY YEARS OF EXPOSURE OR EVEN MANY YEARS AFTER EXPOSURE HAS CEASED. THE DEGREE OF EXPOSURE BELOW WHICH NO BLOOD EFFECTS WILL OCCUR CANNOT BE ESTABLISHED WITH CERTAINTY. IN THE EARLY STAGES, THERE MAY BE BLOOD CLOTTING DEFECTS DUE TO FUNCTIONAL, MORPHOLOGICAL AND QUANTITATIVE PLATELET ALTERATION WITH RESULTANT BLEEDING FROM THE NOSE AND GUMS, EASY BRUISING AND PETECHIAE; LEUKOPENIA WITH PREDOMINANT LYMPHOCYTOPENIA OR NEUTROPENIA; AND ANEMIA WHICH MAY BE NORMOCHROMIC OR MACROCYTIC AND HYPOCHROMIC. LEUKOCYTOSIS AND CIRCULATING IMMATURE MARROW CELLS HAVE ALSO BEEN REPORTED. BONE MARROW MAY BE HYPER-, HYPO- OR NORMOBLASTIC AND DOES NOT ALWAYS CORRELATE WITH THE PERIPHERAL BLOOD PICTURE. ALSO, THE SYMPTOMS DO NOT ALWAYS PARALLEL THE LABORATORY FINDINGS. IF TREATED AT THIS STAGE, THE EFFECTS APPEAR REVERSIBLE, ALTHOUGH RECOVERY MAY BE PROTRACTED AND THERE MAY BE RELAPSES. DECREASED ERYTHROCYTE SURVIVAL, HEMOLYSIS, CAPILLARY FRAGILITY, INTERNAL HEMORRHAGES, IRON METABOLISM DISTURBANCES, AND HYPERBILIRUBINEMIA HAVE ALSO BEEN REPORTED- EXPOSURE TO HIGH LEVELS FOR LONGER PERIODS MAY RESULT IN APLASIA AND FATTY DEGENERATION OF THE BONE MARROW WITH PANCYTOPENIA. THE MOST SERIOUS CASES OF APLASTIC ANEMIA MAY BE FATAL DUE TO HEMORRHAGE AND INFECTION; DEATH MAY OCCUR WITHIN 3 MONTH OF DIAGNOSIS- ENORMOUS VARIABILITY IN INDIVIDUAL RESPONSE, INCLUDING NON-DOSE DEPENDENT APLASIA, AND THE FINDING OF EOSINOPHILIA SUGGESTS THAT, IN SOME CASES, THE BLOOD DYSCRASIA MAY PARTIALLY BE AN ALLERGIC REACTION. NUMEROUS CASE REPORTS AND SERIES HAVE SUGGESTED A RELATIONSHIP BETWEEN EXPOSURE TO BENZENE AND THE OCCURRENCE OF VARIOUS TYPES OF LEUKEMIA. SEVERAL CASE-CONTROL STUDIES HAVE ALSO SHOWN INCREASED ODDS RATIOS FOR EXPOSURE TO BENZENE, BUT MIXED EXPOSURE PATTERNS AND POORLY DEFINED EXPOSURES RENDER THEIR INTERPRETATION DIFFICULT. THREE INDEPENDENT COHORT STUDIES HAVE DEMONSTRATED AN INCREASED INCIDENCE OF ACUTE NONLYMPHOCYTIC LEUKEMIA IN WORKERS EXPOSED TO BENZENE. ALTHOUGH APLASTIC ANEMIA IS PROBABLY THE MORE LIKELY CONSEQUENCE OF LONGTERM EXPOSURE, IT IS NOT UNCOMMON FOR AN INDIVIDUAL SURVIVING THIS, TO GO THROUGH A PRELEUKEMIC PHASE INTO FRANK LEUKEMIA. CONVERSELY, LEUKEMIA WITHOUT PRECEDENT APLASTIC ANEMIA CAN OCCUR. IN ONE STUDY THE RANGE OF TIME FROM THE START OF THE EXPOSURE TO THE DIAGNOSIS OF LEUKEMIA WAS 3-24 YEARS. IT HAS BEEN SUGGESTED THAT THE CHROMOSOMAL ABERRATIONS WHICH CAN ARISE IN PERIPHERAL BLOOD AND BONE MARROW CELLS AND PERSIST FOR A LONG TIME AFTER EXPOSURE CEASES, MAY BE ASSOCIATED WITH THE INCREASED INCIDENCE OF LEUKEMIA. THE IMMUNOSUPPRESSIVE EFFECT HAS ALSO BEEN SUGGESTED AS BEING ASSOCIATED WITH THE LEUKEMOGENESIS. ADVERSE EFFECTS ON THE IMMUNOLOGICAL SYSTEM HAVE BEEN SHOWN TO MAKE RABBITS MORE SUSCEPTIBLE TO TUBERCULOSIS AND PNEUMONIA AND MAY EXPLAIN WHY THE TERMINAL EVENT IN SOME CASES OF BENZENE INTOXICATION MAY BE OVERWHELMING INFECTION. EXPOSED MICE EXHIBITED A TENDENCY TOWARD INDUCTION OF LYMPHOID NEOPLASMS. RATS EXHIBITED AN INCREASED INCIDENCE OF NEOPLASMS, MAINLY CARCINOMAS, AT VARIOUS SITES. MENSTRUAL DISTURBANCES HAVE BEEN REPORTED MORE FREQUENTLY IN EXPOSED WOMEN. TESTICULAR DAMAGE HAS BEEN REPORTED IN RATS, RABBITS AND GUINEA PIGS. SOME ANIMAL STUDIES HAVE DEMONSTRATED EMBRYO/FETOTOXICITY, SOMETIMES AT LEVELS AS LOW AS 10 PPM AND THE POTENTIAL FOR TERATOGENIC EFFECTS SUCH AS DECREASED BODY WEIGHT AND SKELETAL VARIANTS, HAVE ALSO BEEN SHOWN. OTHER STUDIES HAVE NOT PRODUCED ANY ABNORMALITIES OR EMBRYOLETHALITY.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN

SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
BENZENE:
IRRITANT.
ACUTE EXPOSURE- DIRECT CONTACT MAY CAUSE IRRITATION. EFFECTS MAY INCLUDE ERYTHEMA, A BURNING SENSATION, AND WITH PROLONGED CONTACT, BLISTERING AND EDEMA. UNDER NORMAL CONDITIONS, SIGNIFICANT SIGNS OF SYSTEMIC TOXICITY ARE UNLIKELY FROM SKIN CONTACT ALONE DUE TO THE SLOW RATE OF ABSORPTION; IT MAY HOWEVER, CONTRIBUTE TO THE TOXICITY FROM INHALATION. APPLICATION TO GUINEA PIGS RESULTED IN INCREASED DERMAL PERMEABILITY.
CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT DEFATS THE SKIN AND MAY RESULT IN DERMATITIS WITH ERYTHEMA, SCALING, DRYNESS, VESICULATION, AND FISSURING, POSSIBLY ACCOMPANIED BY PARESTHESIAS OF THE FINGERS WHICH MAY PERSIST SEVERAL WEEKS AFTER THE DERMATITIS SUBSIDES. PERIPHERAL NEURITIS HAS ALSO BEEN REPORTED- SECONDARY INFECTIONS MAY OCCUR. TESTS ON GUINEA PIGS INDICATE SENSITIZATION IS POSSIBLE. ALTHOUGH ANIMAL STUDIES HAVE FAILED TO ESTABLISH A RELATIONSHIP BETWEEN SKIN CONTACT AND A CARCINOGENIC EFFECT, MOST OF THE STUDIES WERE INADEQUATE; SOME PAPILLOMAS AND HEMATOPOIETIC EFFECTS HAVE BEEN REPORTED.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
BENZENE:
IRRITANT.
ACUTE EXPOSURE- VAPOR CONCENTRATIONS OF 3000 PPM ARE VERY IRRITATING, EVEN ON BRIEF EXPOSURE. DROPLETS CAUSE MODERATE BURNING SENSATION, BUT ONLY A SLIGHT, TRANSIENT CORNEAL EPITHELIAL INJURY WITH RAPID RECOVERY.
CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE CONJUNCTIVITIS. 50% OF RATS EXPOSED TO 50 PPM FOR MORE THAN 600 HOURS DEVELOPED CATARACTS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
BENZENE:
NARCOTIC/CARCINOGEN.
ACUTE EXPOSURE- MAY CAUSE LOCAL IRRITATION AND BURNING SENSATION IN THE MOUTH, THROAT, AND STOMACH. SIGNS AND SYMPTOMS OF SYSTEMIC INTOXICATION MAY INCLUDE NAUSEA, VOMITING, HEADACHE, DIZZINESS, WEAKNESS, STAGGERING, CHEST PAIN AND TIGHTNESS, SHALLOW, RAPID PULSE, BREATHLESSNESS, PALLOR FOLLOWED BY FLUSHING, AND A FEAR OF IMPENDING DEATH. THERE MAY BE VISUAL DISTURBANCES AND CONVULSIONS. VIOLENT EXCITEMENT, EUPHORIA OR DELIRIUM MAY PRECEDE WEARINESS, FATIGUE AND SLEEPINESS FOLLOWED BY UNCONSCIOUSNESS, COMA AND DEATH. THOSE WHO SURVIVE THE CENTRAL NERVOUS SYSTEM EFFECTS MAY DEVELOP BRONCHITIS, PNEUMONIA, PULMONARY EDEMA, AND INTRAPULMONARY HEMORRHAGE. ASPIRATION MAY CAUSE IMMEDIATE PULMONARY EDEMA AND HEMORRHAGE. THE USUAL LETHAL DOSE IN HUMANS IS 10-15 MILLILITERS, BUT SMALLER AMOUNTS HAVE BEEN REPORTED TO CAUSE DEATH. A SINGLE EXPOSURE MAY PRODUCE LONGTERM EFFECTS WITH PANCYTOPENIA PERSISTING UP TO A YEAR.
CHRONIC EXPOSURE- DAILY ADMINISTRATION TO HUMANS OF 2-5 GRAMS IN OLIVE OIL

HAS CAUSED HEADACHE, VERTIGO, BLADDER IRRITABILITY, IMPOTENCE, GASTRIC DISTURBANCES, AND RENAL DYSFUNCTION, IN FEMALE RATS TREATED WITH 132 SINGLE DAILY DOSES OVER 187 DAYS, NO EFFECTS WERE OBSERVED AT 1 MG/KG; SLIGHT LEUKOPENIA AT 10 MG/KG; AND BOTH LEUKOPENIA AND ANEMIA AT 50 AND 100 MG/KG, IN A 2 YEAR GAVAGE STUDY WITH RATS AND MICE, THERE WAS AN INCREASED INCIDENCE OF LYMPHOMAS AND TUMORS OF THE ORAL CAVITY, SKIN, LUNGS, OVARIES, AND MAMMARY, HARDERIAN, AND PREPUTIAL GLANDS, IN A ONE YEAR GAVAGE STUDY, RATS GIVEN 50 OR 250 MG/KG, 4-5 DAYS/WEEK FOR 52 WEEKS DID NOT EXHIBIT ACUTE OR SUBACUTE TOXIC EFFECTS, BUT A DOSE CORRELATED INCREASE OF LEUKEMIAS AND MAMMARY CARCINOMAS WAS OBSERVED, REPRODUCTIVE EFFECTS HAVE SEEN REPORTED IN ANIMALS,

FIRST AID- EXTREME CARE MUST HE USED TO PREVENT ASPIRATION, GASTRIC LAVAGE WITH A CUFFED ENDOTRACHEAL TUBE IN PLACE TO PREVENT FURTHER ASPIRATION SHOULD DE DONE WITHIN 15 MINUTES, IN THE ABSENCE OF DEPRESSION OR CONVULSIONS OR IMPAIRED GAG REFLEX, EMESIS CAN ALSO BE INDUCED USING SYRUP OF IPECAC WITHOUT INCREASING THE HAZARD OF ASPIRATION (DREISBACH, HANDBOOK OF POISONING, 12TH ED,). TREAT SYMPTOMATICALLY AND SUPPORTIVELY, GASTRIC LAVAGE SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL, GET MEDICAL ATTENTION IMMEDIATELY,

ANTIDOTE:
NO SPECIFIC ANTIDOTE, TREAT SYMPTOMATICALLY AND SUPPORTIVELY,

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REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES,

INCOMPATIBILITIES:
BENZENE:
- ACIDS (STRONG): INCOMPATIBLE
- ALLYL CHLORIDE WITH DICHLOROETHYL ALUMINUM OR ETHYLALUMINUM SESQUICHLORIDE: POSSIBLE EXPLOSION.
- ARSENIC PENTAFLUORIDE + POTASSIUM METHOXIDE: EXFLOSIVE INTERACTION.
- BASES (STRONG): INCOMPATIBLE.
- BROMINE + IRON: INCOMPATIBLE.
- BROMINE PENTAFLUORIDE: FIRE AND EXPLOSION HAZARD.
- BROMINE TRIFLUORIDE: POSSIBLE EXPLOSION OR IGNITION.
- CHLORINE: EXPLOSION IN THE PRESENCE OF LIGHT.
- CHLORINE TRIFLUORIDE: VIOLENT REACTION WITH POSSIBLE EXPLOSION.
- CHROMIC ANHYDRIDE (POWDERED): IGNITION.
- DIBORANE: SPONTANEOUSLY EXPLOSIVE REACTION IN AIR.
- DIOXYGEN DIFLUORIDE: IGNITION, EVEN AT REDUCED TEMPERATURES.
- DIOXYGENYL TETRAFLUOROBORATE: IGNITION REACTION.
- INTERHALOGEN COMPOUNDS: IGNITION OR EXPLOSION.
- IODINE HEPTAFLUORIDE: IGNITION ON CONTACT.
- IODINE PENTAFLUORIDE: VIOLENT INTERACTION ABOVE 50 C,
- NITRIC ACID: VIOLENT OR EXPLOSIVE UNLESS PROPERLY AGITATED AND COOLED.
- NITRYL PERCHLORATE: EXPLOSIVE INTERACTION.
- OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
- OXYGEN (LIQUID): EXPLOSIVE MIXTURE.
- OZONE: FORMATION OF EXPLOSIVE GELATINOUS OZONIDE.
- PERCHLORATES (METAL): FORMATION OF EXPLOSIVE COMPLEX.
- PERCHLORYL FLUORIDE + ALUMINUM CHLORIDE; FORMATION OF SHOCK SENSITIVE COMPOUND.
- PERMANGANATES + SULFURIC ACID: POSSIBLE EXPLOSION.

PERMANGANIC ACTO: EXPLOSION HAZARD.
PEROXODISULFURIC ACID: EXPLOSION HAZARD.
PEROXOMONOSULFURIC ACID: EXFLOSIVE INTERACTION.
POTASSIUM PEROXIDE: IGNITION.
SILVER PERCHLORATE: FORMATION OF EXPLOSIVE COMPLEX.
SODIUM PEROXIDE + WATER: IGNITTON.
URANIUM HEXAFLUORIDE: VIOLENT, REACTION.

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF CARBON.

POLYMERIZATION;
HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL RECOMMENDATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE, FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

STORAGE

STORE IN ACCORDANCE WITH 29 CFR 1910.106.

BONDING AND GROUNDING: SUBSTANCES WITH LOW ELECTROCONDUCTIVITY, WHICH MAY BE IGNITED BY ELECTROSTATIC SPARKS, SHOULD BE STORED IN CONTAINERS WHICH MEET THE BONDING AND GROUNDING GUIDELINES SPECIFIED BY NFPA 77-1983, RECOMMENDED PRACTICE ON STATIC ELECTRICITY.

PROTECT AGAINST PHYSICAL DAMAGE, OUTSIDE OR DETACHED STORAGE IS PREFERABLE, INSIDE STORAGE SHOULD BE IN A STANDARD FLAMMABLE LIQUIDS STORAGE ROOM OR CABINET, SEPARATE FROM OXIDIZING MATERIALS (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

DISPOSAL

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 262, EPA HAZARDOUS WASTE NUMBER U019.

BENZENE - REGULATORY LEVEL: 0.5 MG/L
MATERIALS WHICH CONTAIN THE ABOVE SUBSTANCE AT OR ABOVE THE REGULATORY LEVEL MEET THE EPA CHARACTERISTIC OF TOXICITY, AND MUST BE DISPOSED OF IN ACCORDANCE WITH 40 CFR PART 262, EPA HAZARDOUS WASTE NUMBER D018.

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CONDITIONS TO AVOID

AVOID CONTACT WITH HEAT, SPARKS, FLAMES, OR OTHER SOURCES OF IGNITION, VAPORS MAY BE EXPLOSIVE, AVOID OVERHEATING OF CONTAINERS; CONTAINERS MAY VIOLENTLY RUPTURE IN HEAT OF FIRE, AVOID CONTAMINATION OF WATER SOURCES

SPILL AND LEAK PROCEDURES

SOIL SPILL:
DIG HOLDING AREA SUCH AS LAGOON, POND OR PIT FOR CONTAINMENT,
DIKE FLOW OF SPILLED MATERIAL USING SOIL OR SANDBAGS OR FOAMED BARRIERS SUCH AS POLYURETHANE OR CONCRETE.
USE CEMENT POWDER, FLY ASH, SAWDUST OR COMMERCIAL SORBENT TO ABSORB BULK LIQUID.
REDUCE VAPOR AND FIRE HAZARD WITH FLUOROCARBON WATER FOAM.

AIR SPILL:
KNOCK DOWN VAPORS WITH WATER SPRAY, KEEP UPWIND,

WATER SPILL:
LIMIT SPILL MOTION AND DISPERSION WITH NATURAL BARRIERS OR OIL SPILL CONTROL BOOMS.
APPLY DETERGENTS, SOAPS, ALCOHOLS OR ANOTHER SURFACE ACTIVE AGENT TO THICKEN SPILLED MATERIAL.
APPLY UNIVERSAL GELLING AGENT TO IMMOBILIZE TRAPPED SPILL AND INCREASE EFFICIENCY OF REMOVAL.
IF DISSOLVED, APPLY ACTIVATED CARBON AT TEN TIMES THE SPILLED AMOUNT IN THE REGION OF 10 PPM OR GREATER CONCENTRATION,
USE SUCTION HOSES TO REMOVE TRAPPED SPILL MATERIAL.
USE DREDGES OR LIFTS TO EXTRACT IMMOBILIZED MASSES OF POLLUTION AND PRECIPITATES.

OCCUPATIONAL SPILL:
SHUT OFF IGNITION SOURCES, STOP LEAK IF YOU CAN DO IT WITHOUT RISK, USE WATER SPRAY TO REDUCE VAPORS, FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL, FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL, NO SMOKING, FLAMES OR FLARES IN HAZARD AREA, KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND RESTRICT ENTRY,

REPORTABLE QUANTITY (RQ); 1000 POUNDS
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40), IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-3302 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET THE PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

BENZENE.
VENTILATION SHOULD MEET THE REQUIREMENTS IN 29 CFR 1910.1023(F).

RESPIRATOR:
THE FOLLOWING RESPIRATORS ARE THE MINIMUM LEGAL REQUIREMENTS AS SET FORTH BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION FOUND IN 29 CFR 1910, SUBPART Z.

BENZENE:

CONCENTRATION:	REQUIRED RESPIRATOR;
LESS THAN OR EQUAL TO 10 PPM-	HALF-MASK AIR-PURIFYING RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE.
LESS THAN OR EQUAL TO 50 PPM-	FULL FACEPIECE RESPIRATOR WITH ORGANIC VAPOR CARTRIDGES, FULL FACEPIECE GAS MASK WITH CHIN STYLE CANISTER.
LESS THAN OR EQUAL TO 100 PPM-	FULL FACEPIECE POWERED AIR-PURIFYING RESPIRATOR WITH ORGANIC VAPOR CANISTER.
LESS THAN OR EQUAL TO 1000 PPM-	SUPPLIED AIR RESPIRATOR WITH FULL FACEPIECE IN POSITIVE-PRESSURE MODE.
GREATER THAN 1000 PPM OR UNKNOWN CONCENTRATION-	SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE IN POSITIVE-PRESSURE MODE, FULL FACEPIECE POSITIVE-PRESSURE SUPPLIED-AIR RESPIRATOR WITH AUXILIARY SELF-CONTAINED AIR SUPPLY
ESCAPE-	ANY ORGANIC VAPOR GAS MASK. ANY SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE.
FIREFIGHTING-	FULL FACEPIECE SELF-CONTAINED BREATHING APPARATUS IN POSITIVE-PRESSURE MODE,

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS OR NIOSH CRITERIA DOCUMENTS.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION.

AT ANY DETECTABLE CONCENTRATION:

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE,
SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

SELF CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN

PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED TO PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

BENZENE:
PROTECTIVE CLOTHING SHOULD MEET THE REQUIREMENTS FOR PERSONAL PROTECTIVE EQUIPMENT IN 29 CFR 1910.1028(H).

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

BENZENE:
PROTECTIVE GLOVES SHOULD MEET THE REQUIREMENTS FOR PERSONAL PROTECTIVE EQUIPMENT IN 29 CFR 1910.1028(H).

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE,

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

BENZENE:
PROTECTIVE EYE EQUIPMENT SHOULD MEET THE REQUIREMENTS FOR PROTECTIVE CLOTHING AND EQUIPMENT IN 29 CFR 1910.1028(H).

AUTHORIZED - FISHER SCIENTIFIC, INC,
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-ADDITIONAL INFORMATION-

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PROP: Liquid. D: 1.046 @ 16°/4° bp: 126.5° @ 756 mm. Decomp in water; sol in alc and ether.

SYNS:

as-DIMETHYL SULPHATE
METHANESULPHONIC ACID METHYL ESTER
METHYL ESTER OF METHANESULFONIC ACID
METHYL ESTER OF METHANESULPHONIC ACID
METHYLMETHANSULFONAT (GERMAN)
METHYL METHANESULFONATE
METHYL METHANESULPHONATE
METHYL METHANSULFONATE
METHYL METHANSULPHONATE
MMS
NSC-50256

TOXICITY DATA:	CODEN:
mmo-sat 1 µL/plate	MUREAV 130,79,84
mma-sat 100 µg/plate	ENMUDM 6(Suppl 2),1,84
pic-bcs 50 mmol/L	IJEBA6 22,338,84
dns-dmg:emb 4500 µmol/L	MUREAV 112,215,83
dnr-smc 900 nmol/L	CNJGA8 24,771,82
sce-nml-skn 500 µmol/L	MUREAV 105,235,82
dns-hmn:fbr 2400 µmol/L	ENMUDM 7,267,85
dns-hmn:oth 100 µmol/L	TXAPA9 79,28,85
dnd-mus:emb 250 nmol/L	AJOGAH 148,929,84
orl-rat TDLo:100 mg/kg (1D male):REP	TJADAB 26(3),14A,82
ipr-rat TDLo:100 mg/kg (15D preg):TER	JRPFA4 18,15,69
ipr-rat TDLo:100 mg/kg (13D preg):TER	JRPFA4 17,325,68
orl-rat TDLo:420 mg/kg/2W-C:ETA	CRNGDP 6,1529,85
ipr-rat TDLo:72 mg/kg:ETA	NATUAS 223,947,69
scu-rat TDLo:184 mg/kg/46W-I:ETA	ZEKBAI 74,241,70
ivn-rat TDLo:30 mg/kg (21D preg):ETA,TER	43XWAI -,15,78
ivn-rat TDLo:96 mg/kg:ETA	ANYAA9 163,717,69
ivn-rat TDLo:20 mg/kg/(15D preg):ETA,TER	EJCAAH 8,641,72
unr-rat TDLo:20 mg/kg/(15D preg):ETA,TER	IARCCD 4,143,73
orl-mus TDLo:300 mg/kg/8W-I:NEO	TXAPA9 82,19,86
unr-rat TD :75 mg/kg/10W-I:ETA	BJCAAI 50,63,84
orl-mus TD :14 g/kg/78W-C:NEO	SCIEAS 161,913,68
orl-rat LD50:225 mg/kg	FCTXAV 19,347,81
ipr-rat LD50:114 mg/kg	FCTOD7 22,665,84
scu-rat LD50:125 mg/kg	ZEKBAI 74,241,70
ivn-rat LD50:175 mg/kg	ZEKBAI 74,241,70
ipr-mus LDLo:130 mg/kg	YOMJA9 20,105,79
ivn-dog LDLo:22 mg/kg	CCSUBJ 2,203,65
orl-qal LD50:75 mg/kg	JRPFA4 48,371,76
orl-bwd LD50:56200 µg/kg	AECTCV 12,355,83

IARC Cancer Review: Animal Sufficient Evidence IMEMDT 7,253,74. Reported in EPA TSCA Inventory. EPA Genetic Toxicology Program.

THR: Poison by ingestion, intraperitoneal, intravenous, and subcutaneous routes. An experimental carcinogen, neoplastigen, tumorigen and teratogen. Human mutagenic data. Experimental reproductive effects. When heated to decomposition it emits toxic fumes of SO_x. See also SULFONATES and ESTERS.

MLH750 *HR: 3*

METHYL METHACRYLATE

CAS: 80-62-6 NIOSH: OZ 5075000
DOT: 1247
mf: $C_5H_8O_2$ mw: 100.13

PROP: Colorless liquid, very sltly sol in water. Mp: −50°, bp: 101.0°, flash p: 50°F (OC), d: 0.936 @ 20°/4°, vap press: 40 mm @ 25.5°, vap d: 3.45, lel: 2.1%, uel: 12.5%.

SYNS:

DIAKON
METAKRYLAN METYLU (POLISH)
METHACRYLATE de METHYLE (FRENCH)
METHACRYLSAEUREMETHYL ESTER (GERMAN)
METHYLMETHACRYLAAT (DUTCH)
METHYL-METHACRYLAT (GERMAN)
METHYL METHACRYLATE MONOMER, INHIBITED (DOT)
METHYL-α-METHYLACRYLATE
METHYL-2-METHYL-2-PROPENOATE
2-METHYL-2-PROPENOIC ACID METHYL ESTER
METIL METACRILATO (ITALIAN)
MME
"MONOCITE" METHACRYLATE MONOMER
NCI-C50680
RCRA WASTE NUMBER U162

TOXICITY DATA:	CODEN:
skn-rbt 10 g/kg open	JIHTAB 23,343,41
eye-rbt 150 mg	INMEAF 14,292,45
mma-sat 34 mmol/L	JBJSA3 61-A,1203,79
cyt-rat-ihl 4 mg/m^3/16W	BZARAZ 27,102,74
mma-mus:lym 500 mg/L	ENMUDM 8(Suppl 6),4,86
ihl-rat TCLo:109 g/m^3/17M (6-15D preg):TER	TXAPA9 50,451,79
ihl-rat TCLo:54 mg/m^3/24H (8W pre):REP	GIPZAB 21(2),49,77
ipr-rat TDLo:405 mg/kg (5-15D preg):TER	JDREAF 51,1632,72
imp-rat TDLo:1620 mg/kg:ETA	CORTBR 88,223,72
ihl-hmn TCLo:125 ppm:CNS	GISAAA 19(10),25,54
ihl-hmn TCLo:60 mg/m^3:CNS,CVS	GTPZAB 1,56,57
orl-rat LD50:7872 mg/kg	JIHTAB 23,343,41
ihl-rat LC50:3750 ppm	14CYAT 2,1880,63
ipr-rat LD50:1328 mg/kg	JDREAF 51,1632,72
scu-rat LD50:7500 mg/kg	INMEAF 14,292,45
orl-mus LD50:5204 mg/kg	TOLED5 11,125,82
ihl-mus LCLo:13 g/m^3	GISAAA 20(8),19,55
ipr-mus LD50:1000 mg/kg	INMEAF 14,292,45
scu-mus LD50:6300 mg/kg	INMEAF 14,292,45
orl-dog LDLo:5000 mg/kg	INMEAF 14,292,45
scu-dog LD50:4500 mg/kg	INMEAF 14,292,45
orl-rbt LDLo:6550 mg/kg	JIHTAB 23,343,41
ihl-rbt LCLo:17500 mg/m^3/4H	JIHTAB 23,343,41
orl-gpg LD50:6300 mg/kg	INMEAF 14,292,45
ihl-gpg LCLo:19000 mg/m^3/5H	JIHTAB 23,343,41
ipr-gpg LD50:2000 mg/kg	INMEAF 14,292,45
scu-gpg LD50:6300 mg/kg	INMEAF 14,292,45

IARC Cancer Review: Human Inadequate Evidence IMEMDT 19,187,79; Animal Inadequate Evidence IMEMDT 19,187,79. NTP Carcinogenesis Studies (inha-

lation); No Evidence: mouse, rat NTPTR* NTP-TR-314,86. Reported in EPA TSCA Inventory. Community Right To Know List.

OSHA PEL: TWA 100 ppm
ACGIH TLV: TWA 100 ppm

DOT Classification: Flammable Liquid; Label: Flammable Liquid

THR: Moderately toxic by inhalation and intraperitoneal routes. Mildly toxic by ingestion. An experimental tumorigen and teratogen. Human systemic effects by inhalation: sleep effects, excitement, anorexia and blood pressure decrease. Experimental reproductive effects. Mutagenic data. A skin and eye irritant. A common air contaminant.

A very dangerous fire hazard when exposed to heat or flame; can react with oxidizing materials. Explosive in the form of vapor when exposed to heat or flame. The monomer may undergo spontaneous, explosive polymerization. Reacts in air to form a heat-sensitive explosive product (explodes on evaporation at 60°C). May ignite on contact with benzoyl peroxide. Potentially violent reaction with the polymerization initiators azoisobutyronitrile; dibenzoyl peroxide; di-tert-butyl peroxide; propionaldehyde. To fight fire, use foam, CO_2, dry chemical. When heated to decomposition it emits acrid smoke and irritating fumes. See also ESTERS.

MLI350 ***HR: 3***

METHYL-3-METHOXY CARBONYLAZOCROTONATE

CAS: 63160-33-8
mf: $C_7H_{10}N_2O_4$ mw: 186.17

$$CH_3OCO{\bullet}N{=}NC(CH_3){=}CHCO{\bullet}OCH_3$$

THR: Explodes during vacuum distillation. Potentially dangerous polymerization reaction during storage at room temperature. When heated to decomposition it emits toxic fumes of NO_x.

MLI750 ***HR: 3***

2-METHYL-5-METHOXY-N-DIMETHYLTRYPTAMINE

CAS: 67292-68-6 NIOSH: NL 7400000
mf: $C_{14}H_{20}N_2O$ mw: 232.36

SYNS:
4365 CT
3-(2-(DIMETHYLAMINO)ETHYL)-5-METHOXY-2-METHYLINDOLE
METHYL-2-METHOXY-5-N-DIMETHYLTRYPTAMINE

TOXICITY DATA:	CODEN:
ipr-rat LD50:74 mg/kg	BSCFAS (5),1411,65
ipr-mus LD50:100 mg/kg	BSCFAS (5),1411,65
ivn-mus LD50:48 mg/kg	BSCFAS (5),1411,65
ivn-rbt LD50:22 mg/kg	BSCFAS (5),1411,65

THR: Poison by intraperitoneal and intravenous routes. When heated to decomposition it emits toxic fumes of NO_x.

MLJ000 ***HR: 3***

METHYL(((METHOXYMETHYLPHOSPHINOTHIOYL)THIO)ACETYL) METHYLCARBAMATE

CAS: 29173-31-7 NIOSH: TA 7565000
mf: $C_7H_{14}NO_4PS_2$ mw: 271.31

SYNS:
MC 2420
MECARPHON

TOXICITY DATA:	CODEN:
orl-rat LD50:57 mg/kg	GUCHAZ 6,324,73
skn-rat LD50:720 mg/kg	FMCHA2 -,D191,80

THR: Poison by ingestion. Moderately toxic by skin contact. When heated to decomposition it emits very toxic fumes of SO_x, PO_x and NO_x. See also CARBAMATES.

MLJ500 ***HR: 3***

1-METHYL-6-(1-METHYLALLYL)-2,5-DITHIOBIUREA

CAS: 926-93-2 NIOSH: EC 1490000
mf: $C_7H_{14}N_4S_2$ mw: 218.37

SYNS:
AIMAX
AY-61122
COMPOUND 33.828
DITHIOCARBAMOYLHYDRAZINE
I.C.I. 33.828
MATCH
METALLIBURE
METHALLIBURE
1-α-METHYLALLYLTHIOCARBAMOYL-2-METHYLTHIOCARBAMOYLHYDRAZINE
N-((1-METHYLALLYL)THIOCARBAMOYL)-N'-(METHYLTHIOCARBAMOYL)HYDRAZINE
1-METHYL-6-(1-METHYLALLYL) DITHIOBIUREA
NSC-69536
SUISYNCHRON
TURISYNCHRON

TOXICITY DATA:	CODEN:
unr-wmn TDLo:30 mg/kg (30D pre):REP	JRPFA4 5,459,63
orl-rat TDLo:120 mg/kg (10D male):REP	JRPFA4 38,395,74
orl-rat TDLo:300 mg/kg (4-6D preg):TER	JRPFA4 7,211,64
orl-pig TDLo:5 mg/kg (25-34D preg):TER	CNVJA9 12,125,71
orl-rat LD50:1 g/kg	NATUAS 192,1191,61
ivn-mus LD50:180 mg/kg	CSLNX* NX#03991

THR: Poison by intravenous route. Moderately toxic by ingestion. An experimental teratogen. Human reproductive effects by unspecified route: menstrual cycle changes or disorders. Experimental reproductive effects. When heated to decomposition it emits very toxic fumes of SO_x and NO_x.

MLJ750 ***HR: 3***

2-METHYL-2-(METHYLAMINO)-1,3-BENZODIOXOLE HYDROCHLORIDE

CAS: 78186-61-5 NIOSH: DF 4921100
mf: $C_9H_{11}NO_2{\bullet}ClH$ mw: 201.67

TOXICITY DATA:	CODEN:
ivn-rat LD50:45 mg/kg	EJMCA5 12,413,77
ipr-mus LD50:100 mg/kg	EJMCA5 12,413,77

THR: Poison by intravenous and intraperitoneal routes. When heated to decomposition it emits very toxic fumes of HCl and NO_x.

MLK750 *HR: 3*

N-METHYL-4'-(p-METHYLAMINOPHENYLAZO) ACETANILIDE

CAS: 53499-68-6 NIOSH: AE 4950000

mf: $C_{16}H_{18}N_4O$ mw: 282.38

SYNS:

4-(N-ACETYL-N-METHYL)AMINO-4'-N-METHYLAMINOAZOBENZENE
N'-ACETYL-N'-MONOMETHYL-4'-AMINO-N-MONOMETHYL-4-AMINOAZOBENZENE
N-METHYL-N-(4-((4-(METHYLAMINO)PHENYL)AZO)PHENYL-ACETAMIDE)

TOXICITY DATA:	CODEN:
mma-sat 250 nmol/plate	CNREA8 46,1654,86
dns-rat:lvr 1 µmol/L	CNRAE8 46,1654,86
orl-rat TDLo:2500 mg/kg/17W-C:ETA	CNREA8 34,2274,74

THR: An experimental tumorigen. Mutagenic data. When heated to decomposition it emits toxic fumes of NO_x.

MLK800 *HR: 3*

6-METHYL-8-METHYLAMINO-s-TRIAZOLO (4,3-b)PYRIDAZINE

NIOSH: XZ 5493000

mf: $C_7H_9N_5$ mw: 163.21

SYNS:

COMPOSE 134 P (FRENCH)
134 P
METHYL-6-METHYL-AMINO-8-s-TRIAZOLO(4,3b)PYRIDAZINE (FRENCH)

TOXICITY DATA:	CODEN:
orl-rat LDLo:75 mg/kg	AIPTAK 121,154,59
orl-mus LDLo:54 mg/kg	AIPTAK 121,154,59
scu-mus LDLo:65 mg/kg	AIPTAK 121,154,59
ivn-mus LDLo:40 mg/kg	AIPTAK 121,154,59
ivn-rbt LDLo:70 mg/kg	AIPTAK 121,154,59

THR: Poison by ingestion, subcutaneous and intravenous routes. When heated to decomposition it emits toxic fumes of NO_x.

MLL250 *HR: 3*

METHYL-p-METHYLBENZENESULFONATE

CAS: 80-48-8 NIOSH: XT 7000000

mf: $C_8H_{10}O_3S$ mw: 186.24

PROP: Light brown crystals; crystals of ethyl ligroin. D: 1.230-1.238 @ 25°/25°, vap d: 6.45, mp: 28°. Insol in water; sol in benzene, very sol in alc and ether.

SYNS:

METHYLESTER KYSELINY p-TOLUENSULFONOVE (CZECH)
METHYL-4-METHYLBENZENESULFONATE
METHYL-p-TOLUENESULFONATE
METHYL TOLUENE-4-SULFONATE
METHYL TOSYLATE
METHYL-p-TOSYLATE
p-TOLUOLSULFONSAEURE METHYL ESTER (GERMAN)

TOXICITY DATA:	CODEN:
skn-rbt 500 mg/24H SEV	28ZPAK -,197,72
eye-rbt 500 mg/24H MLD	28ZPAK -,197,72
orl-rat TDLo:1400 mg/kg/2Y:ETA	ZEKBAI 74,241,70
scu-rat TDLo:50 mg/kg:ETA	FCTXAV 6,576,68
scu-rat TD :800 mg/kg/54W-I:ETA	ZEKBAI 74,241,70
orl-rat LD50:341 mg/kg	28ZPAK -,197,72
scu-rat LD50:250 mg/kg	ZEKBAI 74,241,70

Reported in EPA TSCA Inventory.

THR: Poison by ingestion and subcutaneous route. An experimental tumorigen. An eye and severe skin irritant. A vesicant and skin sensitizer. When heated to decomposition it emits toxic fumes of SO_x. See also ESTERS and SULFONATES.

MLL500 *HR: 3*

4-METHYL-1-(2-(2-METHYL-1,3-BENZODIOXOL-2-YL)ETHYL) PIPERAZINE HYDROCHLORIDE

CAS: 52400-65-4 NIOSH: DF 4921120

mf: $C_{15}H_{22}N_2O_2 \cdot ClH$ mw: 298.85

SYN: 2-METHYL-2-(2-(4-METHYL-1-PIPERAZINYL)ETHYL)-1,3-BENZODIOXOLE HYDROCHLORIDE

TOXICITY DATA:	CODEN:
ivn-rat LD50:20 mg/kg	EJMCA5 12,413,77
ipr-mus LD50:110 mg/kg	EJMCA5 12,413,77

THR: Poison by intravenous and intraperitoneal routes. When heated to decomposition it emits very toxic fumes of HCl and NO_x.

MLM500 *HR: 1*

2-METHYL-1-((2-METHYLCYCLOHEXYL)CARBONYL)PIPERIDINE

CAS: 68162-93-6 NIOSH: TN 1275800

mf: $C_{14}H_{25}NO$ mw: 223.40

SYN: AI3-36543

TOXICITY DATA:	CODEN:
skn-rbt 500 mg/24H MLD	NTIS** AD-A053-882
eye-rbt 100 mg MOD	NTIS** AD-A053-882

THR: A skin and eye irritant. When heated to decomposition it emits toxic fumes of NO_x.

MLM600 *HR: 2*

3-METHYL-1-((2-METHYLCYCLOHEXYL)CARBONYL)PIPERIDINE

CAS: 64387-78-6 NIOSH: TN 1276000

mf: $C_{14}H_{25}NO$ mw: 223.40

genesis and effects on testes, epididymis and sperm duct. Human teratogenic effects by an unspecified route: developmental abnormalities of the eye and ear. Experimental reproductive effects. Used as a drug to induce ovulation and for the treatment of oligospermia. When heated to decomposition it emits very toxic fumes of Cl^- and NO_x.

RAG300 *HR: 3*
RACEMOMYCIN A
CAS: 3808-42-2 NIOSH: NJ 5830900
mf: $C_{19}H_{34}N_8O_8$ mw: 502.61

SYNS:
ANTIBIOTIC S 15-1A
2-((2-DEOXY-2-(3,6-DIAMINOHEXANAMIDO)-α-d-GLUOPYRANOSYL)AMINO)-3,3a,5,6,7,7a-HEXAHYDRO-7-HYDROXY-4H-IMIDAZO(4,5-C)PYRIDIN-4-ONE-6'-CARBAMATE
STREPTOTHRICIN F
STREPTOTHRICIN VI
YAZUMYCIN A

TOXICITY DATA:	CODEN:
ipr-mus LD50:250 mg/kg	85GDA2 1,250,80
scu-mus LD50:1370 μg/kg	ANTIBAL 14,48,69
ivn-mus LD50:150 mg/kg	85GDA2 1,285,80

THR: Poison by subcutaneous, intravenous and intraperitoneal routes. When heated to decomposition it emits toxic fumes of NO_x. See also CARBAMATES.

RAQ000 *HR: D*
RADIATION

PROP: Electromagnetic radiation (also called *radiant energy*) is emitted from matter in the form of photons (quanta), each having an associated electromagnetic wave having frequency (ν) and wavelength (λ). The various forms of radiant energy are characterized by their wavelength, and together they comprise the electromagnetic spectrum, the components of which are as follows: (1) cosmic gamma rays, (2) gamma rays from radioactive disintegration of atomic nuclei, (3) x-rays, (4) ultraviolet rays, (5) visible light rays, (6) infrared, (7) microwave, and (8) radio (Hertzian) and electric rays. Radiation having the shortest wavelength is the most penetrating. Quanta are not electrically charged and have no mass, their velocity of propagation is the same, and all display the properties characteristic of light having a dual nature (wave-like and corpuscular). Infrared radiation is that part of the electromagnetic spectrum between visible light and the microwave region, i.e., 7000Å − 2.2×10^6 Å. All objects at a temperature greater than 0°K emit IR radiation to cooler surfaces, and the hotter the emitter the shorter the emitted IR wavelength. When the emitter is hot enough, visible (4000Å−7000Å), and even UV (100Å−4000Å), radiation is also emitted.
THR: The main physical effect of exposure to infrared radiation is heating. This is also true for biological tissue. In the case of the eye, there is very sensitive tissue available for exposure to IR radiation. "Near IR" (7800Å−14000Å) is blamed for many eye cataracts. The eyes may be easily protected by wearing goggles. Ultraviolet (UV) radiation is that part of the EM spectrum between 100Å and 4000Å. The UV-A band of UV extends from 3150Å−4000Å and is called "Black light" or "near UV." This band can cause thermal skin burns, skin pigmentation and photoreactions. It does not, in general, cause eye injury. From 2800Å to 3150Å is "mid-UV," or erythemal region. This band produces photokeratitis and possibly skin cancer. The UV band from 1000Å−2800Å is the UV-C band. It is known as "far UV" or "short UV." This band of UV is germicidal and viricidal, and destroys molds and yeasts as well. There is a sub-region of UV-C from 1700Å−2200Å which produces ozone. The whole UV region can damage human skin and eyes. In eyes, it can cause blepharitis, conjunctivitis, keratitis, keratoconjunctivitis. Skin exposure to solar UV can cause erythema, tanning; chronic skin exposure to solar UV leads to tanning, elastosis (dry, leathery, deeply wrinkled skin) and an incidence of non-melanoma skin cancer.

Type of radiation	Wavelength Å
cosmic	0.0005-0.005
gamma	0.005 -1.4
X	0.1 -100
UV	100 -4000
visible	4000 -7000
infrared	7000 -2,000,000

RAQ010 *HR: D*
RADIATION, IONIZING

Extremely short-wavelength, highly energetic, penetrating rays of the following types: (a) gamma rays emitted by radioactive elements and radioisotopes (decay of atomic nucleus); (b) x-rays generated by sudden stoppage of fast-moving electrons; (c) subatomic charged particles (electrons, protons, deuterons) when accelerated in a cyclotron or betatron. The term is restricted to electromagnetic radiation at least as energetic as x-rays, and to charged particles of similar energies. Neutrons also may induce ionization. Such radiation is strong enough to remove electrons from any atoms in its path, leading to the formation of free radicals.
THR: These short-lived but highly reactive particles initiate decomposition of many organic compounds. Thus, ionizing radiation can cause mutations in DNA and in cell nuclei; adversely affect protein and amino acid mechanisms; impair or destroy body tissue; and attack bone marrow, the source of red blood cells. Exposure to ionizing radiation for even a short period is highly dangerous, and for an extended period may be lethal. The study of the chemical effects of such radiation is called radiation chemistry or (in the case of body reactions) radiation biochemistry.

RAV000 *HR: 3*
RADIUM
af: Ra aw: 226.025

PROP: A radioactive earth metal. Brilliant white, tarnishes in air. Decomp in water. Mp: 700°, bp: 1737°, d: 5.5.
THR: A highly radiotoxic element. 1 g = 3.7×10^{10} dps. Inhalation, ingestion, or bodily exposure can lead to lung cancer, bone cancer, osteitis, skin damage, and blood dyscrasias. A common air contaminant. Radium replaces calcium in the bone structure and is a source of irradiation to the blood-forming organs. The ingestion of luminous dial paint prepared from radium caused death in many of the early dial painters before the hazard was fully understood. The data on these workers has been the source of many of the radiation precautions and the maximum permissible levels for internal emitters which are now accepted. ^{226}Ra is the parent of radon and the precautions described under ^{222}Rn should be followed. ^{228}Ra is a member of the thorium series. It was a common constituent of luminous paints, and while its low beta energy was not a hazard, its daughters in the series may have been a causative agent in the deaths of the radium dial painters following World War I. It is metabolized is the same as any other radium isotope and it is a source of thoron. The precautions recommended under ^{220}Rn should be followed. Highly dangerous; must be kept heavily shielded and stored away from possible dissemination by explosion, flood, etc.

Radiation Hazard: Natural isotope ^{223}Ra (Actinium-X, Actinium Series), $T\frac{1}{2}$ = 11.4 D, decays to radioactive ^{219}Rn by alphas of 5.5-5.7 MeV. Natural isotope ^{224}Ra (Thorium-X, Thorium Series), $T\frac{1}{2}$ = 3.6 D, decays to radioactive ^{220}Rn by alphas of 5.7 MeV. Natural isotope ^{226}Ra (Uranium Series), $T\frac{1}{2}$ = 1600 Y, decays to radioactive ^{222}Rn by alphas of 4.8 MeV. Natural isotope ^{228}Ra (Mesothorium = 1, Thorium Series), $T\frac{1}{2}$ = 6.7 Y, decays to radioactive ^{228}Ac by betas of 0.05 MeV.

RBA000 *HR: 3*
RADON
af: Rn aw: 222

PROP: Colorless, odorless, inert gas; very dense. Bp: −62°; d (gas @ 1 atm and 0°): 9.73 g/L, (liquid @ bp): 4.4.
THR: A common air contaminant. Radon is a noble gas and thus is relatively unreactive. Radiation Hazard: Natural isotope ^{220}Rn (Thoron, Thorium Series), $T\frac{1}{2}$ = 55s, decays to radioactive ^{216}Po by alphas of 6.3 MeV. Natural isotope ^{222}Rn (Uranium Series), $T\frac{1}{2}$ = 3.8 D, decays to radioactive ^{218}Po by alphas of 5.5 MeV. The permissible levels are given for ^{222}Rn in equilibrium with its daughters. The chief hazard from this isotope is inhalation of the gaseous element and its solid daughters, which are collected on the normal dust of the air. This material is deposited in the lungs and has been considered to be a major causative agent in the high incidence of lung cancer found in uranium miners. Radon and its daughters build up to an equilibrium value in about a month from radium compounds, while the build-up from uranium compounds is negligible. Good ventilation of areas where radium is handled or stored is recommended to prevent accumulation of hazardous concentration of Rn and its daughters. Accumulation of radon in homes has been implicated in increased incidence of lung cancers. This accumulation is found in well insulated buildings located over land which has concentrations of uranium.

RBA400 *HR: 2*
RAGWORT

PROP: *S. jacobaea* is a biennial or perennial herb up to 4 feet tall and produces clusters of yellow flowers. It is native to Europe and grows wild in the region from Massachusetts to Newfoundland, Quebec, and Ontario, and on the west coast of North America from British Columbia to Washington and Oregon. *S. longilobus* is a perennial shrub with white flowers. It grows wild in the area from Utah to northern Mexico. *S. vulgaris* is an annual which grows to 1 foot high with golden yellow flowers. It is native to Europe and is a weed in Alaska; all of Canada; the region bounded by New England, South Carolina and Wisconsin; California; New Mexico; and Texas.

SYNS:

COMMON GROUNDSEL	SENECIA LONGILOBUS
GORDOLOBO YERBA (MEXICO)	SENECIO VULGARIS
GROUNDSEL	STINKING WILLIE
HIERBA de SANTIAGO (MEXICO)	TANSY RAGWORT
SENECIA JACOBAEA	THREADLEAF GROUNDSEL

THR: The whole plant contains poisonous pyrrolizidine alkaloids. The milk from cows which have eaten the plant and honey from the nectar are toxic. Chronic consumption of teas made from this plant may cause anorexia with nausea, vomiting, diarrhea and liver and kidney damage due to blockage of the veins in these organs.

RBA500 *HR: 1*
RAIN LILY

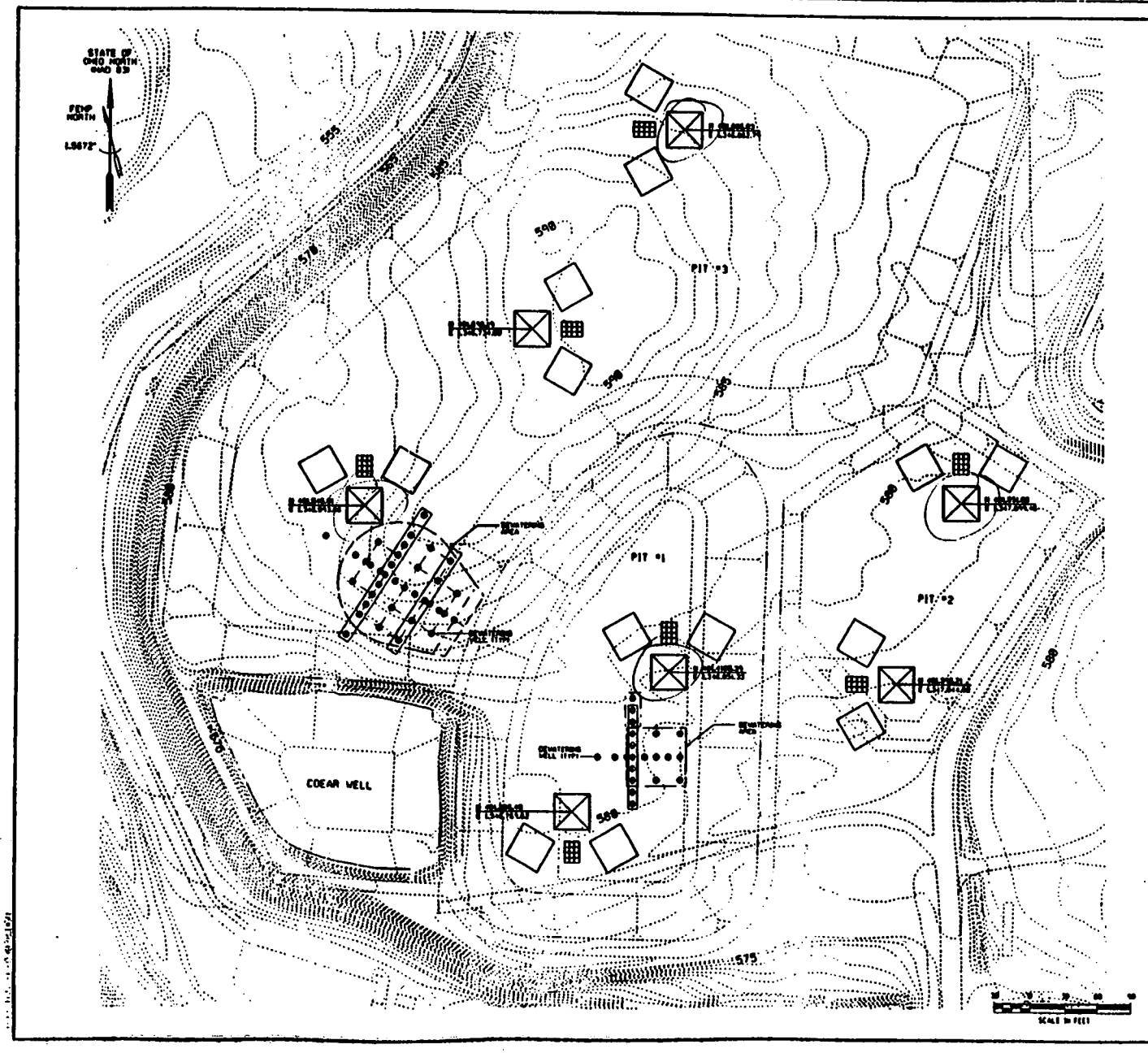
PROP: Bulb-producing plants with 1 foot long grassy leaves that grow directly from the bulb. It produces white flowers (sometimes tinged with purple) which grow at the end of a leafless stalk. It grows in marshy areas in the region bounded by Virginia, Florida and Alabama.

SYNS:

ATAMASCO LILY	ZEPHYR LILY
FAIRY LILY	ZEPHYRANTHES ATAMASCO

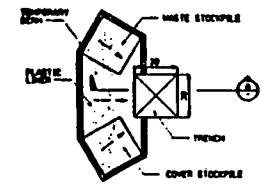
THR: The bulbs contain the poison lycorine. Ingestion of large amounts of the bulbs can cause nausea, persistent vomiting and diarrhea.

ATTACHMENT F
WORK AREA MAP

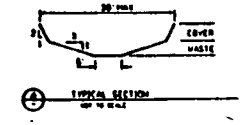


LEGEND

- UNDEWATERED TRENCH
- DEWATERING TEST AREA OBSERVATION WELLS
- PLASTIC LINER
- DRAINAGE LOCATION



TYPICAL TRENCH DETAIL



TYPICAL SECTION

LOCATION MAP
WET EXCAVATION

FIGURE 3-1

000203

ATTACHMENT G
OSHA AND DOE RIGHTS POSTER

Occupational Safety and Health Protection for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities

Policy:

U.S. Department of Energy (DOE) contractor employees shall be provided with safe and healthful working conditions in accordance with the standards prescribed pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, and the Department of Energy Organization Act of 1977; said standards shall be consistent with those promulgated under the Occupational Safety and Health Act of 1970, Public Law 91-596. Please refer to the Order DOE 5483.1A for details.

DOE Contractors:

DOE has determined that _____
Fernald Environmental Restoration
Management Corporation

is subject to DOE Acquisition Regulation (DEAR), Subpart 970.23, and is, therefore, required to comply with applicable DOE-prescribed Occupational Safety and Health Administration (OSHA) standards listed therein. This Order and the standards are available for employee review at _____
Safety & Health Building #53 _____.
As delineated by the Order DOE 5483.1A, the DOE contractor is required to:

1. Furnish to employees, employment and a place of employment which are as free from occupational safety and health hazards as possible.

2. Establish and implement programs and procedures to comply with the Order DOE 5483.1A. These shall include programs and procedures to monitor the workplace for known toxic materials and harmful physical agents which are used or produced at the facility, and maintain records of the data. As part of these programs and procedures:

(a) Advise employees or their representatives that they are to be provided with an opportunity to (1) observe monitoring or measuring for toxic materials or harmful physical agents, and (2) have access to the results thereof.

*(b) Provide to each employee, former employee, or designated representative, within 15 days of the receipt of a written request, access to or copies of any monitoring or bioassay records relevant to the employee's potential exposure to toxic materials or harmful physical agents during employment.

(c) Notify employees promptly of any information indicating that an exposure to toxic materials or harmful physical agents may have exceeded the limits specified by the DOE-prescribed OSHA standards.

*(d) Provide to each employee, former employee, or designated representative, within 15 days of the receipt of a written request, access to or copies of the employee's cumulative recorded occupational radiation dose during employment.

(e) Notify employees promptly of any information indicating that a radiation dose may have exceeded the limits specified by the DOE-prescribed OSHA standards.

*For purposes of access to an employee's monitoring, bioassay, or radiation exposure records, if the representative is not the recognized/certified collective bargaining agent, then he or she must have the employee's written authorization for such access.

Employees:

All employees are required to:

1. Observe the DOE-prescribed OSHA standards applicable to their work.

2. Report promptly to the contractor any condition which may lead to a violation of these standards.

3. Respond to warning signals which may be activated in the event of fire, radiation, or other possible emergencies.

4. Report emergencies using established procedures.

Inspections:

All activities under this contract are subject to inspection by DOE. When an inspection under the Order DOE 5483.1A is conducted, a contractor management representative and a representative authorized by the employees will be given an opportunity to accompany the DOE inspector.

Where there is no representative authorized by the employees, the DOE inspector will consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaints:

Employees may file a complaint with the contractor management or with the local DOE office using the form DOE F 5480.4 to request an inspection of the workplace. Complaints also may be filed by letter, telegram, or oral means. DOE F 5480.4 is available from
Near the south entrance of the cafeteria _____

When an employee requests anonymity from the contractor, DOE shall honor this request.

Imminent Danger

For any condition or practice which presents an immediate hazard that could reasonably be expected to cause death or serious physical harm (permanent or prolonged impairment of the body or temporary disablement requiring hospitalization), the contractor and/or DOE shall take immediate and effective remedial actions to remove employees from the hazard and/or eliminate the hazard. As soon as possible, an inspection shall be conducted by the contractor and/or DOE to assure that appropriate actions have been taken to preclude recurrence of the hazard.

Nondiscrimination:

No contractor shall discharge or in any manner discriminate against any employee by virtue of the filing of a complaint, or in any other fashion exercising on behalf of himself or herself or others any action set forth in the Order DOE 5483.1A.

Inquiries:

Inquiries should be addressed to the contractor; however, additional inquiries may be addressed to the following local DOE official.

Mr. Thomas J. Rowland, Acting Manager
DOE Field Office, Fernald
P. O. Box 398705
Cincinnati, OH 45239-8705

Posting Requirements:

Copies of this notice must be posted in a sufficient number of places in Government-owned plants and facilities operated by DOE contractors subject to DOE Acquisition Regulation (DEAR), Subpart 970.23, to permit employees working in or frequenting any portion of the plant to observe a copy on the way to or from their workplace.

U.S. Department of Energy

DOE F 5480.10 (8-89)

ATTACHMENT H
ACKNOWLEDGEMENT FORM

ATTACHMENT B

QUALITY ASSURANCE PLAN

ATTACHMENT B
QUALITY ASSURANCE PLAN

B.1 TRAINING

All field personnel involved with the Operable Unit 1 Dewatering Excavation Evaluation Program (DEEP) shall receive project-specific training for applicable activities. Training records shall be maintained by the Fernald Environment Restoration Management Corporation of Ohio (FERMCO) Training Department and the CRU1 training coordinator.

B.2 DOCUMENT CONTROL

CRU1 shall control the issuance, use, revision and storage of project documentation including:

- Site procedures
- Design specifications
- Design and work drawings
- Nonconformance reports
- Inspection reports
- Test reports
- General work and special process procedures
- Personnel Files
- Training records
- Quality Assurance records
- Surveillances
- Audits
- Other QA records
- Calibration records of test equipment
- Procurement Inspections and documentation

B.3 PROCEDURES

Work-related instruction, procedures, and other forms of direction shall be developed, verified, validated and approved by technically competent personnel, and shall be provided to employees performing the work. All environmental sampling activities shall comply with the Sitewide CERCLA Quality Assurance Project Plan (SCQ). Any activities not covered by the SCQ shall use American Society for Testing and Materials (ASTM) methods for guidance. The Project-Specific Plan shall be reviewed and approved by the appropriate personnel prior to implementation.

B.4 DESIGN

Project management shall outline how design activities are controlled, including:

- Review and approval of design inputs
- Preparation, review, and approval of calculations
- Validation of computer programs/models that support design
- Processing of design changes including field change request and nonconformances.

B.5 PROCUREMENT

Project management shall ensure that purchased items and services meet established requirements and perform as expected per SSOP-0315. Purchased items and services are to be accepted using specified methods (such as source verification, receipt inspection, pre-installation and post-installation tests, and certificates of conformance, or a combination of these methods).

B.6 INDEPENDENT ASSESSMENT

Work activities associated with the DEEP project shall be monitored periodically by FERMCO Quality Assurance. These independent assessments will monitor work performance, identify non-compliance activities and other abnormal performance and precursors of potential problems, and identify opportunities for improvement.

Independent assessments shall be conducted using criteria that address environmental, safety and health, and remediation requirements, and describe acceptable work performance and promote improvement. They shall include evaluation to determine whether technical requirements, not just procedural compliance, are being met. Assessment findings shall be resolved by management having responsibility in the area assessed.

ATTACHMENT C

PERMIT INFORMATION SUMMARY

ATTACHMENT C
PERMIT INFORMATION SUMMARY
DEWATERING EXCAVATION EVALUATION PROGRAM

C.1 INTRODUCTION

Proposed dewatering and excavation activities will be conducted at the Fernald Environmental Management Project (FEMP) in Hamilton and Butler Counties, Ohio as part of the CERCLA treatability study entitled "Dewatering, Excavation, Evaluation Program (DEEP)." As stated on Page 62 of the U.S. Environmental Protection Agency (EPA) Guide for Conducting Treatability Studies Under CERCLA, (EPA/540/2-89/058, December, 1989) "Onsite treatability studies under CERCLA may be conducted without any Federal State, or local permits; however, such studies must comply with applicable or relevant and appropriate requirements (ARARs) under federal and state environmental laws." This waiver is consistent with the requirement specified in CERCLA Section 121(e), 40 CFR 300.400(e), and Paragraph XIII.A of the Amended Consent Agreement signed by USEPA and DOE. As such, the project will be exempt from the requirement to obtain formal permit approval pursuant to CERCLA Section 121(e).

Although DEEP is exempt from normal permitting requirements, Paragraph XIII.B of the Amended Consent Agreement requires the U.S. Department of Energy (DOE) to supply specific information regarding the permits that would have been required for the project in the absence of the CERCLA permitting exemption described above. Pursuant to Paragraph XIII.B, the following information is required:

1. Identification of each permit that would be required in the absence of the CERCLA 121 (e) permitting exemption described above;

2. Identification of the standards, requirements, criteria, or limitations that would have had to have been met to obtain the permits; and

3. Explanation of how the response action will meet the standards, requirements, criteria, or limitations identified in item 2, above.

The following sections of this attachment have been prepared to address these requirements and to provide a detailed description of how substantive permitting requirements for the project will be addressed.

C.2 PROJECT DESCRIPTION

The proposed project involves conducting a series of eight dewatering tests within Waste Pits 1, and 3. Each test is designed to determine the extent to which pit sludge can be dewatered prior to excavation under the Operable Unit 1 Preferred Alternative. These tests include excavating trenches in Waste Pits 1, 2, and 3 to evaluate how well waste and sludge can be dewatered and subsequently excavated. Trenches will be dug before and after dewatering. In addition to trench excavations, well point and large diameter well dewatering systems will be tested. To compare the two well dewatering approaches, a large-diameter well system will be tested in Waste Pit 3, while the well point system will be tested in Waste Pits 1 and 2.

The total volume of wastewater to be produced by the project is difficult to quantify, however, current estimates call for approximately 105,000 gallons of water per day to be pumped during the initial three to four days of the project. After start-up operations are complete, it is anticipated the pumping rate will decline to a relatively stable rate of 5,000 gallons per day. Two additional 20,000-gallon tanks will be installed within the Waste Pit area to supply surge capacity for wastewater produced during initial pumping operations. These tanks will also be used to provide storage capacity once the pumping rate stabilizes.

Wastewater will be pumped for the 20,000-gallon tanks periodically and transferred to the existing Plant 8 treatment system using a 5,000-gallon mobile tank truck. At Plant 8, the wastewater will be treated to remove uranium and other heavy metals through lime precipitation, sedimentation, and filtration. Treated effluent will be discharged to the uranium contaminated side of the General Sump (GS), where it will be combined with other wastewater and discharged to the Bio-denitrification (BDN) Facility.

At the BDN Facility, removal of organic constituents will occur through aeration within the BDN towers and through activated sludge processes at the BDN-Effluent Treatment System (BDN-ETS). After

treatment at the BDN-ETS the wastewater will be discharged through NPDES permitted outfall *4605 (BDN-ETS), with ultimate disposition occurring to the Great Miami River via outfall *4001 (H-175).

C.3 INFORMATION REQUIRED BY PARAGRAPH XIII.B OF THE AMENDED CONSENT AGREEMENT

Tables A1 & A2 provide a summary of the permits and notifications that would have been required for the project had it not been exempt from the requirement to obtain formal permit approval under CERCLA Section 121(e). A more detailed explanation of these requirements is provided as follows:

C.3.1 Identification of Each Permit That Would Be Required in the Absence of the CERCLA 121(e) Permitting Exemption

State Permits/Notifications

- Ohio Administrative Code (OAC) 3745-31-02 - OEPA PERMITS TO INSTALL

  Pursuant to OAC 3745-31-02, no person shall cause, permit, or allow the installation of a new source of air pollutants without first obtaining a Permit to Install. Because the two (2) 20,000 gallon surge tanks meet the definition of an air contaminant source, a Permit to Install would be required for their installation.

- OAC 3745-35-02 - OEPA PERMITS TO OPERATE

  Pursuant to OAC 3745-35-02, no person may cause, permit, or allow the operation or other use of any air contaminant source without first applying for and obtaining a Permit to Operate. As stated above, the two (2) 20,000 gallon surge tanks are air contaminant sources and therefore, would be subject to the Permit-to-Operate rule.

- NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT - OEPA NPDES PERMIT NO. 1IO00004*DD

FEMP wastewater discharges to the Great Miami River are regulated under OEPA NPDES Permit No. 1IO00004*DD. Project specific discharges will be subject to NPDES effluent limitations and loading rates at NPDES permitted outfalls *4605 and *4001. In addition, the proposed discharges must comply with the terms and conditions of the FEMP NPDES Permit.

By permit condition, the FEMP must notify OEPA of any activities or changes at the site which have the potential to significantly alter the character of its wastewater stream. A NPDES permit modification may be required if the discharge is deemed significant enough to cause a change in the character of the wastewater stream.

In addition, proposed discharges must also be evaluated to ensure they do not violate Clean Water Act (CWA) Section 307 Toxic notification levels promulgated in 40 CFR 122.42 or OEPA Water Quality Standards for the segment of the Great Miami River into which the FEMP discharges its wastewater.

Federal Permits/Notifications

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART H - EMISSIONS OF RADIONUCLIDES OTHER THAN RADON FROM DOE FACILITIES

The NESHAP Subpart H Standard promulgated in 40 CFR Part 61.92 specifies that radiological emissions (except radon-222 and radon-220) from DOE facilities must not cause any member of the general public to receive an effective dose equivalent of more than 10 mrem/year.

Pursuant to 40 CFR 61.07 and 61.96, a permit is required for point sources which could cause an annual effective dose equivalent to the nearest off-site receptor in excess of 0.1 mrem/year. Continuous emission monitoring is required by 40 CFR 61.03 (b) for stacks and vents which have the potential to cause a dose in excess of 0.1 mrem/year to any member of the general public. Monitoring is not required for fugitive emissions under the NESHAP Subpart H regulations; however, isotopic emission estimates must be prepared for the project to demonstrate compliance with the NESHAP Subpart H Standard.

Given these requirements, both fugitive and point source emissions must be evaluated to ensure compliance with the 10 mrem/year site standard. Emissions from the 20,000-gallon storage tanks must be evaluated against the 0.1 mrem/year standard to determine permitting and monitoring requirements mandated by 40 CFR 61.07, 61.96 and 61.03. Isotopic emission estimates must be prepared for fugitive emission associated with excavation activities.

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART Q - EMISSIONS OF RADON FROM DEPARTMENT OF ENERGY FACILITIES

Pursuant to the NESHAP Subpart Q Standard promulgated in 40 CFR Part 61.192, radon-222 emissions from Department of Energy facilities must not exceed a flux rate of more that 20 picoCuries per square meter per second. In November, 1991 EPA and DOE signed the Federal Facility Compliance Agreement (FFCA) for the Control and Abatement of Radon-222 Emissions, in which DOE committed to providing EPA with estimates of radon flux from potential sources of radon emissions such as the Waste Pits.

C.3.2 Identification of the Standards, Requirements, Criteria, or Limitations that Would Have Had to Have Been Met to Obtain the Permits Identified Above

State Permits/Notifications:

- OAC 3745-31-02 - OEPA PERMITS TO INSTALL

OEPA issues Permits to Install for new sources provided: they do not interfere with the attainment or maintenance of applicable air quality standards; do not result in a violation of any applicable laws; and employ best available technology (BAT) to control emissions. BAT requirements are determined using the methodology prescribed under OEPA's Air Toxic Policy.

- OAC 3745-35-02 - OEPA PERMITS TO OPERATE

OEPA issues Permits to Operate provided: the source is operated in compliance with applicable air pollution control laws; is located or installed in accordance with the terms and conditions of a Permit to Install; and does not violate National Emissions Standards for Hazardous Air Pollutants adopted by the Administrator of OEPA.

- NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT - OEPA NPDES PERMIT NO. 1IO00004*DD

Wastewater discharges associated with the proposed project must be treated to comply with effluent limits and loading rates at NPDES regulated outfalls *4605 (BDN-ETS) and *4001 (MH-175). In addition, wastewater discharges must comply with the terms and conditions of FEMP NPDES Permit 1IO00004*DD.

By permit condition, the FEMP is required to notify OEPA of any activities or changes at the site which have the potential to significantly alter the character of the FEMP wastewater stream. Given that the concentration of many pollutants known to be present in the pit leachate are higher than those identified in the FEMP NPDES permit application, the FEMP will be required to notify OEPA about the proposed discharge. To avoid a NPDES permit modification, the FEMP must demonstrate that the proposed discharge will not alter the character of the existing wastewater stream.

In addition, proposed discharges must also be evaluated to ensure they do not violate CWA Section 307 Toxic notification levels promulgated in 40 CFR 122.42 or applicable numeric and narrative water quality standards established for the segment of the Great Miami River into which site discharges occur. Use designations for the Great Miami River and their corresponding water quality criteria are established pursuant to OAC 3745-1-21 and 3745-1-07, respectively.

Federal Permits/Notifications

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART H - EMISSIONS OF RADIONUCLIDES OTHER THAN RADON FROM DOE FACILITIES

Pursuant to the NESHAP Subpart H Standard codified in 40 CFR Part 61.92, all activities conducted at the FEMP must not cause a maximum off-site release of more than 10 mrem for a given year.

Pursuant to 40 CFR 61.07 and 61.96, a notification is required for point sources which could cause an annual effective dose equivalent to the nearest off-site receptor in excess of 0.1 mrem/year. Continuous emission monitoring is required by 40 CFR 61.03 (b) for stacks and vents which have the potential to

cause a dose in excess of 0.1 mrem/year to any member of the general public. The effective dose equivalent is determined pursuant to the methods prescribed in 40 CFR Part 61, Appendix D, and USEPA's CAP-88 modeling program. Monitoring is not required for fugitive emission sources; however, project specific isotopic emission estimates must be prepared to demonstrate compliance with the NESHAP Subpart H Standard.

Given these requirements, both fugitive and point source emissions must be evaluated to ensure compliance with the 10 mrem/year site standard. Emissions from the 20,000 gallon storage tanks must be evaluated against the 0.1 mrem/year standard to determine permitting and monitoring requirements mandated by 40 CFR 61.07, 61.96 and 61.03. Isotopic emission estimates must be prepared for fugitive emissions associated with excavation activities.

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART Q - EMISSIONS OF RADON FROM DEPARTMENT OF ENERGY FACILITIES

Pursuant to Paragraph 28 of the FFCA for the Control and Abatement of Radon-222 Emission, project specific flux rates must be prepared and approved by USEPA prior to conducting the proposed activities.

C.3.3 Explanation of How the Response Action Will Meet the Standards, Requirements, Criteria, or Limitations Identified in C.3.2 Above
State Permits/Notifications

- OAC 3745-31-02 - OEPA PERMITS TO INSTALL

Permits to Install would be required for the two (2) 20,000 gallon surge tanks in absence of the CERCLA 121(e) permitting exemption. The tanks will be installed such that they do not interfere with the attainment or maintenance of any applicable air quality standards or cause a violation of applicable laws. The tanks will use submerged fill to meet Best Available Technology requirements.

- OAC 3745-35-02 - OEPA PERMITS TO OPERATE

Permits to Operate would be required for both the 20,000 gallon surge tanks identified above. The tanks will be operated in compliance with applicable air pollution control laws and will be installed in accordance with the substantive requirements for Permits to Install. The tanks will be operated such that they do not violate applicable NESHAP Standards.

- NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT - OEPA NPDES PERMIT NO. 1IO00004*DD

Wastewater associated with the de-watering activities will be pumped directly from the Waste Pit Area of Operable Unit 1 to the existing Plant 8 treatment system using a 5000-gallon capacity mobile tank truck. Two additional 20,000-gallon mobile tanks will be available at the Waste Pit location to supply surge capacity for wastewater produced by the project.

After treatment at Plant 8, the wastewater will be discharged to the Biodenitrification Facility for additional treatment. After passing through the BDN towers, the wastewater will be discharged through NPDES permitted outfall *4605 (BDN-ETS) prior to its ultimate disposition to the Great Miami River via outfall *4001 (MH-175).

Given that the existing FEMP wastewater treatment system is capable of treating the wastewater to meet NPDES permit limitations and loading rates, a NPDES permit modification will not be required for the project. The FEMP will continue to monitor discharges at NPDES regulated outfalls to ensure the proposed discharge does not violate NPDES permit limitations or OEPA Water Quality Standards for the Great Miami River.

Federal Permits/Notifications

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART H - EMISSIONS OF RADIONUCLIDES OTHER THAN RADON FROM DOE FACILITIES

The FEMP will ensure that the DEEP project does not violate the 10 mrem/year site standard by maintaining records of measured and isotope specific emissions from the project. This information will then be used to estimate the DEEP's contribution to off-site dose impacts in the Annual NESHAP Subpart H Compliance Demonstration.

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART Q - EMISSIONS OF RADON FROM DEPARTMENT OF ENERGY FACILITIES

Excavation activities associated with the proposed project have the potential to cause a release of radon gas and, therefore, are subject to evaluation against the NESHAP Subpart Q Standard. Project specific flux calculations will be prepared. In addition, real-time monitoring for radon emissions will be conducted throughout the course of the project.

000220

TABLE C-1
DEEP PERMIT INFORMATION SUMMARY

PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARARS)	COMPLIANCE PLAN
STATE PERMITS AND NOTIFICATIONS:		
OAC 3745-31-02 - PERMIT TO INSTALL	Unless exempted by OAC 3745-31-03, no person shall cause, permit, or allow the installation of a new source of air pollutants without first obtaining a Permit to Install. OEPA issues Permits to Install for new sources provided they do not interfere with the attainment or maintenance of applicable air quality standards; do not result in a violation of any applicable laws; and employ best available technology to control emissions.	Permits to Install would be required for the 20,000-gallon surge tanks in absence of the CERCLA 121(e) exemption. The tanks will be installed such that they do not interfere with the attainment or maintenance of any applicable air quality standards or cause a violation of any applicable laws. Best available technology (BAT) will be implemented to control emissions from the tanks and will consist of submerged fill.
OAC 3745-35-02 - PERMIT TO OPERATE	Pursuant to OAC 3745-35-02, no person may cause, permit, or allow the operation or other use of any air contaminate source without first applying for and obtaining a Permit to Operate. OEPA issues Permits to Operate provided the source is operated in compliance with applicable air pollution control laws; is located or installed in accordance with the terms and conditions of a Permit to Install; and does not violate National Emissions Standards for Hazardous Air Pollutants adopted by the Administrator of OEPA.	Permits to Operate would be required for the 20,000-gallon surge tanks identified above. The tanks will be operated in compliance with applicable air pollution control laws and will be installed in accordance with the substantive requirements for Permits to Install. The tanks will be operated such that they do not violate National Emissions Standards for Hazardous Air Pollutants.
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT - OEPA NPDES PERMIT NO. 1IO00004*DD	FEMP wastewater discharges must not cause a violation of effluent limits or loading rate at NPDES permitted outfalls. Discharges must also be conducted in accordance with the terms and conditions of the permit. This includes notification requirements under 40 CFR 122.42 for Clean Water Act Section 307 toxic pollutants.	Wastewater associated with the proposed project will be treated at Plant 8 and the BDN Facility to ensure compliance with effluent limits and loading rates at NPDES permitted outfalls *4605 (BDN-ETS) and *4001 (MH-175).

TABLE C-2
DEEP PERMIT INFORMATION SUMMARY

PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARARS)	COMPLIANCE PLAN
FEDERAL PERMITS AND NOTIFICATIONS:		
NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART H - EMISSIONS OF RADIONUCLIDES OTHER THAN RADON FROM DOE FACILITIES	The NESHAP Subpart H Standard codified in 40 CFR 61.92 specifies that radiological emissions (except radon-222 and radon-220) to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem/year. Pursuant to 40 CFR 61.07 and 61.96, a permit is required for point sources which could cause an annual effective dose equivalent to the nearest off-site receptor in excess of 0.1 mrem/year. Continuous emission monitoring is required under 40 CFR 61.03 (b) for stacks and vents which have the potential, under normal operating conditions without any emission control devices, to release radionuclides in sufficient quantity to cause an effective dose equivalent of 0.1 mrem/year or greater to any member of the public.	The FEMP will ensure that the DEEP project does not violate the 10 mrem/year site standard by maintaining records of measured or isotopic-specific emissions from the project. This information will then be used to estimate the DEEP's contribution to off-site dose impacts. Emissions from the 20,000-gallon storage tanks will be evaluated to determine permitting and monitoring requirements pursuant to 40 CFR 61.01, 61.97, and 61.03 (b).
NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR 61, SUBPART Q - EMISSIONS OF RADON FROM DEPARTMENT OF ENERGY FACILITIES	Pursuant to the NESHAP Subpart Q Standard promulgated in 40 CFR 61.192, radon-222 emissions from Department of Energy facilities must not exceed a flux rate of more than 20 pCi/m2/sec. As part of the November, 1991 EPA/DOE Federal Facilities Compliance Agreement (FFCA) for the Control and Abatement of Radon-222 Emissions, the DOE agreed to achieve compliance with the radon flux standards by implementing removal and final remedial actions. DOE also committed to providing the EPA with estimates of the radon flux from potential radon sources at the site.	Excavation activities associated with the proposed project have the potential to cause a release of radon gas and therefore, are subject to evaluation against the NESHAP Subpart Q Standard. Project-specific flux calculations will be prepared for the project. In addition, real-time monitoring of radon emissions will be conducted throughout the course of the project.

000221

12

ATTACHMENT D

DUST SUPPRESSANT TESTING

ATTACHMENT D
DUST SUPPRESSANT TESTING

D.1 INTRODUCTION

FERMCO personnel will conduct field tests to evaluate the effectiveness of six commercially available coating agents in controlling the generation of dust during wet and dry excavation activities. The effectiveness of using pit supernatant water for dust control will also be evaluated. These agents, together with the pit water, will be applied to excavation working surface, stockpiles, and roadways. It is anticipated that as a result of this test, two agents will be identified for controlling the generation of dust during excavation activities associated with final remediation of the Waste Pit Area.

D.2 EXECUTION TEST

Excavation activities associated with final remediation of the Waste Pit Area are expected to generate significant amounts of dust which must be controlled. Dust control can be accomplished using coating agents applied directly to excavation working surfaces, stockpiles, and roadways. These agents include hazardous/mixed waste barrier systems (foams or films) and commercial dust suppressants. The use of available pit supernatant water for dust control will also be evaluated.

Prior to initiating excavation activities, commercially-available agents from various vendors will be preliminarily screened for applicability to the field testing activities. Potential vendors include the following:

Aquadyne	Reef Industries
Georgia Pacific Chemical	Johnson March Systems
Witco Corp.	Martin Marietta
Intersystems	Bartlett
Iron Mountain Tech.	Rusmar Foam Tech.
American Cyanamid Co.	3M

The preliminary screening criteria include:

1. Type of equipment required for application (including manpower requirements)
2. Anticipated ease of application
3. Product constituents
   a. material handling requirements
   b. environmental impacts
   c. agents' compatibility with waste
4. Storage life of product
5. Duration of effective control
6. Quantitative information (non-visual) on particulate control
7. Effective temperature/humidity ranges for application and service
8. Suitability to thermal treatment (drying and/or incineration)

Based upon preliminary screening, six agents will be selected for field performance testing. The selected agents will be applied and evaluated at each of the seven wet and the one dry excavation locations. Evaluation is required at both wet and dry excavation locations due to varying moisture conditions.

Specific applications sites at each excavation location include working excavation surfaces, stockpiles, and roadways. Within each specific application site, six test cells will be identified and delineated for application of the selected agents. Each test cell will be approximately 5 square feet. The locations of the test cells will be determined in the field by the field team leader. Application of the agents within these cells will occur following excavation activities. Each agent will be applied in accordance with the manufacturers' specifications.

The performance of the applied coatings will then be visually monitored over a 24 hour period. The performance period of the tests may be extended by the field team leader, but will be limited by the duration of the excavation activities themselves. Due to safety concerns, excavation activities have been limited to 72 hours at each excavation site. Longer performance periods may be obtained by applying the selected agents to the restored pit surface following backfilling operations. Agents may be re-applied, as necessary, to areas exhibiting wear or cracking. At the discretion of the field team leader, the selected agents may also be employed during actual excavation operations. Testing under these conditions, however, may be restricted due to site-specific health and safety requirements which may limit the distances within which personnel may approach excavation boundaries and operating equipment. Since

standardized testing procedures for monitoring the performance of these agents in the field have not been identified at this time, performance will be based primarily on visual observations.

It is estimated that each agent will be required to coat an area of approximately 75 square feet within the test cells and an additional 250 square feet during actual excavation operations (if initiated) at each excavation location. Allowing for 10 percent waste, each selected agent would be required to coat approximately 360 square feet per excavation.

Upon the conclusion of excavation activities, the six selected agents will be evaluated against the following criteria:

1. Cost per square foot
2. Ease of application
3. Ease of cleanup
4. Amount and type of waste generated (including disposal requirements)
5. Applicability to the full range of particulate control needs - effectiveness of the selected agents in controlling particulate releases that may be caused by wind, rain, and equipments operation
6. Adhesion to waste
7. Durability and integrity of applied coating

The two most effective agents, as identified during the previously described wet and dry excavation activities, will be utilized for controlling the generation of dust during ramp excavation activities. For estimating purposes, each of the two selected agents will be applied to approximately 1,500 square feet of surface area. Each agent will be re-evaluated against the seven above-identified criteria. Testing will be carried out in a manner similar to that previously described; however, the performance period of the test will be longer due to the longer duration of this excavation activity.

ATTACHMENT E

SLUG TESTING

ATTACHMENT E
SLUG TESTING

This section describes the slug testing to be performed as part of the Dewatering Excavation Evaluation Program (DEEP). The tests are designed to provide the information to evaluate the feasibility of mechanical excavation and of slurring, an alternative method of removing the waste from the pits.

E.1 TEST DESCRIPTION AND OBJECTIVES

Slug tests will be performed on nine existing groundwater monitoring wells in Waste Pits 1, 2, and 3. The slug tests will determine the hydraulic conductivity of a relatively small zone of influence of the waste material surrounding the wells to be tested. Wells included are identified in Table E-1 and shown in Figure 2-1.

TABLE E-1.
WELLS TO BE SLUG TESTED

Waste Pit	Wells to be slug tested
1	1073, 1765, 1766
2	1767, 1768, 1769
3	1770, 1771, 1772

Falling and rising head tests will be performed in each of the wells. Water levels in the wells will be measured at least daily for one week prior to, and two weeks after, slug testing. Slug testing will be performed in accordance with ASTM D 4044-91. Waste permeabilities will be used to construct computer flow models of the waste so that dewatering applications, if needed, can be refined.

E.2 DATA COLLECTION, ANALYSIS, INTERPRETATION, AND REPORTING

The Bouwer-Rice method will be used to calculate hydraulic conductivity surrounding a well installed in an unconfined or leaky aquifer. The design characteristics of the waste pits, as well as the unconfined groundwater waste "aquifer" conditions bounded on the top and base by cap and liner materials of suspect integrity, qualifies Bouwer-Rice as the slug test method of choice.

It is recognized that the hydraulic conductivity results may not be representative of the total waste material contained in the waste pits due to the heterogeneous and anisotropic conditions of the waste within the pits. However, much useful information regarding waste permeability characteristics can be inferred if a relatively large number of wells is used.

Bouwer-Rice will also be used for those wells that display a water level above the top of the well screen. Pre-testing measurement of the water level will be performed. Following this, a slug of known dimensions will be introduced into the well, the slug removed, and the resultant water levels measured per unit of time until equilibrium conditions have been achieved in the well.

Removal of the slug will cause a drop in the water level within the well. Measurements of the new liquid level will be taken as this level fluctuates per unit of time until such time as equilibrium conditions return to the well. From this information, the hydraulic conductivity will be calculated. Waste permeabilities will be used to construct computer flow models of the waste so that dewatering applications, if needed, can be refined. These data will be used to obtain a preliminary value for numerical modeling which will be used to assess well spacing.

E.3 RESIDUALS MANAGEMENT

E.3.1 Contact Waste and Personal Protective Equipment (PPE)

Contact waste is categorized as personal protective equipment (PPE), gloves, wipes, plastic, etc. generated during a sampling event, that may be contaminated as a result of coming in contact with the sampled material. Contact waste generated during DEEP will be collected in a plastic bag and sealed with tape. The bag will be labeled with the name and phone number of the project supervisor and the name of the person placing the bag in the dumpster. The bag will be placed in the CRU3 RI/FS-designated locked dumpster. No Material Evaluation Form is generated. The trash in the dumpster will go to the trash baler, where it will be compacted and boxed for transport from the site as low-level radioactive waste. PPE that is contaminated will be placed in a container and stored with the dried material awaiting the Waste Pit 6 Drying Study.

E.4 EQUIPMENT

- Solinst Water Level Indicator (probe and tape)
- Cable Reels and Pressure Transducers (9)
- In Situ Hermit 2000 multichannel data loggers (4, one as backup)
- Slugs: dimensions 2 5/8" outside diameter by 3' (9)

ATTACHMENT F

SAMPLE FIELD ACTIVITY LOGS

FEMP
FIELD ACTIVITY LOG

CONTROL NUMBER:	DATE:	Page of

PROJECT NAME:	PROJECT NUMBER:
FIELD TEAM LEADER:	FIELD TEAM MEMBERS:
FIELD ACTIVITY SUBJECT:	
WEATHER CONDITIONS:	RELATED FIELD FORM CONTROL NUMBERS:

TEAM LEADER SIGNATURE:	DATE	ALPHA METER S.N.:	BETA/GAMMA METER S.N.:

TIME	DESCRIPTION OF ACTIVITY

WATER QUALITY METER SERIAL NO.:	METER CALIBRATION												
INITIALS/DATE:	pH (STD UNITS)		SP. COND. (µmhos/cm)		D.O. (mg/L)	TURBIDITY (NTU)	TEMP. (°C)	SALINITY (mg/L)	PID SERIAL NO.	PID STAND.	PID LOT NO.	PID READING	PID SPAN
TEMP.:	4	7	HIGH	LOW									
Manual Calibration:													
Auto Calibration:													

VISITORS		TIME	
NAME(S)	ORGANIZATION(S)	ARRIVED	LEFT

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CONTROL NUMBER:	FEMP **LITHOLOGIC LOG**	Page of

PROJECT NAME:	PROJECT NUMBER:

BORING NUMBER:	COORDINATES:	RELATED FAL NUMBERS:

SURFACE ELEVATION:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE STARTED:
GEOLOGIST:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED:

WATER USED DURING DRILLING:	DRILLING CONTRACTOR:	DRILLING EQUIPMENT:	DRILLER/HELPER:

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

* Samples collected per ASTM Standard Penetration test.

FS-F-3681 (8/18/93)

FEMP

SAMPLE COLLECTION LOG

SAMPLE LOCATION:

PROJECT NAME:

CONTROL NUMBER:

Page _____ of _____

SAMPLE TEAM LEADER:

SAMPLE TEAM:

PROJECT NUMBER:

RELATED FAL NUMBER(S):

UNIQUE SAMPLE NUMBER	SAMPLE TYPE CODE	SAMPLE SCREEN RESULTS (PID)	SAMPLE SCREEN RESULTS (RAD)	COLLECTION START		COLLECTION STOP		SAMPLE DEPTH INTERVAL	PRESERVATIVE CODE	NUMBER OF CONTAINERS	SAMPLE CONTAINER TYPE & SIZE	ANALYTICAL PARAMETERS (OR TARGET ANALYTE LIST)	VISUAL DESCRIPTION OF SAMPLE	DUPLICATE OF SAMPLE NUMBER	QA/QC SAMPLE DESIGNATION
				DATE	TIME	DATE	TIME								

REMARKS:

FS-F-3714 (10/13/93)

000233

I 2

FEMP

SAMPLE COLLECTION LOG - SAMPLE CODES

PRESERVATIVES CODE	
P00	None Required
P01	Cool, 4° C
P02	Freeze, <0° C
P03	Filter on site
P04	Filter on site/HNO_3 to pH<2
P05	Filter on site/Cool, 4° C
P06	Filter on site/Cool, 4° C/H_2SO_4 to pH < 2
P07	H_2SO_4 to pH < 2
P08	H_2SO_4 to pH < 2/Cool, 4° C
P09	HCl to pH <2
P10	HCl to 1%
P11	HNO_3 to pH <2
P12	HNO_3 to 1%
P13	HNO_3 to pH <2/Cool, 4° C
P14	NaOH to pH >12/Cool, 4° C
P15	$Na_2S_2O_3$ (10% soln) to 1%
P16	$Na_2S_2O_3$ 100 mg/L
P17	Cool, 4° C/2mL ZnOAc + NaOH to pH>9

QA/QC SAMPLE DESIGNATION CODE	
Q01	Preservation Blank
Q02	Container Blank
Q03	Temperature Blank
Q04	Trip Blank
Q05	Field Blank
Q06	Rinsate
Q07	Duplicate Sample
Q08	Split Sample
Q09	Deionized Water Blank
Q10	Matrix Spike
Q11	Matrix Spike/Matrix Spike Duplicate

SAMPLE TYPE CODE	
M100	Ground Water
M101	Surface Water
M102	Milk
M103	Soil
M104	Sediment
M105	Vegetation
M107	Algae
M108	Meat
M109	Fish (total)
M110	Fish (edible fillets)
M111	Sludge
M112	Air Filter
M118	Miscellaneous (specific description addressed in remark field)
M300	Tank Contents (water)
M301	Tank Contents (organic)
M302	Tank Contents (unknown)
M305	Concrete
M310	Liquid (unknown)
M314	Oils
M317	Rocks/Bricks
M322	Solid (unknown)
M333	Deionized Water
M334	Drill Cuttings

000234

FEMP
MONITORING WELL DEVELOPMENT FORM

CONTROL NUMBER:	FAL REF. NUMBER:	Page of

WELL NUMBER:	PROJECT NAME:	PROJECT NUMBER:
DATE(S) OF WELL INSTALLATION:	WELL DEVELOPMENT START DATE/TIME:	COMPLETION DATE/TIME:
DRILLER/HELPER:		
FIELD ENGINEER/GEOLOGIST: DATE:	CHECKED/VERIFIED BY:	DATE:

ITEM	BEFORE DEVELOPMENT	AFTER DEVELOPMENT
STATIC WATER LEVEL		
TOTAL DEPTH		

WELL VOLUME CALCULATIONS

2 inches = 0.163 gal./ft.
4 inches = 0.653 gal./ft.
6 inches = 1.469 gal./ft.
8 inches = 2.612 gal./ft.
10 inches = 4.080 gal./ft.
11 inches = 4.937 gal./ft.
12 inches = 5.875 gal./ft.

TOTAL CALCULATED VOLUME OF WATER TO BE REMOVED/GALLONS:	TOTAL VOLUME OF WATER REMOVED DURING DEVELOPMENT/GALLONS:	TYPE AND SIZE OF PUMP:	TYPE AND SIZE OF BAILER:

LITHOLOGIC DESCRIPTION OF REMOVED SEDIMENTS:	DESCRIPTION OF DEVELOPMENT TECHNIQUES:

SAMPLE COLLECTED		VOLUME OF WATER PURGED FROM WELL (gals.)	TEMP (°____)	SPECIFIC CONDUCTANCE (µmhos/cm)	pH (S.U.)	DO (mg/L)	TURBIDITY (N.T.U.)	COLOR	PARTICULATES	ODOR	REMARKS
DATE	TIME										

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FEMP
MONITORING WELL DEVELOPMENT FORM
(Continuation Page)

CONTROL NUMBER:	FAL REF. NUMBER:	Page of

WELL NUMBER:	PROJECT NAME:	PROJECT NUMBER:

DATE(S) OF WELL INSTALLATION:	WELL DEVELOPMENT START DATE/TIME:	COMPLETION DATE/TIME:

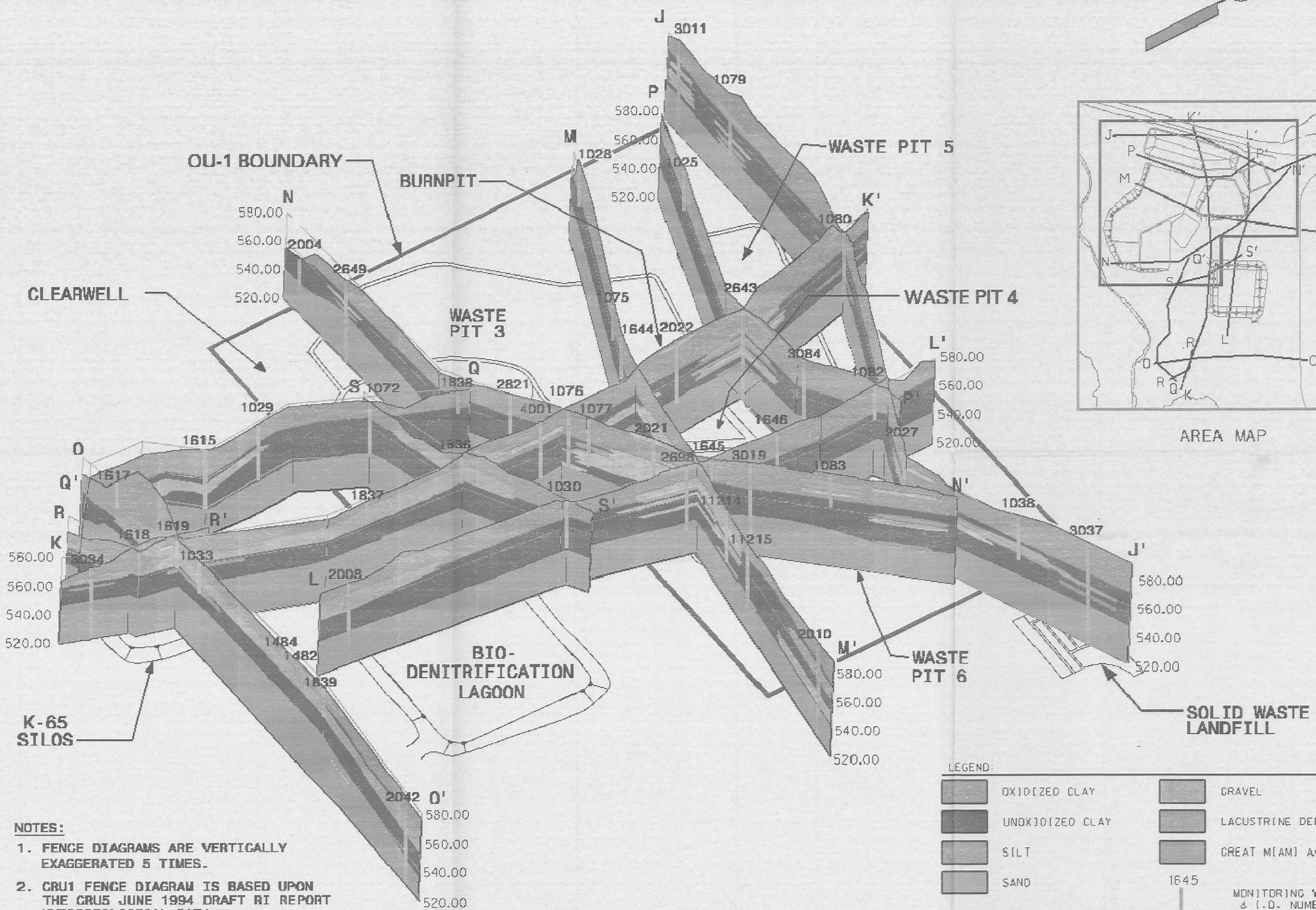
DRILLER/HELPER:

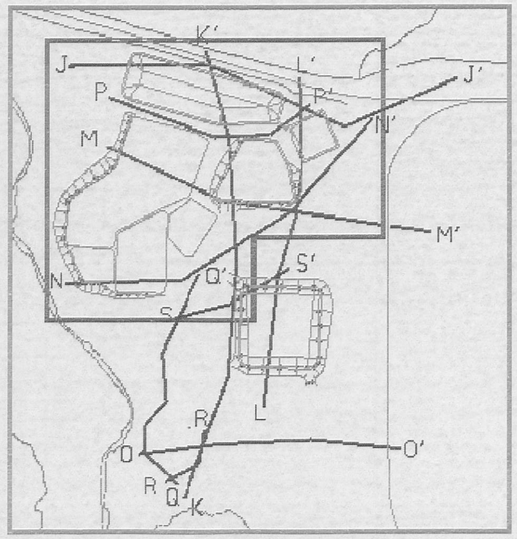
FIELD ENGINEER/GEOLOGIST:	DATE:	CHECKED/VERIFIED BY:	DATE:

SAMPLE COLLECTED		VOLUME OF WATER PURGED FROM WELL (gals.)	TEMP (°___)	SPECIFIC CONDUCTANCE (µmhos/cm)	pH (S.U.)	DO (mg/l)	TURBIDITY (N.T.U.)	COLOR	PARTICULATES	ODOR	REMARKS
DATE	TIME										

ATTACHMENT G

OPERABLE UNIT 1 FENCE DIAGRAM





AREA MAP

NOTES:

1. FENCE DIAGRAMS ARE VERTICALLY EXAGGERATED 5 TIMES.
2. CRU1 FENCE DIAGRAM IS BASED UPON THE CRU5 JUNE 1994 DRAFT RI REPORT HYDROGEOLOGICAL DATA

wpits.rgb 08-10-94 T.A.R.

000238

FENCE DIAGRAM
CONCEPTUAL CROSS-SECTION OF THE CRU-1
(WASTE STORAGE AREA) GLACIAL OVERBURDEN

ATTACHMENT H

PROJECT SPECIFIC PLAN

FOR OPERABLE UNIT 1

DEWATERING EXCAVATION EVALUATION PROGRAM

GEOTECHNICAL INVESTIGATION

PROJECT SPECIFIC PLAN

FOR

OPERABLE UNIT 1

DEWATERING EXCAVATION EVALUATION PROGRAM

GEOTECHNICAL INVESTIGATION

RI/FS WBS NUMBER 10.03.06

REVISION 0

SEPTEMBER 30, 1994

Prepared by

Fernald Environmental Restoration Management Corporation

Prepared for

U.S. Department of Energy
Fernald Field Office

Under Contract DE-AC05-92OR21972

PROJECT SPECIFIC PLAN
FOR OPERABLE UNIT 1
DEWATERING EXCAVATION EVALUATION PROGRAM
GEOTECHNICAL INVESTIGATION
RI/FS WBS NUMBER 10.03.06
REVISION 0, SEPTEMBER 30, 1994

APPROVAL:

Robert Fellman 10/3/94

Robert Fellman, Director — Date
Operable Unit 1

for F. Ford 9/30/94

Fred Ford, Manager — Date
Quality Assurance Department

Linda K Rogers 9-30-94

Linda K. Rogers, Manager — Date
Environmental Program Development

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B	Data Quality Objectives
C	Field Documentation/Equipment/PPE List
D	Sample Numbers
E	Example Field Forms
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H	ASTM Standards
I	Project Schedule

LIST OF ACRONYMS

ASL	analytical support level
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DEEP	Dewatering Excavation Evaluation Program
DOE-FN	Department of Energy, Fernald Field Office
ERMC	Environmental Restoration Management Contract
EFO	Environmental Field Operations
FAL	Field Activity Log
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FS	feasibility study
GPR	ground penetrating radar
IDW	investigation-derived wastes
OU1	Operable Unit 1
PID	photoionization detector
PSP	Project Specific Plan
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	Remedial Investigation/Feasibility Study
SC	Site Characterization
SCQ	Sitewide CERCLA Quality Assurance Project Plan
SED	Sitewide Environmental Database
SPL	Sample Processing Laboratory
SWAR/CR	Sitewide Analysis Request/Custody Records
TCLP	Toxic Characteristic Leaching Procedure
TCR	Task Closure Report
UAP	Uranyl Ammonium Phosphate
USCS	Unified Soil Classification System

1.0 INTRODUCTION

This Project Specific Plan (PSP) has been developed to support the Dewatering Excavation Evaluation Program (DEEP) Treatability Study. This PSP outlines the sampling and drilling activities for 15 borings to be completed and sampled. The project consists of four phases of geotechnical sampling and testing, the four phases of this project are: nine borings being completed prior to wet excavation and dewatering testing (Phase 1), two borings during dewatering testing (Phase 2), two borings completed during a later stage of the dewatering testing (Phase 3), and two borings after dewatering testing is accomplished (Phase 4).

A total of 15 systematic soil borings will be completed in three waste pits (Pits 1, 2, and 3) during the four phases to provide sufficient geotechnical information on the pit caps and the waste material. The study area is shown in Figures 1-1, 1-2, and 1-3 (Appendix A). Several distinct magnetic anomalies have been observed in the waste pits. Figures 1-4, 1-5, and 1-6 show the geophysical anomalies encountered in the three waste pits. The tests of interest for this project will be grain-size analysis, Atterberg limits, moisture content, specific gravity, triaxial shear strength test, and unit weight test.

A total of 6 borings will be completed and sampled within Waste Pit 1. According to the Operable Unit 1 Remedial Investigation Report (DOE, 1994), the majority of the materials in Waste Pit 1 were dry solids, including general sump sludge, depleted slag, trailer cake, depleted residues, graphite and ceramics, thorium waste, and uranyl ammonium phosphate (UAP) filtrate. Typical water levels in the pit range from 3.0 to 3.5 feet below ground surface.

A total of 2 borings will be completed and sampled in Waste Pit 2. The material placed in Waste Pit 2 consisted of the same wastes placed in Waste Pit 1 with the exception of having a relatively coarser grain size (DOE, 1994).

A total of 7 borings will be completed and sampled in Waste Pit 3. The material in Waste Pit 3 consists of general sump sludge, raffinate, trailer cake, slag leach, water treatment sludge, and thorium waste (DOE, 1994).

This PSP of the Operable Unit 1 Dewatering Excavation Evaluation Program (DEEP) Treatability Study Work Plan, has been developed under the specifications of the FEMP Sitewide Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Quality Assurance Project Plan (SCQ). The PSP will guide FERMCO and subcontractor personnel in drilling, collection of samples, and the associated laboratory work required to meet the project specific Data Quality Objectives (Appendix B). All field operations and data handling procedures will be consistent with the FEMP SCQ; sections of the SCQ are incorporated into this PSP by reference. Other DEEP PSPs will outline the activities to be completed during the remaining stages of the DEEP Treatability Study.

2.0 PROJECT ORGANIZATION

An Environmental Restoration Management Contract (ERMC) has been implemented at the FEMP site to manage the restoration activities, with Fernald Environmental Restoration Management Corporation (FERMCO), a wholly-owned subsidiary of Fluor Daniel, Inc., currently serving as the ERMC. FERMCO, reporting directly to the Department of Energy, Fernald Field Office (DOE-FN), will act as the main contractor for FEMP activities and coordinator of technical support and remediation subcontractors. Primary FERMCO organizational responsibility for implementation of the Operable Unit 1 DEEP Treatability Study is Operable Unit 1. Additional support will be provided by matrixing Site Characterization Department staff, equipment, and by subcontractor personnel.

PROJECT PERSONNEL

Key positions involved in completing the Operable Unit 1 DEEP Treatability Study Geotechnical Investigation specifically are presented as follows:

Operable Unit 1 Director
The Operable Unit 1 Director is responsible for coordinating all Operable Unit 1 activities including project performance, schedule, budget and resources. The Operable Unit 1 Director provides guidance and support to all Operable Unit 1 projects. Additionally, he provides project status information to senior management, client, and regulatory officials.

Operable Unit 1 Health and Safety Officer
The Health and Safety Officer is responsible for the comprehensive Operable Unit 1 Health and Safety Program. The Health and Safety Officer reviews and approves the DEEP Health and Safety Plan, which is specific to the proposed field activities, in accordance with FEMP policy, proper health and safety practices, and the SCQ. The Operable Unit 1 Health and Safety Officer will coordinate with the Field Health and Safety Officer to assess unforeseen circumstances, from a health and safety perspective, and issue addenda to the Health and Safety Plan, as necessary.

Field Health and Safety Officer
The Field Health and Safety Officer ensures that the Project Specific Health and Safety Plan is fully implemented during all field activities. The Field Health and Safety Officer will coordinate with the DEEP Project Manager to ensure that field activities are conducted in a manner which is consistent with the Project Health and Safety Plan. The Field Health and Safety Officer can request, verbally or in writing, that individual personnel be relieved of field duties for specific violations to the Project Health and Safety Plan. The Field Health and Safety Officer will coordinate with the Operable Unit 1 Health and Safety Officer to assess unforeseen circumstances, from a health and safety perspective, and implement addenda to the Project Health and Safety Plan issued by the Operable Unit 1 Health and Safety Officer.

Project Manager
The Project Manager is ultimately responsible for fully implementing every aspect of this PSP. The Project Manager can halt field activities at any time for any reason, and is ultimately responsible for the health and safety of field personnel during field activities. Specific responsibilities include:

- overall planning and execution of the DEEP in accordance with the SCQ,
- requesting variances to the PSP, in writing, to the Operable Unit 1 Quality Assurance (QA) Officer,
- coordinating with knowledgeable personnel to make informed decisions about all field activities, in particular, placement of discretionary sample locations, and
- signature approval of requested discretionary boring locations and variances to the PSP.

Field Operations Lead
Responsible for ensuring the PSP is implemented correctly and efficiently in the field. Coordinates all drilling and sampling activities in the field, obtains work permits, provides technical oversight of field personnel and subcontractors.

Field Geologist
Responsible for supervising sampling and drilling activities at each boring location. The Field Geologist of each sampling and drilling crew will also be responsible for preparing and maintaining all field data documentation that provides a written record of activities and measurements in the field.

Quality Assurance (QA) Officer
Responsible for establishing and preparing QA requirements for the DEEP program. The QA officer will perform or coordinate project audits and surveillance, as required, in cooperation with any FERMCO project quality oriented organization.

Sampling Technicians
Under supervision of the Field Geologist, Sampling Technicians are responsible for the collection of samples in accordance with the approved PSP. These technicians are also responsible for ensuring the proper sample equipment is available and in serviceable condition (See Appendix C), and properly decontaminated between each sampling event/interval. Sampling technicians are responsible for ensuring that sample field screening results are reported to the Field Geologist.

3.0 BORING INSTALLATION AND SAMPLING PLAN

All DEEP geotechnical investigation field and laboratory activities will be governed and conducted in accordance with the appropriate sections of the SCQ.

3.1 SOIL AND WASTE BORING INSTALLATIONS

During the 4 phases of this project, a total of 15 shallow depth borings (see Table 3-1) will be completed to depths ranging from 11.0 feet to 33.0 feet into the soil cap and waste material within 3 waste pits. The 4 phases of this project consist of borings being completed prior to dewatering testing (Phase 1), during dewatering testing (Phase 2), during a later stage of dewatering (Phase 3), and after dewatering testing is accomplished (Phase 4). The resultant data will be used to evaluate the dewatering alternatives to be tested during the DEEP Treatability Study.

TABLE 3-1
TABLE OF DEEP PROGRAM WASTE PIT BORING AND SAMPLING LOCATIONS, AND IDENTIFICATION NUMBERS

OU1 BORING NUMBER*	RI/FS BORING NUMBER	WASTE PIT NUMBER	BORING DEPTH (ft.)	SAMPLING PHASE	GROUND ELEVATION (ft.)	ESTIMATED DEPTH TO PIT LINER (ft.)	NORTHING (ft.)	EASTING (ft.)
G1-101	11352	1	15.5	1	579.939	20.9	481405.4	1346851.3
G1-102	11353	1	15.5	1	580.227	21.2	481286.4	1346769.6
G1-103	11354	1	15.5	1	579.566	20.5	481335.7	1346838.3
G1-104	11355	1	15.5	2	579.503	20.5	481335.7	1346843.3
G1-105	11356	1	15.5	3	580.090	21.1	481330.7	1346828.3
G1-106	11357	1	15.5	4	579.424	20.4	481330.7	1346843.3
G1-201	11358	2	12.5	1	579.458	18.4	481551.1	1347099.5
G1-202	11359	2	11.0	1	577.719	16.7	481396.2	1347044.0
G1-301	11360	3	33.0	1	586.940	38.4	481866.8	1346862.8
G1-302	11361	3	33.0	1	589.490	40.9	481698.2	1346734.0
G1-303	11362	3	30.0	1	584.529	36.0	481546.0	1346593.1
G1-304	11363	3	31.5	1	585.980	37.5	481473.7	1346633.6
G1-305	11364	3	31.5	2	586.052	37.5	481473.7	1346638.6
G1-306	11365	3	31.5	3	585.656	37.2	481468.7	1346633.6
G1-307	11366	3	33.0	4	585.811	38.3	481468.7	1346638.5

* Included in the Operable Unit 1 Dewatering Excavation Evaluation Program Treatability Study Work Plan

Figure 3-1 (Appendix A) shows the locations of waste pit cross sections, Figures 3-2, 3-3, and 3-4 contain cross sections of the contents of Waste Pits 1, 2, and 3. The respective maximum depths to their pit liners are 21 feet, 20 feet, and 40 feet. Under no circumstances will a boring be advanced to within five feet of the pit liner. All borings will be installed using a truck mounted auger drilling rig. Borings will be installed in accordance with FERMCO Site Characterization and Data Management Department Standard Operating Procedure SCDM FO 001, titled "Procedure for Auger Drilled Borings and Solids Sampling with a Split-Barrel or Thin-Walled Tube" (see Appendix G). All soil borings shall be installed using 8 inch outer diameter (4.25 inch inner diameter) hollow stem augers. All sampling will be completed downhole through the hollow stems in advance of the auger tip.

Phase 1 drilling activities will be completed by the designated FERMCO drilling subcontractor. Phases 2, 3, and 4 will be completed by the designated Dewatering subcontractor.

3.1.1 Phase 1

Phase 1 borings shall be completed and sampled in Waste Pits 1, 2, and 3 before dewatering activities have been initiated. Phase 1 shall consist of the following shallow borings into the waste pits. Two borings (11352 and 11353) will be completed in Waste Pit 1 to a depth of 15.5 feet below ground surface. Boring 11354 will be completed at or near the center of the Waste Pit 1 dewatering test area to a depth of 15.5 feet below ground surface. Two borings (11358 and 11359) will be completed in Waste Pit 2 to a depths of 12.5 feet and 11.0 feet below ground surface, respectively. Three borings (11360, 11361, and 11362) will be completed in Waste Pit 3. 11360 and 11361 to a depth of 33.0 feet below ground surface, and 11362 to a depth of 30.0 feet below ground surface. One boring (11363) will be completed to a depth of 31.5 feet below ground surface at or near the center of the Waste Pit 3 dewatering test area. Figures 1-1, 1-2, and 1-3 indicate the boring locations in each waste pit.

3.1.2 Phase 2

During dewatering testing, the Phase 2 borings will be completed and sampled. Boring 11355 will be completed in Waste Pit 1 to a depth of 15.5 feet below ground surface. Boring 11364 will be completed in Waste Pit 3 to a depth of 31.5 feet.

3.1.3 Phase 3

During a later state of dewatering testing, the Phase 3 borings will be completed and sampled. Boring 11356 will be completed in Waste Pit 1 to a depth of 15.0 feet below ground surface. Boring 11365 will be completed in Waste Pit 3 to a depth of 31.5 feet.

3.1.4 Phase 4

After dewatering testing has been accomplished, the Phase 4 borings will be completed and sampled. Boring 11357 will be completed to a depth of 15.0 feet below ground surface in Waste Pit 1. Boring 11366 will be completed to a depth of 33.0 feet below ground surface in Waste Pit 3.

If dewatering operations in Waste Pit 1 and Waste Pit 3 do not begin and end during the same time frame, Phases 2, 3, and 4 will become Phases 2, 3, 4, 5, 6, and 7 (all with one boring per phase). The project manager will determine when the four phases are to begin and end.

3.2 MATERIAL SAMPLING PROCEDURE

Samples will be collected using split-spoon samplers, thin-walled tube samplers and/or piston samplers in all borings. Split-spoon samples will be collected during Standard Penetrating Testing using standard 2-inch diameter, 2.0 foot long split-spoon samplers driven 1.5 feet with a 140-pound sampling hammer falling 30 inches in accordance with the American Society for Testing and Materials (ASTM) Method D 1586-84 (see Appendix H). For obtaining undisturbed samples, a standard 3.0 foot long 3-inch diameter thin-walled sampler will be used. All thin-walled tube sampling will be pushed 2.5 feet and administered in accordance with ASTM Method D 1587-83 (Appendix H). The thin-walled tube samples will be capped and sealed with wax at both ends of the sampler to prevent damage and disturbance to the sample.

In the event that the thin-walled tube sampler is ineffective for obtaining undisturbed samples, a piston sampler will be used. Piston samples will be collected using a standard 3-inch diameter, 2.5 foot long piston sampler pushed 2.5 feet. All samples collected with the piston sampler will be in accordance with ASTM 4700-91 (Appendix H).

Split-spoon and thin-walled tube or piston sampling will be conducted in advance of the drill bit to total depth.

Appendix D outlines the samples to be collected from each boring, the sample type from each depth interval, and its unique six-digit sample number. All undisturbed samples (thin-walled tube or piston) collected for the project will be archived for potential geotechnical testing, except those undisturbed samples collected from borings 11354, 11355, 11364, and 11366. The undisturbed samples collected from these borings will be tested for Consolidated-Undrained Triaxial Compression with Pore Pressure measurements and Unit weight by the University of Cincinnati Geotechnical Laboratory as soon as possible.

When distinct lithologic changes are encountered, and at the Field Geologist's discretion, two 500-ml samples will be collected from the split-spoon samples. One of the samples will be analyzed for the project specific disturbed geotechnical tests (Atterberg Limits, grain-size analysis, specific gravity, and moisture content). The second sample will be archived for future Operable Unit 1 data needs.

In accordance with ASTM D 2488-90 (Appendix H), the Field Geologist will describe and classify all split-spoon samples for lithologic purposes, the soil or waste material collected in the Shelby tube sampler will also be described, by examining the material at the ends of the sample tubes. Soil and waste material samples will be described and classified based on color (Munsell Soil Color Chart), consistency (pocket penetrometer), angularity, grain-size distribution, particle size, estimated water content, and depth from land surface. To avoid confusion with the laboratory results of the Unified Soil Classification System (USCS), a field approximation of the USCS, which is normally classified in the field will not be completed for this project.

Immediately following sampling and prior to containerization, each soil and waste material sample shall be field screened for radiological activity and the presence of organic vapor constituents. Field screening shall be accomplished by using an alpha meter, pancake Geiger Mueller detector, and photoionization (PID) detector.

Field screening results shall be recorded on the Lithologic Log, Sample Collection Log, chain of custody form, and the sample label. Appendix E contains examples of the Field Forms to be used during this project. The split-spoon samples shall be placed in a 500 millimeter (ml) clear glass jar. The disturbed geotechnical tests will be completed on split-spoon samples when distinct lithologic changes are encountered. The Field Geologist will be responsible for determining when split-spoon samples will be collected. Any material from a split-spoon not being analyzed will be discarded with the drill cuttings.

Sampling equipment will be transported between boring locations in tightly wrapped plastic sheeting to prevent gross contamination of sampling and drilling personnel, and the truck transporting the sampling equipment. Prior to use at each location, sampling equipment shall be thoroughly cleaned. Upon completion of the project, sampling equipment shall be decontaminated according to Level II Contamination Procedures listed in Appendix K.11 of the SCQ. Level III decontamination shall be completed for equipment exhibiting gross contamination.

Upon completion of sampling and drilling activities, and following the direction of the Operable Unit 1 Project Manager, the borehole will be plugged and abandoned with Volclay grout up to the ground surface in accordance with ASTM D 5299, "Standard Guide for Decommissioning Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities (Appendix H)". The grout will be tremied into the borehole with a grout pump. A survey stake with the boring identification number will be driven into the top of the Volclay grout at each boring location. During the plug and abandonment process, the Field Geologist will document the plug and abandonment on a Well Completion Log (Appendix E).

3.3 WASTE PIT SAMPLING CONSIDERATIONS

The characteristics of the waste pit material will dictate the sampling methodologies to be used. If drilling or sampling refusal occurs prior to reaching the pre-determined depth, the Project Manager and the Field Geologist will determine if a new boring should

be initiated. A new boring location shall be a minimum of 5 feet from any pre-existing boring location.

Changes to the requirements outlined in this PSP shall be approved by the DEEP Project Manager. Changes such as moving a boring location, changing sampling devices, etc., will be documented on a approved variance to this PSP.

3.4 GEOTECHNICAL TESTING

Soil and waste material samples will be tested to provide the following geotechnical information to evaluate the effectiveness of the dewatering alternatives to be tested during the DEEP. Geotechnical testing in this project includes:

TABLE 3-2

TABLE OF GEOTECHNICAL TESTS FOR 10.03.06

GEOTECHNICAL TEST	SAMPLE TYPE	METHOD (Appendix H)
Consolidated-Compression Tests with Pore Pressure Measurements	Undisturbed	ASTM D 4767-88 / EM-1100-2-1906, APPENDIX X
Grain-Size Analysis	Disturbed	ASTM D 422-63 / ASTM D 1140-92
Atterberg Limits	Disturbed	ASTM D 4318-84
Moisture Content	Disturbed	ASTM D 2216-92
Specific Gravity	Disturbed	ASTM D 854-92
Unit Weight	Undisturbed	EM-1100-2-1906, APPENDIX II

At distinct lithologic changes, split-spoon samples shall be tested for grain-size analysis, Atterberg limits, specific gravity, and moisture content (Table 3-2). A sample volume of 500 ml will be sufficient sample to complete the requested tests. The thin-walled tube or piston samples will be tested for unit weight, and Consolidated, Undrained Triaxial Compression Tests with Pore Pressure measurements (TX-CU w/pp). After the TX-CU w/pp is completed on the thin-walled tube or piston samples, the disturbed tests (Table 3-2) will also be completed on the resultant cuttings from the tube. The University of Cincinnati laboratory personnel will determine if the amount of cuttings is adequate to complete the disturbed tests.

Geotechnical testing for physical properties will be conducted under the appropriate ASTM standards and laboratory procedures using qualified geotechnical laboratory technicians and properly calibrated apparatus which meets ASTM D 3740-90, "Evaluation

of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction" (Appendix H).

3.5 ARCHIVE OF UNDISTURBED AND DISTURBED SAMPLES

The undisturbed thin-walled tube or piston samples will be archived for potential testing to be determined by Operable Unit 1. The 500-ml disturbed samples not being tested for the disturbed geotechnical tests found in table 3-2, will be archived for future Operable Unit 1 data needs.

3.6 INVESTIGATION-DERIVED WASTE (IDW)

During sampling and drilling activities borehole cuttings will be placed into 55-gallon drums. Drums shall be marked with the boring number, media type (soil, water, or waste), drum number, and the date generated. The drums contents will be backfilled into the subsequent trench excavated during the wet and/or dry excavations of the DEEP Treatability Study.

Contact waste (such as used PPE, etc.) will be placed in plastic bags or 55 gallon drums, and handled in accordance with Standard Operating Procedure 20-C0604 "Control and Utilization of Contaminated Trash Dumpsters" (Appendix G). The bag will be placed in the Operable Unit 4 RI/FS dumpster. Prior to placing the bag in the dumpster, a label will be attached, with the name and phone number of the project manager.

3.7 SURVEYING

Stakes will be placed at each boring location by the Field Geologist or designee. Each boring installation and sampling point will be surveyed vertically and horizontally to the nearest 0.1 foot by a State of Ohio licensed surveyor. Surveying will occur before the field work has been initiated to minimize the possibility of drilling into the pit liners. A surveyor's stake with a highly visible ribbon tied around the top will be driven into the ground at each sample location. Sample location number and coordinates will be written on each stake.

3.8 SAMPLE HANDLING AND SHIPPING

3.8.1 Sample Management

Immediately following collection a Radiation Technician shall survey each sample with a Geiger Mueller frisker and an Alpha meter, the readings will be recorded and reported to the Lead Field Geologist. Immediately following containerization, each sample will be labeled and custody taped. A unique six-digit sample number (Appendix D) shall be assigned to each collected sample. Each sample shall be affixed with a label containing, at a minimum, the unique sample number, WBS number, location number, sample matrix, depth interval sampled, collection time, samplers' initials, geotechnical parameters, and field screening results. The custody tape shall be initialed and dated by the sampler.

3.8.2 Sample Chain-of-Custody Records and Field Data Documents

Sample custody procedures outlined in the SCQ shall be adhered to throughout the sample handling process from field collection to shipment of the samples to the laboratory. A Site-Wide Analysis Request/Custody Record (SWAR/CR) shall be used to document collection data, chain-of-custody, and geotechnical parameters requested for each sample.

In addition to the custody records, a Sample Collection Log shall be completed which summarizes all samples collected from a single borehole. All field work shall be documented in detail on a daily basis using the Field Activity Log (FAL). All field documentation will be completed by the Field Geologist.

3.8.3 Sample Packaging, Storage, and Shipping

Sample custody seals will be examined and verified by FERMCO Sample Processing Laboratory (SPL) personnel of the FERMCO Sample Management Organization prior to acceptance of samples. The field screening results will be clearly displayed on the sample label and the SWAR/CR. Sample packaging shall be performed in accordance with the SCQ Section K.10.

Final sample handling, screening, storage, and shipping activities will be completed by the SPL. Samples will be shipped to the designated on-site U.C. Geotechnical Laboratory for the geotechnical tests required.

3.8.4 Calibration of Field Equipment

All equipment used during this investigation shall be operated and calibrated according to the manufacturer's specification. Written logs of equipment calibration are maintained by the FERMCO personnel responsible for performing the instrument calibrations.

4.0 DATA MANAGEMENT PLAN

This data management plan will be implemented so that information collected during the investigation will be properly managed following completion of the field activities. Data and field documentation generated during the investigation shall be validated to ensure compliance with the DQOs outlined in Appendix B of this PSP.

4.1 FIELD DOCUMENTATION

As specified in Section 5.1 of the SCQ, sampling teams shall describe daily activities on the FAL sufficient for the sampling team to reconstruct a particular situation without reliance on memory. The Field Geologist shall complete lithologic logs for each boring as specified in Section J.4.1.2 of the SCQ. Sample collection logs shall be completed according to instructions specified in Appendix B of the SCQ.

4.1.1 Field Documentation Validation

To assure appropriate documentation was completed during field activities and that documentation was completed correctly, field documentation shall be validated to Analytical Support Level (ASL) A by Environmental Programs Development (EPD) and Quality Assurance (QA) as described in the SCQ, Section D.5.

4.1.2 Field Documentation Data Entry and QA/QC

Validated data shall be entered into the FEMP Site-Wide Environmental Database (SED) by Analytical Data Management. Manual, double keyed, data entry shall be performed and the entered data shall be compared to the original data sheets; corrections shall be initialed and dated, and made as necessary. Hard-copy documents are kept in permanent storage in the RI/FS Project Files, filed under the RI/FS WBS number 10.03.06; the electronic database is permanently archived in a neutral ASCII file format.

5.0 HEALTH AND SAFETY PLAN

A Project-Specific Health and Safety Plan for this PSP is contained in Appendix F.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

The primary objectives of the Quality Assurance/Quality Control (QA/QC) section of this plan relate to the collection of field information and data sufficient to evaluate the dewatering testing to occur during the DEEP. Specific objectives of this field sampling effort shall be designed, organized, and implemented in a manner which will optimize the collection of information which meets the DQOs (Appendix B) specified in this PSP. To ensure information is gathered in such a manner that DQOs are met, QA/QC measures will be used to determine conformance with overall Operable Unit 1 objectives.

The fundamental mechanisms used to achieve these quality goals can be characterized as prevention, assessment, and correction. These components are further described as follows:

- Prevention of defects in the data quality through planning and design, documented instruction and procedures, and careful selection and training of skilled, qualified personnel.
- Quality assessment through program or regular audits and surveillance to supplement continual informal review.
- Permanent correction of conditions adverse to quality objectives through a close-looped corrective action system.

6.1 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

All Environmental Field Operations (EFO) sampling programs follow protocol established in the Sitewide CERCLA Quality Assurance Project Plan, Vol I, Section 4, Vol II, Appendix K.

Self-assessment and independent assessments of work processes and operations shall be undertaken to assure quality of performance. Self-assessment shall be performed by the Quality Assurance Officer assigned to the DEEP Treatability Study. Self-assessment activities shall encompass technical and procedure requirements, and may be conducted at any point in the project.

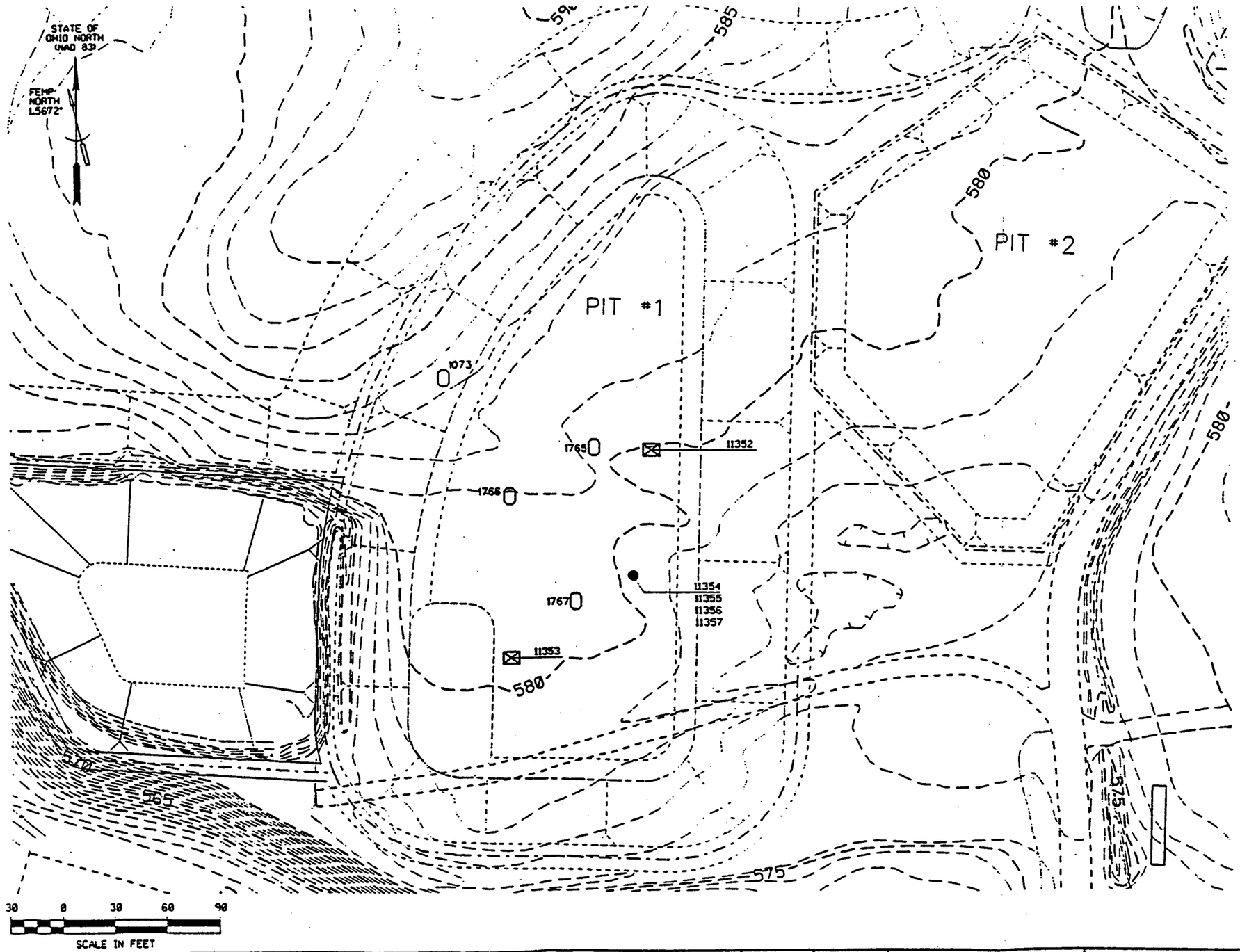
At a minimum, one surveillance shall be conducted, consisting of monitoring/observing on-going project activity and work areas to verify conformance to specified requirements. Surveillance shall be planned and documented in accordance with Section 12.3 of the SCQ.

7.0 PROJECT SCHEDULE

The project schedule for this field activity is summarized in APPENDIX I.

APPENDIX A

FIGURES



LEGEND

0 LEACHATE WELL FOR SLUG TESTING

● BEFORE, DURING AND AFTER DEWATERING SPI

⊠ STANDARD PENETRATION TEST

BORING LOCATION

BORING NO	NORTH	EAST
11352	481,485.4	1,346,851.3
11353	481,286.4	1,346,784.6
11354	481,335.7	1,346,838.3
11355	481,335.7	1,346,841.3
11356	481,338.7	1,346,838.3
11357	481,338.7	1,346,841.3

NO. | REVISIONS | DATE/DWN BY/APPD | NO. | REVISIONS | DATE/DWN BY/APPD | REF. DWG. NO

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

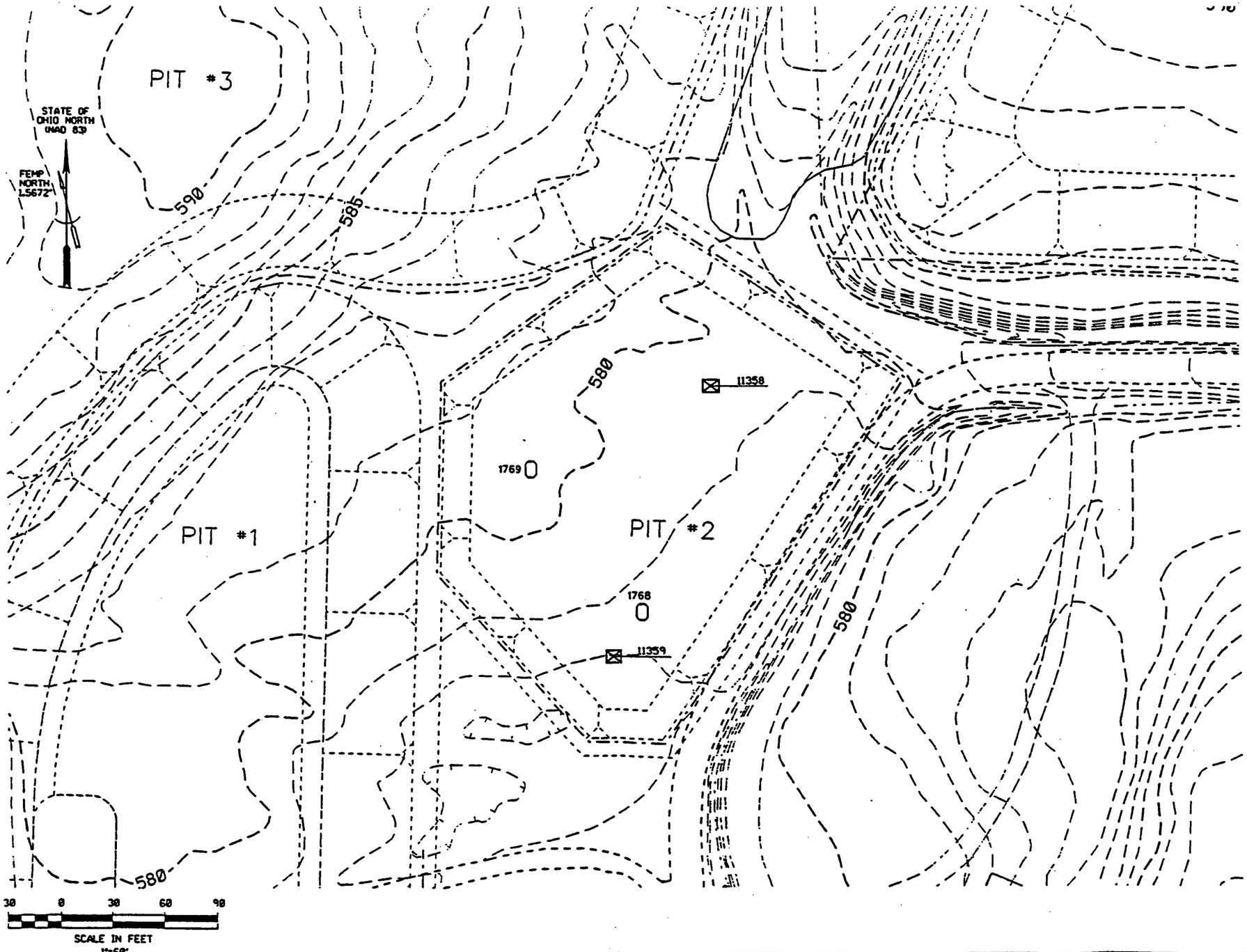
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
Fernald
Environmental Management Project
U.S. DEPARTMENT OF ENERGY

FIGURE 1-1

WASTE PIT 1 BORING LOCATION

FIGURE -

FILE NAME:



71

LEGEND

O LEACHATE WELL FOR SLUG TESTING

⊠ STANDARD PENETRATION TEST

BORING LOCATION

BORING NO	NORTH	EAST
11358	481,551.1	1,347,899.5
11359	481,396.2	1,347,844.8

FIGURE 1-2

WASTE PIT 2
BORING LOCATIONS

FIGURE •

NO | REVISIONS | DATE | DWN. | BY | APPD

NO | REVISIONS | DATE | DWN. | BY | APPD

REF. DWG NO

NOTE:
FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

CIVIL & SITE
ELECTRICAL
ENGINEER
INSTRUMENT
MECHANICAL
CHECKED
APPROVED

SAFETY ENG.
HEALTH PHYSICS
QA
SITE PROTECT
WASTE MANAGE
SECURITY
CDV

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
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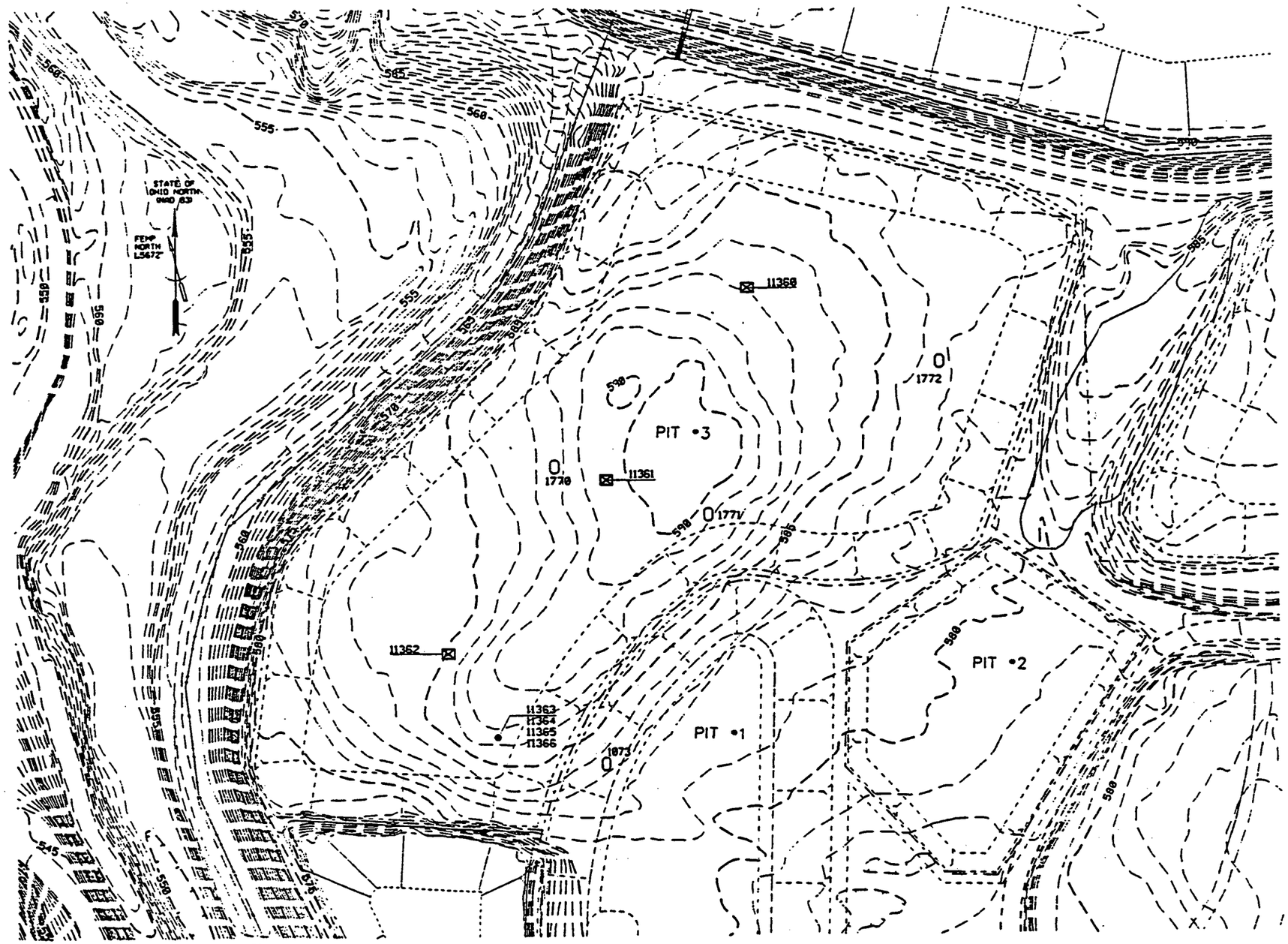
U.S. DEPARTMENT OF ENERGY

FILE NAME:

000259



50 0 50 100 150

SCALE IN FEET
1"=100'

LEGEND

71

- O LEACHATE WELL FOR SLUG TESTING
- ● BEFORE, DURING AND AFTER DEWATERING SPT
- ⊠ STANDARD PENETRATION TEST

BORING LOCATION

BORING NO	NORTH	EAST
11360	481,866.0	1,346,862.8
11361	481,698.2	1,346,734.8
11362	481,546.0	1,346,593.1
11363	481,473.7	1,346,633.6
11364	481,473.7	1,346,638.6
11365	481,468.7	1,346,633.6
11366	481,468.7	1,346,638.6

FIGURE 1-3

NO	REVISIONS	DATE	DWN	BY	APPD.	NO	REVISIONS	DATE	DWN	BY	APPD.	REF. DWG NO.

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

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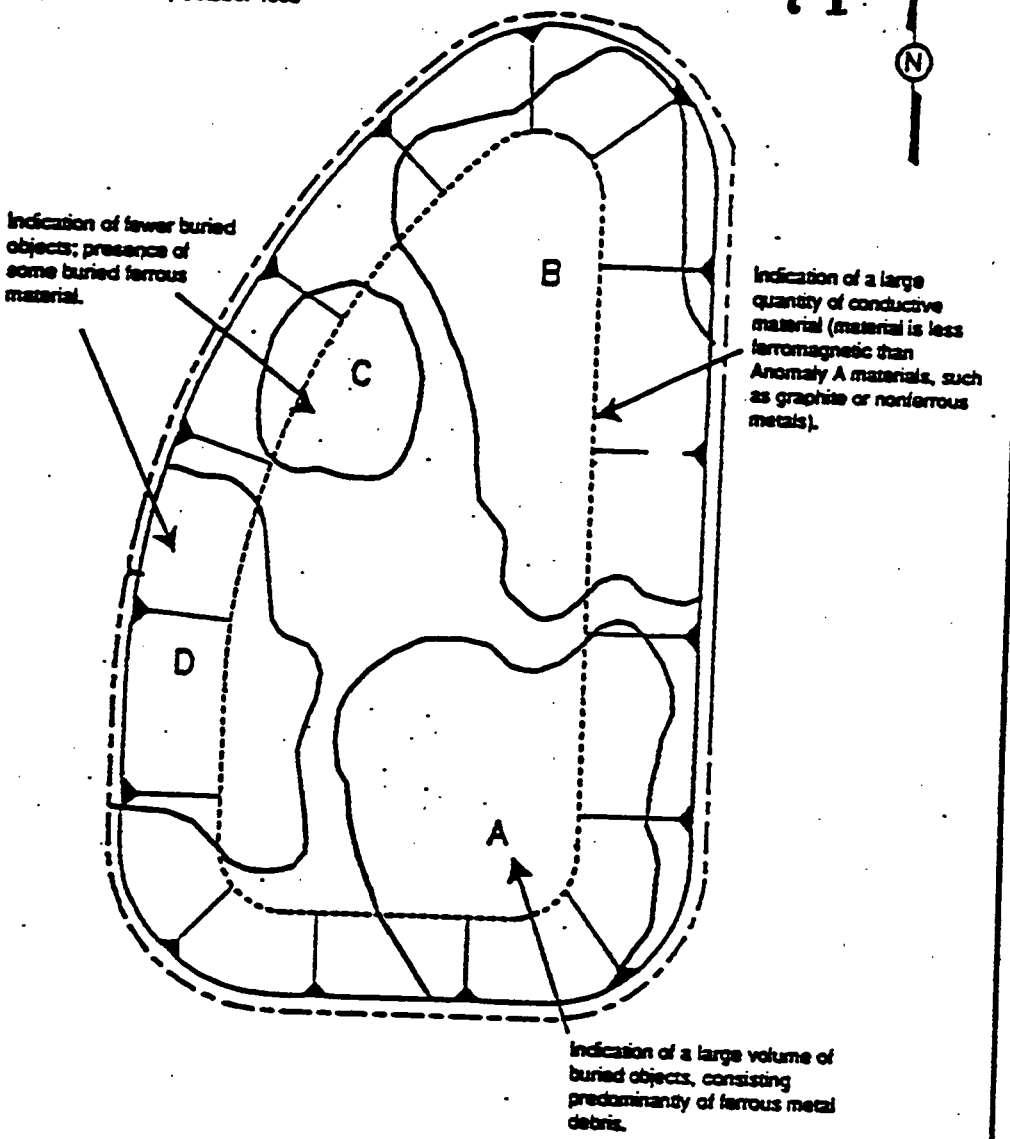
WASTE PIT 3 BORING LOCATIONS

FIGURE #

FILE NAME:

Source: *Draft Remedial Investigation Report for Operable Unit 1*, October 1993



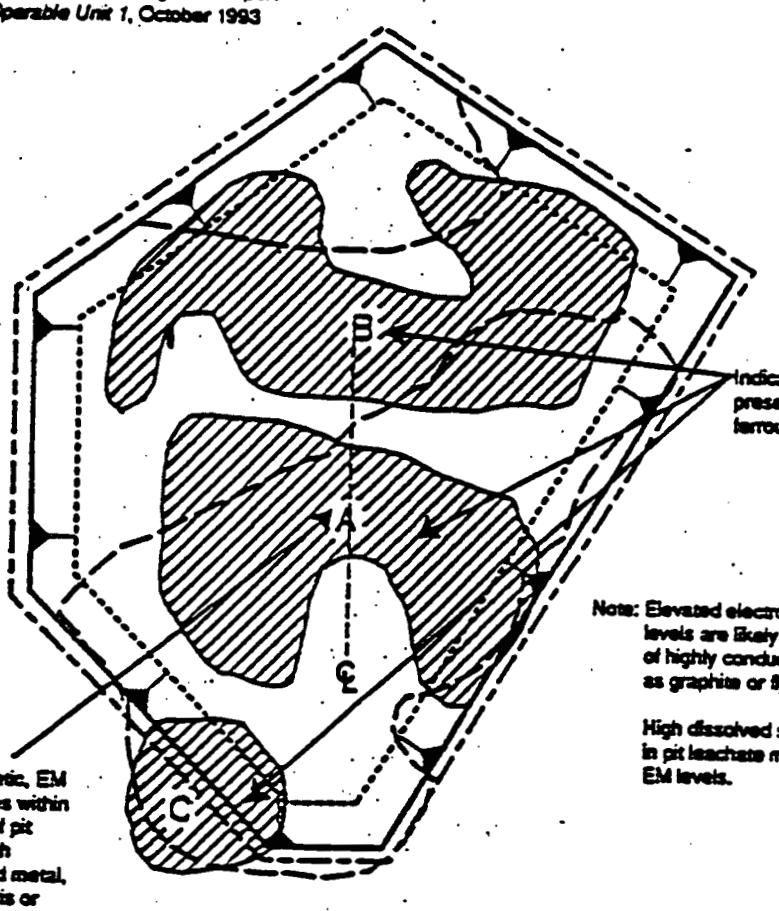
ANOMALY	MAGNETICS	EM31 HORIZONTAL	EM31 VERTICAL	GPR
A	X			X
B	X	X	X	X
C	X	X	X	X
D	X			X

X-DENOTES ANOMALOUS MEASUREMENTS

ILLUS\OU-1\PO-19\WP1 ANOMAP.EPS

FIGURE 1-4 GEOPHYSICAL ANOMOLY MAP OF WASTE PIT 1

Source: *Draft Remedial Investigation Report for Operable Unit 1*, October 1993



Indication of possible presence of buried ferrous metal.

Note: Elevated electromagnetic (EM) levels are likely due to the presence of highly conductive material, such as graphite or flyash.

High dissolved solids concentrations in pit leachate may also contribute to EM levels.

Concurrent, magnetic, EM and GPR anomalies within Area A, just west of pit center, indicate high probability of buried metal, such as metal debris or drums.

ANOMALY	MAGNETICS	EM31 HORIZONTAL	EM31 VERTICAL	GPR
A	x			x
B	x			
C	x			

LEGEND:

MAGNETIC ANOMALY

ELECTROMAGNETIC ANOMALY

X-DENOTES ANOMALOUS MEASUREMENTS

\\ILLIS\OU-1\PO-1\RWP2 ANOMAP.EPS

FIGURE 1-5 **GEOPHYSICAL ANOMOLY MAP OF WASTE PIT 2**

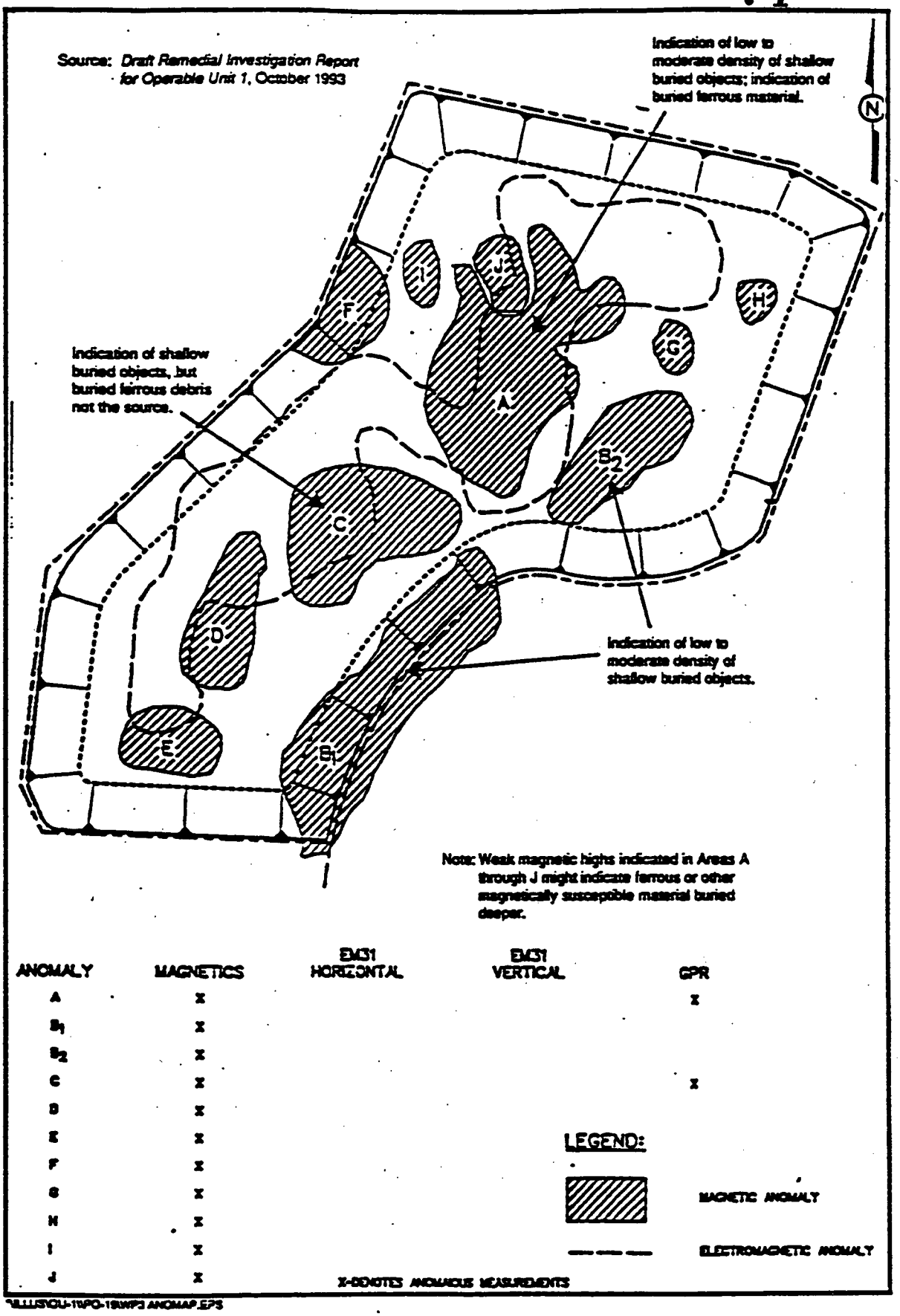


FIGURE 1-6 GEOPHYSICAL ANOMOLY MAP OF WASTE PIT 3

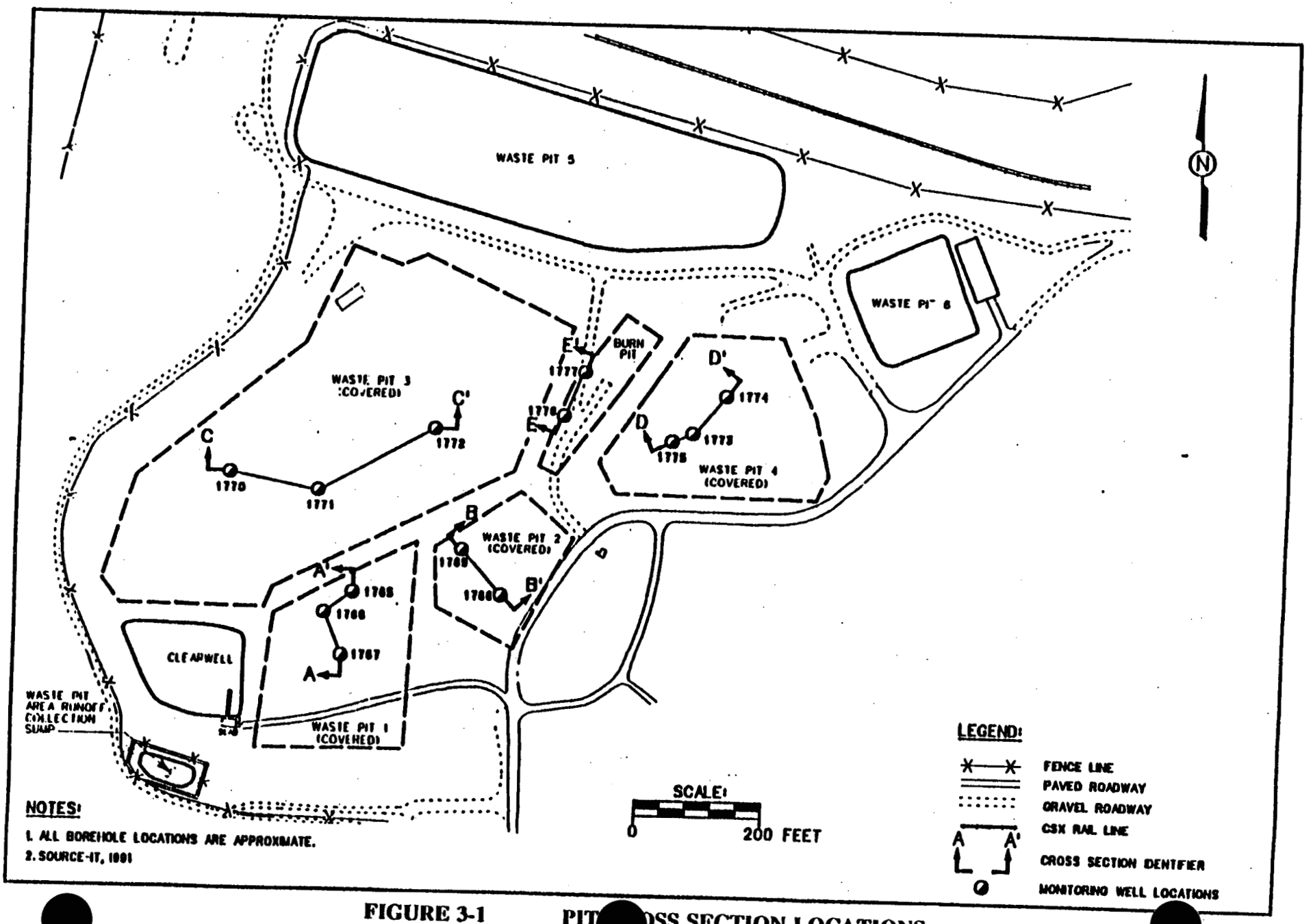
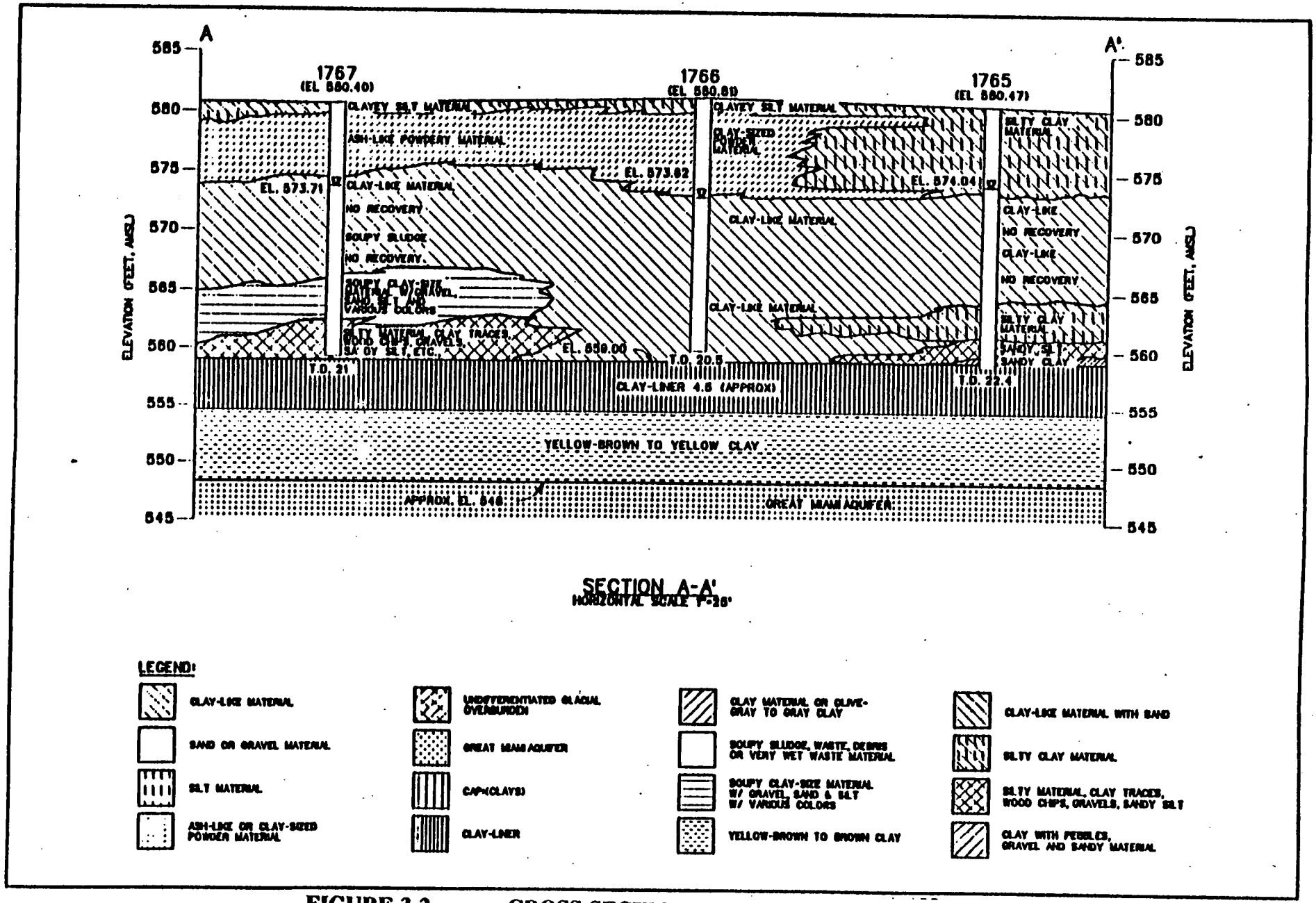


FIGURE 3-1 PIT CROSS SECTION LOCATIONS



SECTION A-A'
HORIZONTAL SCALE 1"=25'

FIGURE 3-2 CROSS SECTION OF WASTE PIT 1 CONTENTS

000265

T 2

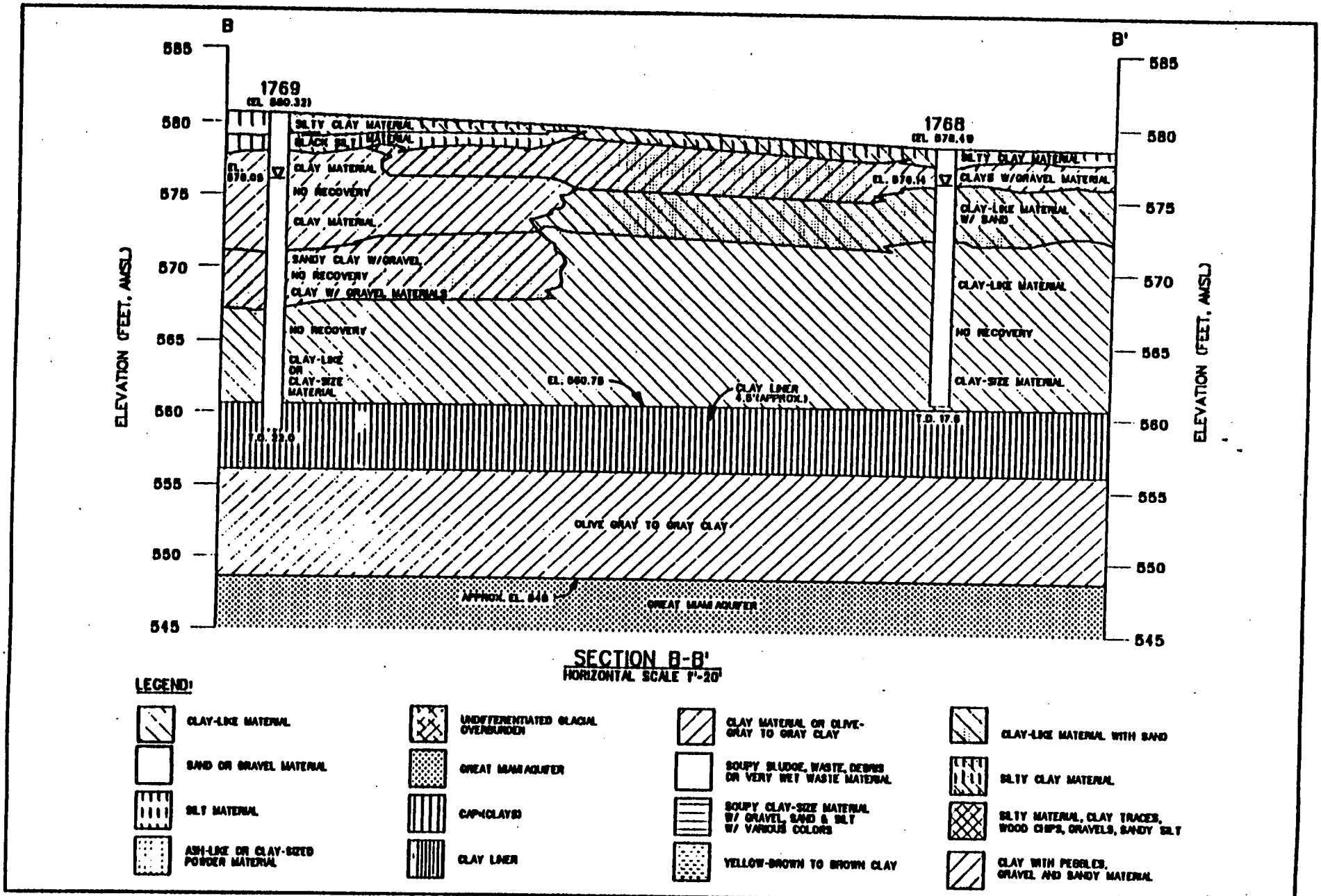


FIGURE 3-3 CROSS SECTION OF WASTE PIT 2 CONTENTS

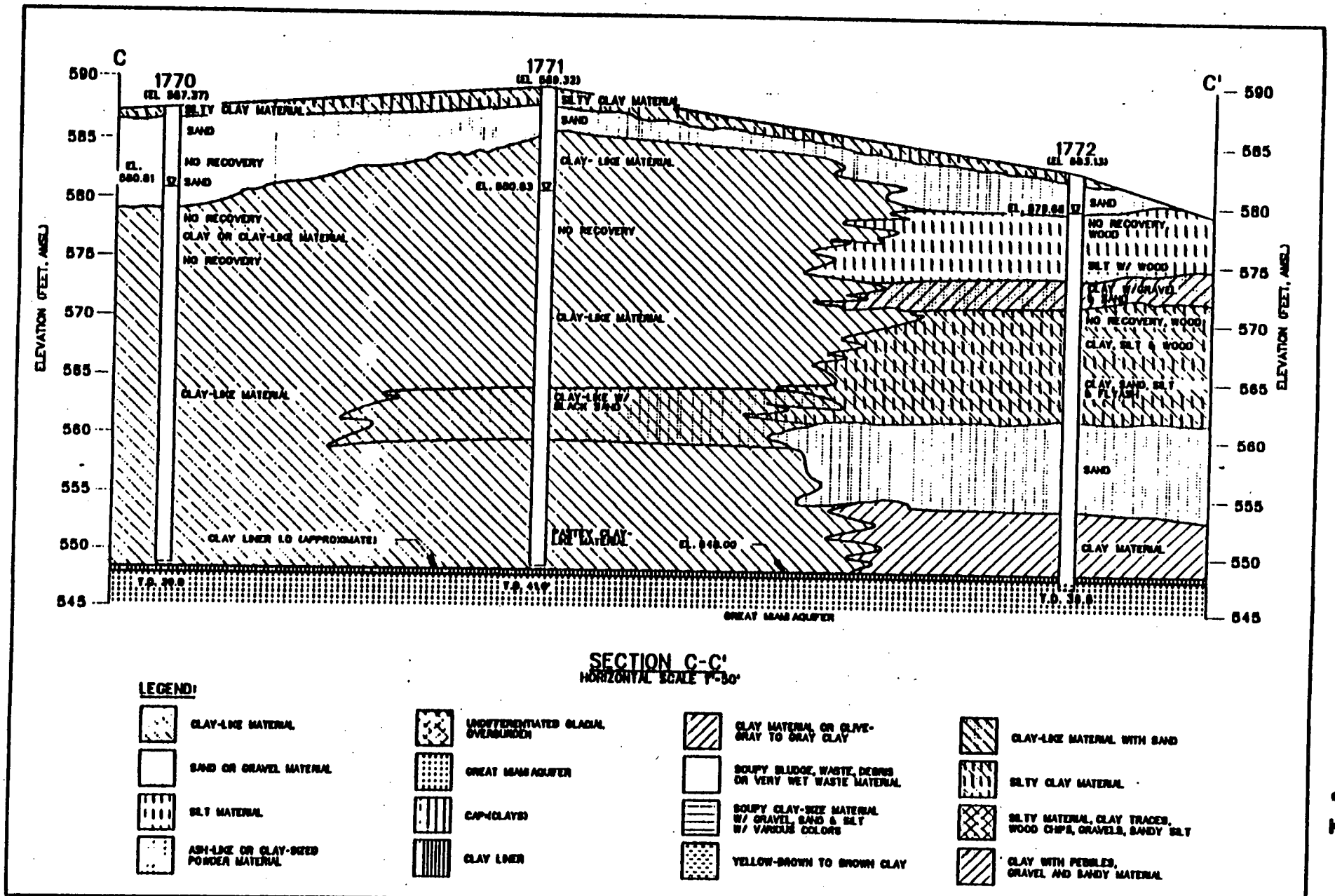


FIGURE 3-4 **CROSS SECTION OF WASTE PIT 3 CONTENTS**

000267

T.2

APPENDIX B

DATA QUALITY OBJECTIVES

NOTE: This copy of the Data Quality Objectives is an uncontrolled document. Verify current revision is being used prior to implementation.

Fernald Environmental Management Project

Data Quality Objectives

Title: DEEP Treatability Study Geotechnical Investigation

Number: GT-002

Revision: 0

Effective Date: 10/03/94

Contact Name: Pat Riley

Approval: _____ *Date:* 10/03/94
DQO Coordinator

Rev #	0				
Date	10/03/94				

UNCONTROLLED

Data Quality Objectives for DEEP Treatability Study Geotechnical Investigation

1. State the Problem or the Situation to be Resolved

The Operable Unit 1 Dewatering Excavation Evaluation Project (DEEP) has been developed to investigate the ability to dewater the materials contained in Waste Pits 1, 2, and 3. The DEEP Treatability Study Geotechnical Investigation will provide supporting data to evaluate the effectiveness of the dewatering process being tested on the waste materials. This will be achieved by sampling the waste pit contents before, during, and after the dewatering process is completed. The effectiveness of the dewatering process will determine if removing the material by conventional excavation is a feasible alternative. If the dewatering process is proved ineffective, an alternative to wet slurry the waste will be evaluated. The DEEP Treatability Study is driven by the terms of Section XII.D.1 and D.2 of the Amended Consent Agreement between the Department of Energy and the U.S. Environmental Protection Agency.

Geotechnical and analytical data collected for the Operable Unit 1 Remedial Investigation/Feasibility Study for Operable Unit 1 provides information for each waste pit. This data includes the thickness and volumes of the liners, caps, and waste in Waste Pits 1, 2, and 3. A general accounting of the types of waste deposited in each pit is also included. To adequately evaluate the dewatering process's effectiveness, additional geotechnical tests are required to provide data specific to the areas where dewatering testing will be conducted. The additional tests are crucial to establish the physical properties of the waste pit contents before, during, and after dewatering testing is completed.

2. Identify the Decisions to be Made that Affect the Situation

The DEEP Treatability Study Geotechnical Investigation is designed to provide supporting data for the evaluation of proposed remediation methods. One remediation method under consideration includes installing a network of extraction wells to remove the liquid portion (dewater) of the waste pit contents, treating the extracted waste water, and then remove the solids using traditional construction methods utilizing equipment such as bulldozers and backhoes. The other remediation method includes slurring the waste pit material, pumping the material to tanks, and mechanically removing the remaining waste pit material that could not be removed in a slurry (i.e. drums). It is unknown how the waste pit material will react to the remediation methods. The geotechnical test data will provide further insight into the physical characteristics of the material (sheer strength and moisture content before, during, after dewatering, specifically) which will help determine the final remediation alternative.

3. Identify Inputs that Affect the Decision

The heterogeneity of the waste pit contents is a key consideration in selecting the number and locations of the DEEP sampling points. Points were chosen, in relation to the location of the proposed dewatering wells, and trench excavation sites. The locations of these sites were based upon the amount of historical geotechnical data from the each waste pit, combined with the best engineering judgement of the factors involved, and to provide a maximum amount of data from a minimum amount of sampling locations. The number of boring locations was determined based on the need to provide adequate lateral data coverage of Waste Pits 1, 2, and 3.

Standard Penetration Tests (ASTM Method D 1586-84) will be completed at a total of 15 borings

locations in three waste pits; 6 borings in Waste Pit 1, 2 borings in Waste Pit 2, and 7 borings in Waste Pit 3. The Standard Penetration Tests will provide data about the nature of the waste pit stratification and strength.

At or near the center of the dewatering test areas in Waste Pit 1 and Waste Pit 3, a total of 4 boring locations (1 in each pit before and after dewatering) will be tested for Consolidated Undrained Compression Test with Pore Pressure Measurements, the unit weight for the material will also be determined. These tests will measure the change or lack of change in material strength from the dewatering. These 4 borings will also be tested for the following disturbed geotechnical tests: grain-size analysis, Atterberg limits, moisture content, and specific gravity when distinct lithologic changes are encountered. The other 11 boring locations will be tested for the disturbed geotechnical tests. A total of 9 borings will be completed before dewatering (3 in Waste Pit 1, 2 in Waste Pit 2, and 4 in Waste Pit 3).

4. Define the Boundaries of the Situation

Sampling will be conducted in Waste Pits 1, 2,and 3 which are located northwest of the former process area of the FEMP. Specific locations are based on the position of the subsequent trench locations and dewatering test areas. Borings will be 15, 15.5 or 33 feet deep. The depth of each boring was chosen in relation to the depth to the pit liner at each boring location.

Each waste pit contains a different mix of process waste materials. The majority of Waste Pit 1 materials are dry solids including general sump sludge, depleted slag, trailer cake, depleted residues, graphite, ceramics, thorium waste, and uranyl ammonium phosphate filtrate. Drums were visible in a mid-1959 photograph.

The material in Waste Pit 2 consists of general sump sludge, depleted slag, trailer cake, uranyl ammonium phosphate filtrate, depleted residues and graphite/ceramics. The material in Waste Pit 2 is generally coarser than in Waste Pit 1.

Waste Pit 3 contains general sump sludge, raffinate, trailer cake, slag leach, water treatment sludge, and thorium wastes.

The average depth to the water table in Waste Pits 1, 2, and 3 is 3.5 feet below ground surface.

5. Develop a Logic Statement

All information obtained from this investigation will be used to evaluate Waste Pit 1, 2, and 3 remediation options. By conducting geotechnical tests before, during, and after dewatering the effectiveness of the dewatering program can be measured, and the physical properties of the waste material during the different phases of the dewatering process. After each phase of dewatering has been completed, the resultant data will be reviewed by the DEEP Project Engineer. The DEEP Project Engineer will make the determination if the dewatering process has been effective. If the geotechnical testing indicates that the waste pit material can be dewatered and removed with conventional excavation methods, then the option to slurry the material may be abandoned. If the geotechnical testing indicates that the waste pit material cannot be dewatered and excavated, then the slurry method will be further evaluated.

The data obtained from this program will be used primarily by Operable Unit 1, but will be

available for use by other interested parties at the FEMP.

6. Establish Constraints on the Uncertainty of the Decision

Sampling errors will be controlled through review of the sampling plan with sampling technicians and technical guidance will be provided by Operable Unit 1 technical staff during drilling and sampling operations. The collection undisturbed geotechnical samples is critical to the measurement of the dewatering process. If the consistency of the waste pit material proves to be such that the undisturbed geotechnical sampling equipment (thin-walled Shelby tube sampler) is ineffective, a more sophisticated 3-inch diameter sampler with a trap type device will be used (in accordance with ASTM D 1587-83) to collect undisturbed samples. The collection of the disturbed geotechnical samples is also important, and if the material is remaining in the split-spoon sampler, a split-spoon trap will be used. In the event that an impenetrable object is encountered in the borehole, the boring location shall be moved at least 5 feet away from the original location that has been specified by the DEEP Project Manager.

Geotechnical testing for physical properties will be conducted under the appropriate ASTM standards and laboratory procedures using qualified geotechnical laboratory technicians and properly calibrated apparatus which meets ASTM D 3740-80, "Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil Rock as Used in Engineering Design and Construction.

Geotechnical data errors would result in the physical qualities of the waste pit material being incorrectly identified. A false positive error in which the material is assumed to have reacted favorably to the dewatering process and therefore having an adequate amount of strength to maintain a slope, would incapacitate conventional excavation of the waste pit contents. A false negative error, the material has been dewatered but assumed to be wet, would result in the slurry method being further investigated based upon an incorrect assumption. In either case the cost of the project would be dramatically increased due to the need to resample to correct for these errors.

From a political/social standpoint, data errors result in a perception that the project is mismanaged.

7. Optimize a Design for Obtaining Quality Data

Maximum benefit from the data is achieved by relying on historical information to avoid areas of known problems (i.e. buried drums), and concentrating on areas of specific concern to this Treatability Study. Information has been collected for the Operable Unit 1 Remedial Investigation and Feasibility Study for each of the waste pits. The 15 additional borings will provide data from the specific locations of concern for the evaluation of alternatives for Waste Pit 1, 2, and 3 remediation.

Data quality will be optimized by following the Sitewide CERCLA Quality Assurance Plan (SCQ) and American Society for Testing and Materials (ASTM) sampling and geotechnical protocols. The geotechnical method standards required are: Grain Size Analysis (ASTM D 42263/ASTM D 1140-92), Atterberg Limits (ASTM D 4318-84), Moisture Content (ASTM D 2216-92), Specific Gravity (ASTM D 854-92), Consolidated-Compression Tests with Pore Pressure Measurements (ASTM D 4767-88/EM-1100-2-1906, Appendix X), and Unit Weight (EM 1100-2-1906, Appendix II).

To ensure appropriate documentation was completed during field activities and that documentation was completed correctly, field documentation shall be validated to Analytical Support Level (ASL) A as described in the SCQ, Section D.5.

DQO SUMMARY FORM

Revision:
Effective Date:

1.A. Task/Description: CRU #:_____

Dewatering Excavation Evaluation Program (DEEP) Treatability Study
Geotechnical Investigation

1.B. Project Phase: (Put an X in the appropriate selection.)

RI FS RD RA R,A OTHER X Specify: Treatability Study

1.C. DQO No.: GT-002 DQO Reference No.: _____

---

2. Media Characterization: (Put an X in the appropriate selection.)

Air Biological Groundwater Sediment Soil X

Waste X Wastewater Surface water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Put an X in the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization
A B C D E

Risk Assessment
A B C D E

Evaluation of Alternatives
A X B C D E

Engineering Design
A B C D E

Monitoring during remediation activities
A B C D E

Other (Explain) _____
A B C D E

4.A. Drivers: The DEEP Treatability Study is driven by the terms of Section XII.D.1 and D.2 of the Amended Consent Agreement between the Department of Energy and the U.S. Environmental Protection Agency.

4.B. Objective: The DEEP Treatability Study Geotechnical Investigation will provide supporting data to evaluate the effectiveness of the dewatering process being tested on the waste materials. This will be achieved by sampling the waste pit contents before, during, and after the dewatering process is completed. The effectiveness of the dewatering process will determine if removing the material by conventional excavation is a feasible alternative. If the dewatering process is proved ineffective, an alternative to wet slurry the waste will be evaluated.

5. Site Information (Description):

Sampling will be conducted in Waste Pits 1, 2,and 3 which are located northwest of the former process area of the FEMP. Specific locations are based on the position of the subsequent trench locations and dewatering test areas. Borings will be 15, 15.5 or 33 feet deep.

DQO SUMMARY FORM

Revision:
Effective Date:

DQO Number: GT-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and SCQ Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the SCQ Section.)

1. pH	2. Uranium	3. BTX
Temperature	Full Radiologic	TPH
Specific Conductance	Metals	Oil/Grease
Dissolved Oxygen	Cyanide	
	Silica	

4. Cations	5. VOA	6. Other (specify)
Anions	ABN	Geotechnical
TOC	Pesticides	
TCLP	PCB	
CEC		
COD		

6.B. Equipment Selection and SCQ Reference:

Equipment Selection — Refer to SCQ Section

ASL A X ASTM Standards outlined in PSP SCQ Section: N/A

ASL B _____ SCQ Section: _____

ASL C _____ SCQ Section: _____

ASL D _____ SCQ Section: _____

ASL E _____ SCQ Section: _____

7.A. Sampling Methods: (Put an X in the appropriate selection.)

Biased	Composite	Environmental	Grab X	Grid
Intrusive X	Non-Intrusive	Phased	Source	

Other (specify): _____

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DQO SUMMARY FORM

Revision:
Effective Date:

DQO Number: GT-002

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Project Specific Plan for DEEP Geotechnical Investigation

7.C. Sample Collection Reference: (Please provide a specific reference to the SCQ Section and subsection guiding sampling collection procedures.)

Sample Collection Reference: Section 5.3.3, PSP outlines ASTM Standards to be followed

---

8. Quality Control Samples: (Place an "X" in the appropriate selection box.)

8.A. Field Quality Control Samples: Not Applicable

Trip Blanks	Container Blanks
Field Blanks	Duplicate Samples
Equipment Rinsate Samples	Split Samples
Preservative Blanks	Performance Evaluation Samples

Other (specify) _____

8.B. Laboratory Quality Control Samples: Not Applicable

Method Blank	Matrix Duplicate/Replicate
Matrix Spike	Surrogate Spikes

Other (specify) _____

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

APPENDIX C

FIELD DOCUMENTATION/EQUIPMENT/PPE LIST

APPENDIX C
FIELD DOCUMENTATION/EQUIPMENT/PPE LIST

Required Documents

General Work Permit
Penetration Permit
Health and Safety Plan
Radiological Worker Permits
Training Certification Card
Radiological Survey
Equipment Inspection for Rig
Project-Specific Plan

Transportation

2 DOE vehicles

Blank Forms

Tailgate Safety Meeting
FAL
Lithologic Log
Sample Collection Log
SWAR/CR
Material Evaluation Forms

Storage

Metal Clipboard Box
File Box

Meters and Detectors

Alpha Detector
Pancake Geiger Mueller Detector (Frisker)
Photoionization Detector (PID)

Emergency Equipment and Supplies

Cellular Phone
Radio
Emergency Eyewash Station
5-10 Extra Gallons of De-Ionized Water for Emergency Decontamination
First Aid Kit

Geological Supplies

Munsell Color Chart
Pocket Penetrometer

Investigation-Derived Waste Supplies

Plastic Trash Bags
55-Gallon Steel
Drums Stencils
White & Black Spray Paint
drum stencil
oak pallets

Sampling Supplies

2-inch split-spoon traps
500 ml clear glass jars
Sample Labels
Custody Tape
Permanent Markers
Pens

Miscellaneous Tools

Scissors
Screwdriver
Hammer
Box Knife

Exclusion Zone Supplies

Caution Tape
Wooden Stakes
Danger/Caution Signs/Flags/Stanchions

Decontamination Supplies

Alconox
Large elbow-length Nitrile Gloves
Brushes
Stainless Steel Water Sprayer
De-Ionized Water
Chemical wipes
Large tubs for cleaning sampling equipment

Tape and Plastic

Silver Duct Tape
Yellow Radiological Tape
Wide Clear Tape
Roll of Clear Plastic Sheeting
Custody Tape

Personal Protective Equipment (PPE)

Saranex Coveralls
Saranex Hoods
Saranex Booties
PAPPR Respirators and cartridges
Steel-Toed Boots
Hard Hat
Safety Glasses
Dosimeter
Latex Gloves
Cotton Glove Liners
Leather Work Gloves
Ice Vests/Ice

APPENDIX D

SAMPLE NUMBERS

APPENDIX D

SAMPLE NUMBERS

NOTE: **A block of 250 unique six-digit sample numbers (400025 - 400274) have been assigned to this project. Due to the nature of the sampling, the sample numbers will not be assigned to each interval in the PSP. The Field Geologist will determine if a sample is to be tested for tests listed in Table 3-2, and will assign six-digit sample numbers as needed.**

Boring #11352

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample Archived for potential Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 7.5	X	
	7.5 - 10.0		X
	10.0 - 11.5	X	
	11.5 - 14.0		X
	14.0 - 15.5	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

Boring #11353

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample Archived for potential Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 8.5		X
	8.5 - 10.0	X	
	10.0 - 12.5		X
	12.5 - 14.0	X	
	14.0 - 15.5	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX D (cont.)

SAMPLE NUMBERS

Boring #11354

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample to be collected for Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 7.5	X	
	7.5 - 10.0		X
	10.0 - 11.5	X	
	11.5 - 14.0		X
	14.0 - 15.5	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

Boring #11355

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample to be collected for Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 7.5	X	
	7.5 - 10.0		X
	10.0 - 11.5	X	
	11.5 - 14.0		X
	14.0 - 15.5	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX D (cont.)
SAMPLE NUMBERS

Boring #11356

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample Archived for potential Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 8.5		X
	8.5 - 10.0	X	
	10.0 - 12.5		X
	12.5 - 14.0	X	
	14.0 - 15.5	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

Boring #11357

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample Archived for potential Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 7.5	X	
	7.5 - 10.0		X
	10.0 - 11.5	X	
	11.5 - 14.0		X
	14.0 - 15.5	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX D (cont.)

SAMPLE NUMBERS

Boring #11358

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample Archived for potential Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 8.5		X
	8.5 - 10.0	X	
	10.0 - 12.5		X

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

Boring #11359

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample Archived for potential Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 7.0		X
	7.0 - 8.5	X	
	8.5 - 11.0		X

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX D (cont.)

SAMPLE NUMBERS

Boring #11360

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample Archived for potential Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 7.5	X	
	7.5 - 9.0	X	
	9.0 - 10.5	X	
	10.5 - 13.0		X
	13.0 - 14.5	X	
	14.5 - 16.0	X	
	16.0 - 17.5	X	
	17.5 - 19.0	X	
	19.0 - 20.5	X	
	20.5 - 23.0		X
	23.0 - 24.5	X	
	24.5 - 26.0	X	
	26.0 - 27.5	X	
	27.5 - 29.0	X	
	29.0 - 31.5		X
	31.5 - 33.0	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX D (cont.)

SAMPLE NUMBERS

Boring #11361

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample Archived for potential Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 7.5	X	
	7.5 - 9.0	X	
	9.0 - 10.5	X	
	10.5 - 13.0		X
	13.0 - 14.5	X	
	14.5 - 16.0	X	
	16.0 - 17.5	X	
	17.5 - 19.0	X	
	19.0 - 20.5	X	
	20.5 - 23.0		X
	23.0 - 24.5	X	
	24.5 - 26.0	X	
	26.0 - 27.5	X	
	27.5 - 29.0	X	
	29.0 - 31.5		X
	31.5 - 33.0	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX D (cont.)

SAMPLE NUMBERS

Boring #11362

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample Archived for potential Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 7.5	X	
	7.5 - 9.0	X	
	9.0 - 10.5	X	
	10.5 - 13.0		X
	13.0 - 14.5	X	
	14.5 - 16.0	X	
	16.0 - 17.5	X	
	17.5 - 19.0	X	
	19.0 - 20.5	X	
	20.5 - 23.0		X
	23.0 - 24.5	X	
	24.5 - 26.0	X	
	26.0 - 27.5	X	
	27.5 - 30.0		X

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX D (cont.)

SAMPLE NUMBERS

Boring #11363

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample Archived for potential Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 7.5	X	
	7.5 - 9.0	X	
	9.0 - 10.5	X	
	10.5 - 12.0	X	
	12.0 - 14.5		X
	14.5 - 16.0	X	
	16.0 - 17.5	X	
	17.5 - 19.0	X	
	19.0 - 21.5		X
	21.5 - 23.0	X	
	23.0 - 24.5	X	
	24.5 - 26.0	X	
	26.0 - 27.5	X	
	27.5 - 30.0		X
	30.0 - 31.5	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX D (cont.)

SAMPLE NUMBERS

Boring #11364

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample to be collected for Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 7.5	X	
	7.5 - 9.0	X	
	9.0 - 10.5	X	
	10.5 - 13.0		X
	13.0 - 14.5	X	
	14.5 - 16.0	X	
	16.0 - 17.5	X	
	17.5 - 19.0	X	
	19.0 - 20.5	X	
	20.5 - 23.0		X
	23.0 - 24.5	X	
	24.5 - 26.0	X	
	26.0 - 27.5	X	
	27.5 - 29.0	X	
	29.0 - 31.5		X

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX D (cont.)

SAMPLE NUMBERS

Boring #11365

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample Archived for potential Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 7.5	X	
	7.5 - 9.0	X	
	9.0 - 10.5	X	
	10.5 - 12.0	X	
	12.0 - 14.5		X
	14.5 - 16.0	X	
	16.0 - 17.5	X	
	17.5 - 19.0	X	
	19.0 - 21.5		X
	21.5 - 23.0	X	
	23.0 - 24.5	X	
	24.5 - 26.0	X	
	26.0 - 27.5	X	
	27.5 - 30.0		X
	30.0 - 31.5	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX D (cont.)

SAMPLE NUMBERS

Boring #11366

Sample Number	Sample Interval (ft.)	split-spoon sample*	piston sample to be collected for Undisturbed tests
	0.0 - 1.5	X	
	1.5 - 3.0	X	
	3.0 - 4.5	X	
	4.5 - 6.0	X	
	6.0 - 7.5	X	
	7.5 - 9.0	X	
	9.0 - 10.5	X	
	10.5 - 13.0		X
	13.0 - 14.5	X	
	14.5 - 16.0	X	
	16.0 - 17.5	X	
	17.5 - 19.0	X	
	19.0 - 20.5	X	
	20.5 - 23.0		X
	23.0 - 24.5	X	
	24.5 - 26.0	X	
	26.0 - 27.5	X	
	27.5 - 29.0	X	
	29.0 - 31.5		X
	31.5 - 33.0	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX E

EXAMPLE FIELD FORMS

FEMP
FIELD ACTIVITY LOG

CONTROL NUMBER:	DATE:	Page of

PROJECT NAME:	PROJECT NUMBER:

FIELD TEAM LEADER:	FIELD TEAM MEMBERS:

FIELD ACTIVITY SUBJECT:

WEATHER CONDITIONS:	RELATED FIELD FORM CONTROL NUMBERS:

TEAM LEADER SIGNATURE:	DATE	ALPHA METER S.N.:	BETA/GAMMA METER S.N.:

TIME	DESCRIPTION OF ACTIVITY

WATER QUALITY METER SERIAL NO.:	METER CALIBRATION												
INITIALS/DATE:	pH (STD UNITS)		SP. COND. (µmhos/cm)		D.O. (mg/L)	TURBIDITY (NTU)	TEMP. (°C)	SALINITY (mg/L)	PID SERIAL NO.	PID STAND.	PID LOT NO.	PID READING	PID SPAN
TEMP.:	4	7	HIGH	LOW									
Manual Calibration:													
Auto Calibration:													

VISITORS		TIME	
NAME(S)	ORGANIZATION(S)	ARRIVED	LEFT

000292

FS-F-3682 (REV. 9/10/93)

CONTROL NUMBER:	FEMP LITHOLOGIC LOG	Page of

PROJECT NAME:				PROJECT NUMBER:
BORING NUMBER:	COORDINATES:	RELATED FAL NUMBERS:		
SURFACE ELEVATION:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE STARTED:
GEOLOGIST:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED:
WATER USED DURING DRILLING:	DRILLING CONTRACTOR:	DRILLING EQUIPMENT:		DRILLER/HELPER:

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (tsf)	REMARKS

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

* Samples collected per ASTM Standard Penetration test.

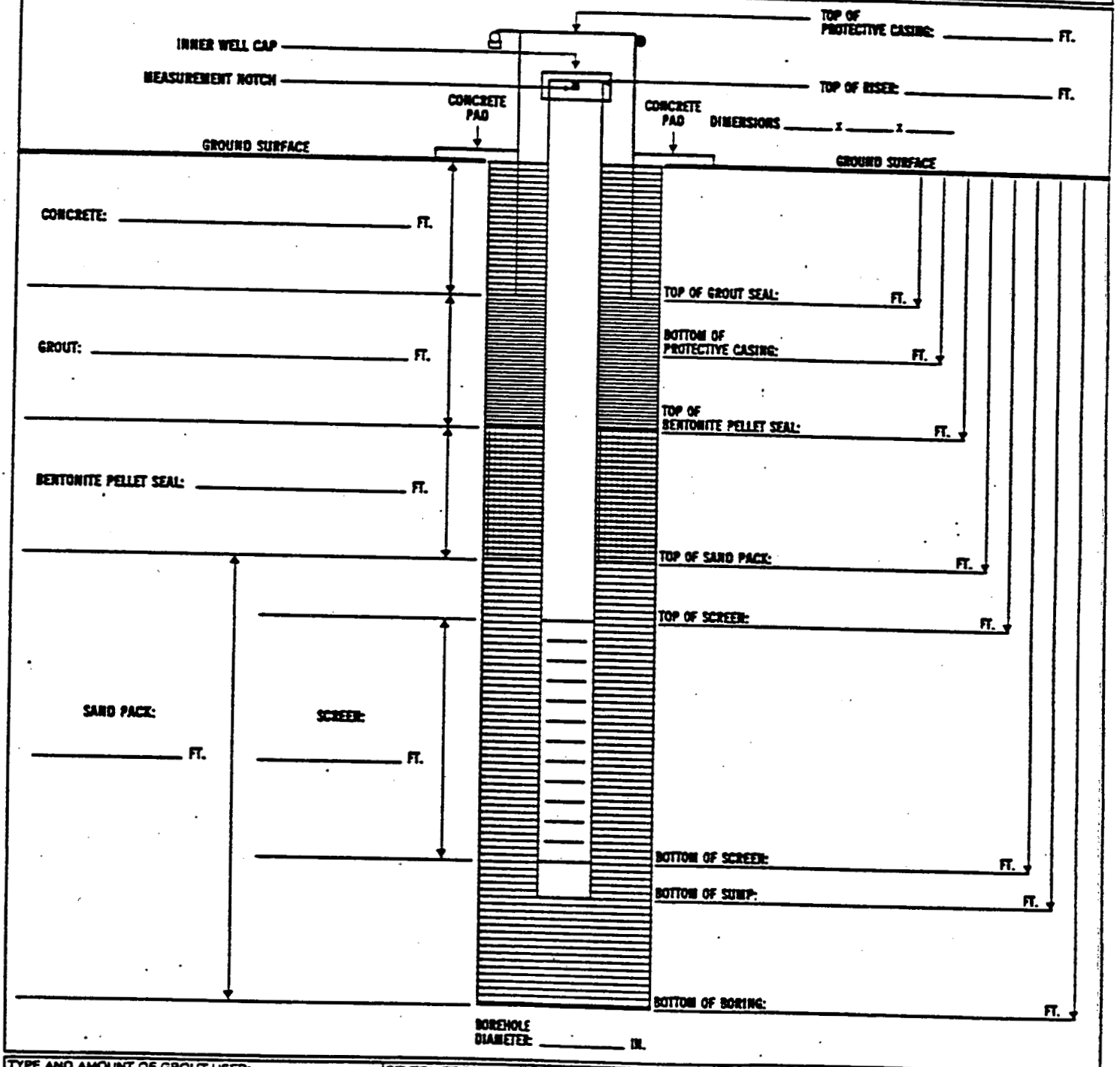
FS-F-3681 (8/18/93)

FEMP

WELL COMPLETION LOG

WELL NUMBER:	CONTROL NUMBER:
PROJECT NAME:	PROJECT NUMBER:
GEOLOGIST:	DRILLING METHOD:

DATES OF INSTALLATION:	WATER LEVEL (ft.):	DATE:	RELATED FAL NUMBERS:	CHECKED BY:



TYPE AND AMOUNT OF GROUT USED:	BENTONITE PELLETS (5-GALLON BUCKETS):	DEEPEST TEMPORARY DRILLING CASING PENETRATION: FT.
VOLUME OF WATER USED DURING DRILLING: GAL.	RISER MATERIAL:	VOLUME OF WATER USED FOR GROUT HYDRATION: GAL.

RISER WALL THICKNESS:	TYPE OF SAND PACK:	SCREEN MATERIAL:	DRILLING CASING DIAMETER: IN.
RISER/SCREEN DIAMETER: IN.	SCREEN SLOT SIZE: IN.	SCREEN TYPE:	DEPTH OF CENTRALIZER(S): FT.

FS-F-3684 (9/10/93)

FEMP
SAMPLE COLLECTION LOG

SAMPLE LOCATION:

SAMPLE TEAM LEADER:

PROJECT NAME:

SAMPLE TEAM:

CONTROL NUMBER:

Page _____ of _____

PROJECT NUMBER:

RELATED FAL NUMBER(S):

UNIQUE SAMPLE NUMBER	SAMPLE TYPE CODE	SAMPLE SCREEN RESULTS (PID)	SAMPLE SCREEN RESULTS (RAD)	COLLECTION START		COLLECTION STOP		SAMPLE DEPTH INTERVAL	PRESERVATIVE CODE	NUMBER OF CONTAINERS	SAMPLE CONTAINER TYPE & SIZE	ANALYTICAL PARAMETERS (OR TARGET ANALYTE LIST)	VISUAL DESCRIPTION OF SAMPLE	DUPLICATE OF SAMPLE NUMBER	QA/QC SAMPLE DESIGNATION
				DATE	TIME	DATE	TIME								

REMARKS:

FS-F-3714 (10/13/93)

000295

FEMP

RSO - ANALYTICAL

Form Number: _____ - _____ - _____

SITE-WIDE ANALYSIS REQUEST/CUSTODY RECORD

Page _____ of _____

PROJECT:

☐ PLAN NO.: OR ☐ PROJECT NO.:

PROJECT MANAGER/ENGINEER:

FOR SAMPLE RELATED PROBLEMS, CONTACT:

ORGANIZATION:

NAME: PHONE:

SAMPLER: PHONE:

CHARGE NUMBER: LOT MARKING CODE:

SAMPLER REMARKS:

SAMPLER SIGNATURE(S):

SEND RESULTS TO:

CHECK FOR: ☐ S R LAB ☐ BIO LAB ☐ WTP LAB

SAMPLE SOURCE, DESCRIPTION/IDENTIFICATION, ANALYSIS REGIMEN

ITEM NO.	SAMPLE NUMBER	CUSTOMER NUMBER	SAMPLE POINT	MATRIX CODE	COLLECTED DATE	COLLECTED TIME	CONTAINER/ VOLUME	COMPOSITE	GRAB	NO. OF CONTAINERS	ANALYTES CODE - (UNITS CODE)	REMARKS
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

ITEM/REASON	RELINQUISHED BY	RECEIVED BY	DATE	TIME	ITEM/REASON	RELINQUISHED BY	RECEIVED BY	DATE	TIME

NO.	DISTRIBUTION OF COPIES
1	LABORATORY
2	REQUESTER
3	SAMPLER

FS-F-3361 (REV. 3/25/93)

962000

12

APPENDIX F

PROJECT SPECIFIC HEALTH AND SAFETY PLAN

NOTE: This copy of the Project Specific Health and Safety Plan is an uncontrolled document. Verify current revision is being used prior to implementation.

PROJECT SPECIFIC HEALTH AND SAFETY PLAN

FOR

DEWATERING EXCAVATION EVALUATION PROGRAM

GEOTECHNICAL INVESTIGATION

RI/FS WBS NUMBER 10.03.06

REVISION 0

EMERGENCY PHONE: 738-6511

RADIO: CONTROL

September 30, 1994

APPROVAL:

Robert Fellman 10/3/94

Robert Fellman, Project Director — Date
CERCLA/RCRA Unit #1

9/30/94

Daryl C. Mills, Manager — Date
Occupational Safety and Health Compliance

Paul R. Blake 9-30-94

Paul Blake, Health and Safety Manager — Date
Site Characterization

UNCONTROLLED

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LIST OF ATTACHMENTS

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

1.0 INTRODUCTION

This Project Specific Health and Safety Plan (PSHSP) is for the field geotechnical sampling of materials in Waste Pits 1, 2, and 3 in support of the Dewatering Excavation Evaluation Project (DEEP) Treatability Study conducted by CERCLA/RCRA Unit 1 (CRU1). Compliance with this plan is required by all personnel who perform field sampling and field support activities in association with this project.

Prior to mobilization and actual performance of project field activities, a walkdown of the sampling area was performed. Key personnel who participated in this walkdown included representatives from Industrial Hygiene (IH), Radiation Control (RC), Environmental Field Operations (EFO), CERCLA/RCRA Unit (CRU) 1, and the drill rig operator and helper. The walkdown was organized for key personnel to have an opportunity to familiarize themselves with the proposed drilling and sampling activities, locations, and associated health and safety concerns. This document, the culmination of contributions from key personnel, addresses the health and safety issues associated with these proposed activities.

Field personnel who enter the Exclusion Zones for this project must be trained to the requirements of this PSHSP. All personnel must be trained to the requirements of the Project Specific Health and Safety Requirements Matrix (PSHSRM), which is shown as Attachment A of this PSHSP. All personnel must signify that they have received training to this PSHSP, understand the PSHSP requirements, and will abide by the provisions of the plan. This affirmation verification shall be documented on an Acknowledgement Log (Attachment H) which is to be signed by all project personnel. Acknowledgement Logs shall be controlled by FERMCO health and safety personnel.

1.1 WORK AREA CHARACTERIZATION

A total of 15 soil borings will be completed in three waste pits (Pits 1, 2, and 3) during the four stages to provide sufficient geotechnical information on the pit caps and the waste material. The tests of interest for this project will be grain-size analysis, Atterberg limits, moisture content, specific gravity, triaxial shear strength test, and unit weight test.

Six borings will be completed and sampled within Waste Pit 1. Previous investigations indicate the majority of the materials in Waste Pit 1 are dry solids, including general sump sludge, depleted slag, trailer cake, depleted residues, graphite and ceramics, thorium waste, and uranyl ammonium phosphate (UAP) filtrate. Typical water levels in the pit range from 3.0 to 3.5 feet below ground surface.

Two borings will be completed and sampled in Waste Pit 2. The material placed in Waste Pit 2 consisted of the same wastes placed in Waste Pit 1 with the exception of having a relatively coarser grain size.

Seven borings will be completed and sampled in Waste Pit 3. The material in Waste Pit 3 consists of general sump sludge, raffinate, trailer cake, slag leach, water treatment sludge, and thorium waste.

The borings will range in depth from 16 feet to 33.5 feet into the soil cap and waste material within 3 waste pits. The 4 phases of this project consist of borings being completed prior to dewatering testing (Phase 1), during dewatering testing (Phase 2), during a later stage of dewatering (Phase 3), and after dewatering testing is accomplished (Phase 4). The resultant data will be used to evaluate the dewatering effectiveness during the DEEP Treatability Study.

All boring locations are shown on the project map, which is Attachment F of this PSHSP. All borings are located within the boundary of the Fernald Environmental Management Project (FEMP), in Waste Pits 1, 2, and 3, located in the Waste Pit Area. A description of proposed borings, depths, and locations is provided in the Project Specific Plan for this project.

1.2 WORK DESCRIPTION

Mobilization/Setup - All borings will be installed using a truck mounted auger drilling rig by Alliance Environmental Inc., a site subcontractor. Mobilization/setup includes transport of the rig to the boring location, the setup of the rig, and boring operation preparation.

Boring Operations - Borings will be installed by subcontractor personnel. Data and samples will be collected by EFO personnel. A temporary casing may be advanced or driven to prevent collapse of the boring during sampling.

Sampling - All sampling will be completed downhole through the hollow stems in advance of the auger tip. Samples will be collected from split-spoon samplers and Shelby tube samplers by EFO personnel. If sample collection is not successful using the Shelby tube samplers then piston samplers will be utilized. Split-spoon samples will be collected using standard 2 inch diameter, 2 foot long split spoon samplers driven 1.5 feet with a 140-pound sampling hammer in accordance with the American Society for Testing and Materials (ASTM) Method D 1586-84. Sample extraction will be conducted in advance of the drill bit. Any material from a split-spoon not being analyzed will be discarded with the drill cuttings per applicable site procedures.

Sample Preparation - The EFO Field Geologist will describe and classify all split-spoon samples for lithologic purposes prior to containerizing the sample. Following description and classification, samples collected with the Shelby tube or piston sampler will be capped and sealed with tape and wax in preparation for sample transport. Immediately following sampling and prior to containerization, each soil and waste material sample shall be field screened for radiological activity and the presence of organic vapor constituents. Field screening shall be accomplished by using an alpha scintillator, pancake Geiger Mueller (GM) detector (frisker), and photoionization (PID) detector.

Mobilization of Rig to Next Location - The rig and sampling equipment will be dismantled and relocated to the next boring location by EFO and subcontractor personnel.

Grouting of Boring - Following sampling, all boreholes will be backfilled with K-Grout bentonite grout material to the natural landscape surface.

Demobilization - Upon completion of the project, the rig and associated sampling equipment will be transported to the Decontamination and Decommissioning Facility for decontamination.

2.0 ORGANIZATION STRUCTURE AND KEY PERSONNEL RESPONSIBILITIES

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

TITLE	PRIMARY	ALTERNATE
Manager, Occupational Safety and Health Compliance (OSHC)	Daryl Mills	Laurie Hagen
Project Director, CRU1	Robert Fellman	Terry Hagen
Project Manager, CRU1: DEEP	William Benson	Greg Stephens
Health and Safety Manager, Site Characterization (SC)	Paul Blake	Laurie Hagen
Field Operations Lead	Jim Hey	Greg Stephens
Environmental Division, Site Characterization Department Manager	Doug Harmel	Mike Frank
Environmental Field Operations	Mike Frank	Linda K. Rogers

3.0 SITE CONTROL

FEMP Standard Penetration Permits (PP) will be obtained for each sampling location. Radiation Work Permits (RWPs) will be issued where required according to RC Technician surveys. A Chemical Hazardous Materials Work Permit will be issued by IH and an Open Flame and Welding Hazardous Work Permit will be issued by Fire and Safety for each phase of the investigation.

A survey of loose and fixed-plus-loose contamination will be performed for Th-230 release limits prior to the truck and truck-mounted auger rig entering the Contamination Area surrounding Waste Pits 1, 2, and 3.

3.1 WORK AREA REQUIREMENTS

At the beginning of each work day and prior to field staff departing into the field, the FEMP Communications Center (non-emergency number, 6295) will be notified of the area at the FEMP where the work is to be performed, and the number of personnel at that location.

3.1.1 Radiological Areas

Entrances to and perimeters of radiological areas will be defined by yellow and magenta rope or, where practical, by physical structures such as fences or buildings. All radiological areas will be identified by signs having the standard radiation symbol, the trifoil, on a yellow background.

The following lists the types of radiological areas to be encountered during the performance of activities covered by this PSHSP:

Controlled Area - A controlled area is any area, room, or enclosure to which access is controlled to protect individuals from exposure to radiation or radioactive materials, or where radioactive materials may be present. Surface contamination, radiation, and airborne contaminants are less than applicable limits for further posting.

Contamination Area - A Contamination Area is an area where removable radiological contamination is greater than DOE surface contamination guidelines for the isotope of concern.

3.1.2 Waste Pit Exclusion Zone

An Exclusion Zone will be established around the waste pit area so as to include all drilling locations in support of this project. The Exclusion Zone shall have one ingress and egress point. Access to the Exclusion Zone will be limited to sampling technicians, project field management staff, IH Technicians, and RC Technicians. All other field activities directly related to sampling (sample containerization, labeling, temporary storage, etc.) will be performed inside the Exclusion Zone boundary. All equipment, tools, etc. in contact with soils and waste pit contents shall be taken to the FEMP Decontamination and Decommissioning (D&D) Facility for Level III decontamination.

The Exclusion Zone shall have a sign posted to specify the hazard(s) within (e.g., Contamination Area, hearing protection required, etc.).

All boring operations in support of this project have the potential to encounter and release inorganic contaminants. Waste Pit contents include general sump sludge, depleted slag, trailer cake, depleted residues, graphite, ceramics, thorium waste, uranyl ammonium phosphate (UAP) filtrate, raffinate, slag leachate, and water treatment sludge. Most, if not all, materials encountered during drilling operations are expected to be water saturated. The possibility of contaminant particulates becoming entrained in the atmosphere and worker's breathing zone is minimal. Dust conditions will be monitored during drilling and sampling operations and, if necessary, a mist of deionized water, applied by a hand-held portable aerosol sprayer, will be applied to control the dust.

All boring operations in support of this project have the potential to encounter and release organic contaminants. Drill crew personnel will wear personal organic vapor monitors.

4.0 TRAINING

The Project Specific Health and Safety Requirements Matrix, produced in conjunction with the PSHSP, gives training as well as other requirements for each task involved in the sampling project. This Matrix is included with this PSHSP as Attachment A.

4.1 HAZARD COMMUNICATION

4.1.1 Material Safety Data Sheets (MSDSs)

One project field activity, plugging of boreholes with bentonite (Sodium Montmorillonite), will use materials requiring an MSDS. The bentonite MSDS is included in Attachment E of this PSHSP. Also included are MSDSs for inorganic arsenic, soluble barium, beryllium, cobalt, inorganic lead, uranium, and thorium. These substances could be encountered in waste pit contents.

4.1.2 Job Briefings/Safety Meetings

All personnel involved in this project shall be given a job briefing (pre-project meeting) prior to receiving authorization to begin work. The job briefing shall be conducted by the SC Health and Safety Manager and shall include review of this PSHSP. Also, personnel will be briefed on Radiological Control and RWP requirements by the Lead or the RC Technician covering field activities prior to work commencement.

Tailgate safety meetings will be held at a minimum of once a day. Tailgate safety meetings shall be conducted by the Field Operations Manager or designee, the RC Technician, and the IH Technician assigned to the field project.

All field personnel involved in this project shall attend the job briefing and tailgate safety meetings.

Written documentation of the job briefing and tailgate safety meetings, in the form of attendance sheets, shall be maintained by the Safety Field Lead or Project Field Lead as part of the project permanent record.

4.2 RECORDS

Attendance at training classes shall be documented by personnel signing the Acknowledgement Form, Attachment H.

Verification of project field staffs' attendance of all required Occupational Safety and Health Administration (OSHA), FEMP and FERMCO site training courses shall consist of employee training records on file within the FERMCO Training Department, FERMCO Medical Services, and the CRU1 and Environmental Division Training Coordinators, as applicable.

4.3 VISITORS

Anyone accessing the field sampling locations for the sole purpose of observation or viewing the field work in progress (hands off inspections) is considered to be a "visitor." Visitors cannot operate any equipment, participate in the ongoing field activities, or supervise/oversee any field work activity.

Visitors shall be oriented to the hazards of the site and the control measures through the same means as other project personnel. Visitors who enter the Exclusion Zone shall also be dressed in the same types of Personal Protective Equipment (PPE) as the field operations staff.

Visitors will comply with the training requirements specified for the activities in progress. These requirements are specified on the Project-Specific Health and Safety Requirements Matrix, included with this PSHSP as Attachment A.

Visitors who enter the Exclusion Zone must receive prior authorization from the Manager of Radiological Control and the EFO Field Geologist. Visitors who enter any Exclusion Zones must receive authorization from the SC Health and Safety Manager.

5.0 MEDICAL MONITORING AND SURVEILLANCE

5.1 REQUIREMENTS

Medical

All personnel engaged in the performance of project field activities are required to participate in the FEMP medical monitoring program. This program shall include in-vivo whole body monitoring and urinalysis, including baseline, annual, incident (as necessary), every 60 days, and termination. Fecal sampling (baseline, annual, and incident [as necessary]) will be required by all personnel with the potential for direct contact with the waste pit material.

5.2 RECORDS

The FERMCO Medical Services Department will maintain copies of all employee medical records.

6.0 HAZARD ASSESSMENT

This section addresses the identified health and safety hazards associated with the conduct of field activities covered by this PSHSP.

Potential hazards to field sampling personnel may originate from the chemical, physical, radiological, biological, and safety hazards known or suspected to be present at the sampling locations. Full-time radiological coverage and industrial hygiene coverage (as required) shall be provided when field work is in progress.

6.1 RADIOLOGICAL ISSUES

For the purposes of controlling this project, thorium-230 is considered to be the isotope-of-concern. All items leaving the Exclusion Zone shall be surveyed to release limits for thorium-230. Any person crossing the Exclusion Zone boundary into the area where the work described by this Health and Safety Plan is to take place will, first, leave a baseline (to be updated annually) fecal sample with Radiological Dosimetry. Fecal sampling kits may be obtained in Building 53B, the *In Vivo* Building.

Thorium is a radioactive material and in its soluble form is highly toxic. Soluble thorium is absorbed through the skin and can affect the kidneys. Insoluble thorium is an inhalation and radioactive hazard.

6.2 INDUSTRIAL HYGIENE ISSUES

6.2.1 Heat/Sun Exposure Issues

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

FERMCO personnel have been trained to identify the four stages of heat stress, and to be aware of the warning signs and symptoms. The four stages of heat stress, descriptions and symptoms are as follows:

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

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

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

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

Sunburn - Though not a stage of heat stress, sunburn can be a contributing factor of heat stress. This hazard is caused by prolonged exposure to ultraviolet light. Symptoms range from first degree to second degree burns. A suitable sunscreen on exposed areas will help to prevent sunburn.

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

Field staff will be instructed to notify IH when the ambient air temperature reaches 80 degrees Fahrenheit. At that time, the mechanism of heat stress control will be determined by IH Technicians and the SC Health and Safety Manager, who will periodically measure the relative humidity and temperature to determine work/break intervals. All prescribed work/break intervals specified by the IH Technicians will be followed by the field staff.

6.2.2 Noise

Hazardous noise levels may be created during operation of heavy equipment and portable power tools. Workers exposed to sound levels greater than 85 dBA shall wear hearing protection. Generally, noise which obscures a normal speaking voice exceeds the 85 dBA limit.

6.2.3 Chemical Contaminants

Chemical analyses of the contents of Waste Pits 1, 2 and 3 indicate the following major industrial hygiene concerns relating to this project.

Arsenic, Inorganic

Arsenic is a steel grey metal in its pure form. It is a human carcinogen and is an acutely toxic poison if ingested. Soluble trivalent forms, such as arsenic trioxide may cause skin and mucous membrane irritation. Acute inhalation effects are rare and chiefly inflammatory. Chronic inhalation effects may include perforation of the nasal septum, weight loss, nausea, diarrhea, hair loss, skin discoloration/lesions, and loss of sensation from peripheral nerves.

Barium, Soluble

Barium is a silver-white malleable metal in its pure form. Alkaline barium compounds may cause local irritation to the eyes, nose, throat, and skin. Barium presents a hazard when ingested or inhaled. Acute exposure symptoms may include vomiting, diarrhea, irregular pulse, and muscular paralysis. Chronic exposure to barium sulfate may lead to a benign pneumoconiosis.

Beryllium

Beryllium in its pure form is a grey metal and is a suspected human carcinogen. Acute inhalation exposure may cause a nonproductive cough, shortness of breath, and some weight loss. Chronic inhalation exposure may lead to respiratory symptoms, weakness, fatigue and weight loss.

Cobalt

Cobalt is a silver-grey, hard, brittle, magnetic metal and is mildly irritating to the eyes and skin. Inhalation of cobalt may cause an asthma-like disease with cough and dyspnea. Vomiting, diarrhea and a sensation of hotness may occur after ingestion or inhalation of excessive amounts of cobalt.

Lead, Inorganic

Lead is a bluish-grey metal when pure and may be brightly colored yellow or orange when present in its various oxides. Lead is a toxin to the blood-forming organs. Early symptoms of exposure may include loss of appetite, insomnia, irritability and muscle/joint pains, followed by anemia. Lead is also listed as a possible human carcinogen of the lungs and kidneys. Routes of entry are inhalation and ingestion.

Nuisance Particulates

Nuisance particulates are inert dusts considered to be relatively harmless unless exposure is severe, therefore, nuisance particulates are not regulated by their chemical composition. Excessive exposure to even low toxicity dusts may cause skin, eye and upper respiratory tract irritation.

Organic Vapors

Below-action-levels of a variety of organic compounds were identified during previous sampling activities. Identified compounds include: chlorinated solvents, polynuclear aromatics, aromatics, ethers, esters and alcohols.

6.2.4 Biological Hazards

Biological hazards which could potentially affect field workers are limited to plants, insects and animals. The following subsections describe the nature of the hazards.

Plants - Plant life which has the highest potential for affecting field workers includes poison ivy, poison oak, and poison sumac. Staff will be informed during the job briefing of how to recognize and avoid these plants. If workers know or suspect that an exposure has occurred, the affected body area will be washed as soon as possible following exposure. If the exposed body area does not respond to washing, or if the employee seems to display a hypersensitivity to poison exposure, then the employee will be sent to FERMCO Medical Services for treatment.

Insects/Animals - A variety of insects, including ticks, mosquitos, bees, wasps, and chiggers, may be encountered at the project field sampling locations. As is well evidenced by human reactions to most insect bites or stings, reactions are usually limited to skin irritations which may range from mild to extreme. Many humans display a hypersensitivity to such exposures; however, it is virtually impossible to anticipate reaction of an affected individual until after exposure has occurred. Persons with a history of hypersensitivity to insect bites or stings should take the appropriate precautions through FERMCO Medical Services prior to the performance of field work where the potential for insect-related exposure is great.

In order to minimize the potential for health and safety related problems associated with insects, field staff will be instructed to:

- Wear FERMCO issued coveralls
- Avoid areas if high vegetation growth, if possible
- Avoid or minimize skin contact with any vegetation
- Use a manually operated weed cutter to clear the area prior to sampling, if necessary
- Avoid the use of personal hygienic strongly fragrant items such as deodorant, perfume, cologne, etc., as these items often attract some insects
- Allow field staff to tape their coveralls at the ankles, if so desired, to control insects

Staff are free to use insect repellents, which are available through FERMCO Medical Services, and will be provided if requested.

Animal concerns consist predominantly of snakes. Both poisonous and nonpoisonous snakes are found in Southwest Ohio. Snakes have no sense of hearing, but respond readily to vibrations. Workers will be instructed to toss pebbles or similar items into an area of concern. This should cause snakes to leave the area. Additionally, workers will be instructed to use caution when moving items which may contain a void space which could contain a snake.

6.3 SAFETY ISSUES

The following safety issues have been evaluated during the preparation of this PSHSP. Although many of the safety issues do not apply to this project, their evaluation has been performed to ensure that the issues have been considered.

6.3.1 Physical Hazards

6.3.1.1 Lifting

Field activities which involve lifting an item or items that weighs more than 50 pounds shall be performed by 2 or more persons working together or through use of a mechanical lifting device and qualified operator. No individual shall lift more than 50 pounds.

6.3.1.2 Auger Drill Rig

A truck-mounted auger drill rig will be used to advance boreholes into the waste pit material. Sampling technicians and other non-essential personnel shall remain separated from the drill rig when it is operating. The drill rig shall be equipped with an emergency shutdown system or "kill" switch.

6.3.1.3 Underground Utilities

Underground utilities present at any proposed borehole location will be identified during the acquisition of the Penetration Permit.

6.3.2 Sanitation

All personnel shall have access to toilet facilities. Under no circumstances will any employee be required to travel more than 5 minutes to reach toilet facilities. Toilet facilities for participants in this project are located within the waste pit area, adjacent to the sealand containing potable water, eyewash facilities, etc.

6.3.3 Fire Protection

The potential for explosion during the performance of project field work is slight. The only possible source of an explosion hazard is from the vehicles used to access the work site. With normal use of the vehicles, and by following established FEMP and safe work practices, explosions should not be a problem.

The potential for fires, as with explosions, is slight. In addition to the potential for fire hazard from location access vehicles, the primary additional fire source is dry vegetation in the vicinity of the sampling sites. Personnel will be instructed to avoid parking the vehicles in locations where potentially combustible materials could be ignited. A FERMCO Open Flame and Hazardous Work Permit will be necessary as Shelby tube samples are to be sealed with hot wax, as per procedure SC-FO-001.

Other combustible materials, such as dirty disposable coveralls, used disposable wipes, and used plastic sheeting will be removed at regular intervals during the course of sampling. Disposal of such material shall be in accordance with established FERMCO waste disposal requirements.

7.0 HAZARD CONTROL

7.1 ENGINEERING CONTROLS

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

- Containment and disposal or decontamination of inorganically or radiologically contaminated sampling equipment and/or PPE
- The use of deionized water mist as a dust suppressant, if required during drill rig operations

7.2 ADMINISTRATIVE CONTROLS

Administrative controls shall be the primary means of hazard control. Administrative controls shall include, but not be limited to:

- This Project-Specific Health and Safety Plan
- Project Work Plan
- Applicable Standard Operating Procedures (SOPs)
- Site Policy
- Ensuring that only a Qualified Operator is assigned to operate the drill rig
- Restricted personnel access if atmospheric dust entrainment at sampling locations is noted by the IH Technician and/or the RC Technician

7.3 PERSONAL PROTECTIVE EQUIPMENT/RESPIRATORY PROTECTION

The level of PPE and respiratory protection to be worn by field personnel performing project activities is defined on an activity basis in the PSHSRM. Modifications to the described PPE ensembles may be necessary for some field activities if conditions change.

PPE typically used for field work at the determined level for this project includes steel toe safety boots, standard issue FERMCO work clothing, approved disposable water-resistant coveralls, gloves, safety glasses, and a full-face powered air-purifying respirator (FFPAPR) with high-efficiency particulate air (HEPA)/organic vapor (magenta/black stripe) cartridge(s). FFPAPR will be used in support of this project.

Should conditions change and a subsequent change of PPE become necessary, changes will be made based on a review of specific hazards, weather, work conditions, operating requirements, and air monitoring at the work location. Additionally, respiratory protection may be upgraded as deemed appropriate by the SC Health and Safety Manager or designee, the RC Technician, and the IH Technician within the constraints of this PSHSP. Respiratory protection may be downgraded by the SC Health and Safety Manager upon consultation with an Industrial Hygienist and/or RC Engineer. With written approval of the SC Health and Safety Manager, substitution of some PPE items may be appropriate.

The SC Health and Safety Manager shall document revisions in the controlled copy of the PSHSP, located at the entry point of the Exclusion Zone. The same controlled copy of the PSHSP shall be utilized throughout the sampling effort unless a revised controlled copy of the PSHSP is issued.

The RC Technician and IH Technician, in addition to project personnel, shall be responsible for ensuring that all personnel are wearing the appropriate level of PPE for their respective work function.

8.0 DECONTAMINATION

8.1 SITE DECONTAMINATION REQUIREMENTS

8.1.1 Personal Contamination

Equipment for the decontamination of radiologically or inorganically contaminated equipment or PPE shall be kept available in the area surrounding the Exclusion Zone. Upon exiting the Exclusion Zone, workers shall be instructed by an RC Technician and/or IH Technician on frisking procedures, disposition of PPE, and appropriate action if personal radioactive contamination is detected.

8.1.2 Equipment

Equipment to be used during soil and/or media drilling and sampling shall be decontaminated in accordance with the Project Specific Plan and Sitewide CERCLA Quality Assurance Project Plan (SCQ) Level III requirements at the end of drilling activities. Prior to removing truck and truck-mounted auger rig from the Contamination Area, a RCT shall survey for removable and fixed-plus-removable contamination and compare results to Th-230 release limits.

8.2 WASTE DISPOSITION

Drill cuttings not submitted for analysis shall be placed into 55 gallon drums. Other solid investigation derived wastes, such as disposable PPE, used plastic sheeting, and used wiping tissues, shall be placed together into plastic bags, sealed with tape, and then placed into properly labeled 55 gallon drums. Decontamination solutions and rinsates shall be placed into properly labeled bung-type 55 gallon drums. Investigation derived wastes shall be dispositioned according to applicable site procedures.

9.0 EMERGENCY/CONTINGENCY PLANS

9.1 REPORTING

9.1.1 Emergency Numbers (Radio call numbers listed are for FERMCO Frequency 2)

NAME	FEMP TELEPHONE NUMBER	RADIO
Ambulance	738-6511	CONTROL
Hospital	738-6511	CONTROL
Fire	738-6511	CONTROL
Security	738-6511	CONTROL
Emergency Response	738-6511	CONTROL
SC Health & Safety Manager	pager 844-7086	936
Industrial Hygiene	738-6207	357
Radiological Control 2nd and 3rd shift	738-6433 / 9244 738-6889	397, 495, 687
Fire and Safety Inspectors	738-6235	303
Assistant Emergency - Duty Officer (AEDO)	738-6295 / 6431	202
Accountability	738-6202	CONTROL

9.1.2 Site Notification Procedures

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

- Phone 738-6511
- Radio to "Control"

Any injury, irrespective of severity, shall be reported immediately to FEMP Medical Services for evaluation or treatment. The injured employee shall be accompanied to FEMP Medical Services for evaluation and treatment by the supervisor in charge or designee. The CRU1 Project Director, the injured employee's supervisor, and the SC Health and Safety Manager shall be notified as soon as possible after the injury/accident has occurred.

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

9.1.3 What to Report

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

- serious injury
- injury complicated by contamination
- chemical/radiation release
- chemical splash (eye and skin)
- fire
- major property damage
- unusual occurrence(s)

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

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

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

9.2 EVACUATION ROUTES/ACCOUNTABILITY

9.2.1 Rally Point Accountability

Should a situation require an emergency evacuation of the work area, all equipment should be turned off (if possible) and left in place. On-site personnel should immediately proceed to the nearest established rally point, which is Rally Point 6, near the waste pit area entrance from the former process area, as identified on the map found in Attachment C.

9.2.2 In-Place Accountability

When in-place accountability is required, employees shall contact their supervisor and report their current position. The supervisor in charge shall report the names of any unaccounted personnel to his or her management within 10 minutes.

9.3 EMERGENCY EQUIPMENT

9.3.1 FEMP Site Equipment

The FEMP Medical Services Section Facility is staffed and equipped to handle most types of medical emergencies that would occur during a task. The medical facility is staffed with Emergency Medical Technicians (EMTs) and is equipped with an ambulance to transport the injured person to the nearest off-site hospital should extended or specialized treatment be necessary.

The FEMP Medical Services Section Facility is located at the east end of the first floor of the ES&H Building (Building 53). The location of this facility is shown on the site map included as Attachment D.

9.3.2 Work Area Equipment

Equipment for emergency eyewashing and minor fire suppression, as well as potable water, will be maintained at the work site, outside of the Contamination Zone and located within a sealand container. Specific location of the sealand container will be determined by the SC Health and Safety Manager for each work site and communicated to all project participants during a pre-work safety meeting.

9.4 EMERGENCY RESPONSE

The FEMP Emergency Preparedness Section will handle all on-site emergencies. Any request for emergency help should be requested by telephone (738-) 6511 or on any FEMP radio frequency by calling "CONTROL."

9.4.1 Medical Emergencies

The FEMP Medical Services Section utilizing the site ambulance shall serve as the first-aid responder. Personnel will respond within 5 minutes to FEMP site emergencies.

9.4.2 Fire Emergencies

All work sites shall maintain effective communication to summon fire fighting assistance. The nearest fire alarm will be activated, if available. If not available, other effected employees will be notified by alternate methods, such as radio, cellular phone, or voice. Access to the work area shall be maintained at all times to permit fire trucks and fire fighting crews to safely approach the fire emergency.

Only trained personnel shall attempt to operate any fire fighting equipment and only when the fire is clearly within the capability of the fire fighting equipment. All site vehicles are equipped with hand-operated fire extinguishers.

The FEMP Emergency Response Team (ERT) will also respond to all on-site fire emergencies. For any fire emergency at the FEMP, call (738-) 6511.

9.4.3 Explosion Emergencies

When an explosion has occurred the following actions are to be taken:

- Activate nearest fire alarm if possible

NOTE: **If a fire alarm is not available or functioning, affected employees must be notified of a fire by alternate methods which include the utilization of a radio, cellular phone, or by voice.**

- Evacuate building or work area
- Proceed to an appointed rally point
- If qualified, render first aid to injured personnel
- Instruct all persons in transit to avoid the work area and surrounding area
- Contact CONTROL by radio or phone (6511)
- Call for medical assistance if necessary
- Report to supervisor for accountability

9.4.4 Chemical Emergencies

9.4.4.1 Splashes

Since no liquids other then water will be used in support of this project, a chemical splash incident would be rare. Should a project employee be involved in a chemical splash incident, the clothing affected will be immediately removed. Then, the area of skin affected will be flushed with clean water for fifteen minutes. After initial treatment, the affected employee must report to the FEMP Medical Services Section for evaluation and possible further treatment. Location of FEMP Medical Services Section is shown in Attachment D.

9.4.4.2 Personal Contamination

Due to the limited nature of project field activities, equipment and materials involved, personal contamination from either caustic or corrosive materials is not expected. However, should such a contamination event occur, the affected area should be flushed with clean water for a minimum of 15 minutes. After initial treatment, the affected employee must immediately report to FEMP Medical Services Section. Location of FEMP Medical Services Section is shown in Attachment D.

When personal contamination occurs from other than caustic or corrosive materials, immediately contact IH and remain at the work location until an IH Technician arrives and provides further instructions.

9.4.5 Radiological Emergencies

9.4.5.1 Releases

If a release of suspect or known radiological contaminants occurs, the release area shall be evacuated. The supervisor in charge, Assistant Emergency Duty Officer (AEDO), Radiological Control, the CRU1 Project Manager, and the SC Health and Safety Manager shall be notified of the release.

9.4.5.2 Personal Contamination

Any circumstances which could have resulted in an intake of radioactive materials by inhalation, ingestion, or absorption shall be immediately reported to a supervisor. The supervisor shall immediately report the circumstances of possible radioactive materials intake to RC for evaluation. When the suspect isotope is uranium, the involved employees shall report to the Urine Sampling Station at the end of their respective shift to submit a urine sample and complete an Investigative Report (IIR, form FMPC-ES&H-1458). The involved employees shall also report to the Urine Sampling Station at the start of their next shift to submit a follow-up urine sample. When the suspect isotope is other than uranium, the involved employee(s) shall report to the Dosimetry Section of RC for further direction. Employees are responsible for complying with additional requirements as specified by RC.

Sampling personnel are required to contact RC Technicians in the event of a personal contamination incident. Detection of a count rate above background with a field portable "frisker" should alert personnel of possible contamination. Ambient background count rate is not to exceed 300 counts per minute (cpm) when using a G-M pancake probe in the location in which personal monitoring is performed. If background levels exceed 300 cpm, proceed to an area of lower background to perform frisking of the potentially contaminated individual. Ideal background levels would be less than 100 cpm.

When using an alpha instrument, if the background exceeds 50 cpm, attempt to decontaminate the probe. If the background cannot be lowered, the instrument is to be tagged "out of service" and a new alpha survey instrument must be used.

Responding RC Technicians are to follow the instructions given in applicable ES&H procedures. Personnel involved in the incident are to follow the reporting instructions given in Section 9.1 of this PSHSP and instructions given by the responding RC Technicians for bioassay evaluation of potential internal radiation hazard from possible inhalation, ingestion, or absorption of radioactive materials.

Contamination should be avoided when possible by minimizing contact with the contaminant. All instances of personnel radiological contamination must be reported to the supervisor in charge, Assistant Emergency Duty Officer (AEDO), Radiological Control, the CRU1 Project Manager, and the SC Health and Safety Manager.

The health and safety of the worker is of primary concern; however, control of potential radiological contamination shall be considered when treating and/or transporting contaminated workers until such time as personnel can be monitored and/or decontaminated. If necessary (i.e., if it becomes impossible to survey the worker for radiological contamination, or a survey of the worker indicates the worker has been radiologically contaminated), a path-of-travel survey shall be performed of surfaces in contact with the worker from the place where contaminants were acquired to the place treatment was administered, to insure that contamination was not spread.

9.4.6 Weather Limitations/Adverse Conditions

Any outside work will be suspended and the area evacuated if warnings for high winds, lightning, thunderstorms, or tornadoes are sounded.

9.4.7 Accident Investigation

Any injury or accident shall require the completion of an accident report by the supervisor in charge. This report shall be completed within 24 hours of the event and forwarded to the FERMCO Worker's Compensation Coordinator at site Mail Stop #31. Should a serious accident/injury occur, the involved area should not be disturbed until approved by the SC Health and Safety Manager.

10.0 CHANGES/AMENDMENTS TO THE PSHSP

This PSHSP for CRU1 field activities is based on information available at the time of preparation. It is important that this plan be routinely (at least quarterly) reassessed by supervision, project management, and the SC Health and Safety Manager. In addition, unexpected conditions/events may arise which require reassessment of the health and safety issues. Downgrading of precautions, personal protective equipment, etc. identified in this plan must be approved in writing by the SC Health and Safety Manager, or designee, upon consultation with the appropriate expert on the subject (i.e., RC Engineers or Industrial Hygienists). Formal documentation of the changes must be completed.

Unplanned operations and/or changes in work scope shall require a review and may require an amendment to the PSHSP. All amendments must be approved by the CRU1 Program Director, SC Health and Safety Manager, and the Manager of OSHC. These amendments must be controlled by ES&H Document Control.

10.1 CONTROL OF HEALTH AND SAFETY PLAN

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

TITLE	INDIVIDUAL
Manager, OSHC Technical Support	Laurie Hagen
Project Director, CRU1	Robert Fellman
Health and Safety Manager, SC	Paul Blake
Field Operations Lead	Jim Hey
Manager, Site Characterization	Doug Harmel
Manager, Environmental Field Operations	Mike Frank
Director, Medical Services	Doran Christensen
Supervisor of Technicians, IH	Jack Patrick
Manager, IH	Dave Jackson

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

10.2 REVIEW OF CONTENTS

This PSHSP will be reviewed at a frequency determined by the SC Health and Safety Manager for currency and applicability to job tasks. The review shall be documented with a written memo to the Manager of OSHC. Revised pages will be submitted to ES&H Document Control for distribution.

ATTACHMENT A

PROJECT-SPECIFIC HEALTH AND SAFETY REQUIREMENTS MATRIX

HEALTH AND SAFETY REQUIREMENTS MATRIX

Project Name: DEWATERING EXCAVATION EVALUATION PROGRAM GEOTECHNICAL INVESTIGATION RI/FS WBS NO.: 10.03.06

Requirements of Section 1.0 apply to all activities on Matrix

ACTIVITY (TASKS)	HAZARD IDENTIFICATION	FREQUENCY & TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONNEL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING & SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE & ENGINEERING CONTROL MEASURES	PERMIT	DECONTAMINATION & DISPOSAL PROCEDURES
1.0 Minimum Project Requirements for All Personnel	• Radiological (including thorium)/ Heavy Metal/ Organic Vapor Contamination	• Dosimeter (TLD) • Radiological Personal Air Sampling/ Breathing Zone (PAS/BZ) on 25% of workers when entering area to work • Radiological air sampling at border of Contamination Area	• Safety glasses with rigid side shields • Latex gloves • Steel-toed shoes • Rubber shoe covers • FERMCO issued clothing • Full anti-Cs • Respirator-FFPAPR with organic/HEPA cartridge (when drilling operations are being performed)	• Site Worker and Refresher • Site Specific Orientation • Rad I or Rad II as shown below • Respirator fit • Respirator training	• FERMCO or approved physical • In-vivo - baseline, annual, incident (as necessary), and termination • Urinalysis - baseline, annual, incident (as necessary), every 60 days, and termination • Fecal sample - baseline, annual, incident (as necessary) for all workers/employees with potential for direct contact with Waste Pit material	• Visitor escort • Health and safety plan • Work plan • Standard Operating Procedures (SOPs) • Site Policy • Limited access to rig • Qualified rig operator	• General Work • Radiation Work • Chemical/ Hazardous Material Work	• Tools, equipment, etc. shall be surveyed prior to leaving Contamination Areas • Whole body alpha and beta/gamma survey upon exiting Contamination Area • Personnel must frisk with beta/gamma monitor or PCM when exiting Controlled Area
	• Plant/animal exposure		• Long sleeves			• Cut weeds prior to job initiation • Avoid tall vegetation areas • Tape coverall leg openings closed		
	• Severe weather					• Cease operations		
	• Heat stress	• Physiological monitoring of workers • Contact IH when ambient temperature exceeds 80 degrees F	• Ice vest, if necessary			• Establish work/break schedules • Adequate water supply		
	• Heavy lifting injuries					• Loads greater than 50 lbs. require more than 1 person or mechanical assistance to handle		
	• Fire					• Phone 6511 or radio CONTROL		

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000323

Project Name: DEWATERING EXCAVATION EVALUATION PROGRAM GEOTECHNICAL INVESTIGATION

HEALTH AND SAFETY REQUIREMENTS MATRIX

RI/FS WBS NO.: 10.03.06

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ACTIVITY (TASKS)	HAZARD IDENTIFICATION	FREQUENCY & TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONNEL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING & SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE & ENGINEERING CONTROL MEASURES	PERMIT	DECONTAMINATION & DISPOSAL PROCEDURES
2.0 Mobilization/ Setup	• Uneven work terrain			• Experienced rig operator		• Experienced Field Lead directing movement of equipment • Experienced vehicle operator		
	• Overhead hazards			• Experienced rig operator		• Experienced Field Lead directing movement of equipment • Experienced vehicle operator		
	• Heavy equipment			• Experienced rig operator				
	• Radiological concerns					• No kneeling in Waste Pit area unless full anti-Cs are worn or new plastic sheeting is used		• Minimize equipment entering Contamination Area • Prior to bringing truck and truck-mounted auger rig into Contamination Area, RCT shall survey for removable and fixed-plus-removable contamination and compare results to Th-230 release limits

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000324

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Project Name: DEWATERING EXCAVATION EVALUATION PROGRAM GEOTECHNICAL INVESTIGATION RI/FS WBS NO.: 10.03.06

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ACTIVITY (TASKS)	HAZARD IDENTIFICATION	FREQUENCY & TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONNEL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING & SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE & ENGINEERING CONTROL MEASURES	PERMIT	DECONTAMINATION & DISPOSAL PROCEDURES
3.0 Boring Operations	• Being caught in moving parts		• Leather palm gloves or other work gloves	• Experienced rig operator		• Kill switch		
	• Airborne dust	• Visually monitor airborne dust conditions				• Application of deionized water spray, if required		
	• Noise		• Hearing protection (required when noise is greater than 85 dBA)			• Area posted for hearing protection when noise is greater than 85 dBA		
	• Buried utilities						• Penetration	
	• Radiological airborne release	• Contamination Area boundary monitoring				• Deionized water spray and/or plastic underlayment and covering of drill cuttings will be used for dust control		
	• Radiological/ organic vapor/ heavy metal contamination	• Radiological PAS/BZ monitoring on 25% of workers • Continuous personal VOC monitoring on representative number of workers	• Respirator - FFPAPR with organic/HEPA cartridge	• Respirator approved physical • Respirator fit	• Urinalysis every 60 days	• Contamination zone established • covering of drill cuttings		

The requirements of this document are based upon current conditions and/or planned or current operations in areas near the planned construction zone. This Document is to be used as an aid in conjunction with the Project Specific Health and Safety Plan and assist the contractor in understanding the requirements of the project. This PSH&S Plan will provide more detail for certain aspects of this document. This document does not relieve the contractor of planning for or providing a safe work site. This document does not relieve the contractor from recognizing and complying with all appropriate Local, State and Federal regulations.

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HEALTH AND SAFETY REQUIREMENTS MATRIX

Project Name: DEWATERING EXCAVATION EVALUATION PROGRAM GEOTECHNICAL INVESTIGATION RI/FS WBS NO.: 10.03.06

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ACTIVITY (TASKS)	HAZARD IDENTIFICATION	FREQUENCY & TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONNEL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING & SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE & ENGINEERING CONTROL MEASURES	PERMIT	DECONTAMINATION & DISPOSAL PROCEDURES
4.0 Sampling	• Radiological/ organic vapor/ heavy metal contamination	• Radiological PAS/BZ monitoring on 25% of workers • Continuous personal VOC monitoring on representative number of workers	• Respirator - FFPAPR with organic/HEPA cartridge	• Respirator approved physical • Respirator fit	• Urinalysis every 60 days	• Contamination zone established • covering of drill cuttings		
	• Mishandled/ dropped sampling tubes		• Steel toe shoes • leather palm or cotton gloves			• Competent person shall be present during soil sampling and packaging activities		
5.0 Sample Preparation	• Radiological/ organic vapor/ heavy metal contamination	• Radiological PAS/BZ monitoring on 25% of workers • Continuous personal VOC monitoring on representative number of workers	• Respirator - FFPAPR with organic/HEPA cartridge	• Respirator approved physical • Respirator fit	• Urinalysis every 60 days	• Contamination zone established • covering of drill cuttings		
6.0 Mobilization of rig to next location	• Radiological/ organic vapor/heavy metal contamination		• Full anti-Cs (may be paper, but must be disposable) • Respirator NOT required to move rig unless airborne hazard has been identified			• Workers must stand upwind from rig • No kneeling unless full anti-Cs are worn or new plastic sheeting is used		
	• Bodily injury					• 1 person moves rig while other person spots rig movement		

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HEALTH AND SAFETY REQUIREMENTS MATRIX

Requirements of Section 1.0 apply to all activities on Matrix

ACTIVITY (TASKS)	HAZARD IDENTIFICATION	FREQUENCY & TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONNEL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING & SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE & ENGINEERING CONTROL MEASURES	PERMIT	DECONTAMINATION & DISPOSAL PROCEDURES
7.0 Grouting of boring	• Airborne dust	• Visually monitor airborne dust conditions				• Application of deionized water spray, if required		
	• Radiological/ organic vapor/heavy metal contamination	• PAS/BZ monitoring on 25% of workers	• Full anti-Cs • Respirator - FFPAPR with organic/HEPA cartridge	• Respirator fit • Respirator training		• Plastic spread on ground under workers		
8.0 Demobilization	• Radiological contamination					• Truck monitored for Th-230 contamination prior to leaving Waste Pit area		• Items sent to D&D for decon. shall be wrapped and tagged as "ISOTOPE OF CONCERN: TH-230. RELEASE ONLY AFTER REMOVABLE CONTAMINATION IS <20 DPM/100CM² AND FIXED-PLUS-REMOVABLE CONTAMINATION IS 100 DPM/100CM². CONTACT A MATERIAL RELEASE EVALUATOR FOR RELEASE IF SURVEYS INDICATE GREATER THAN MDA OR MDCR

The requirements of this document are based upon current conditions and/or planned or current operations in areas near the planned construction zone. This Document is to be used as an aid in conjunction with the Project Specific Health and Safety Plan and assist the contractor in understanding the requirements of the project. This PSH&S Plan will provide more detail for certain aspects of this document. This document does not relieve the contractor of planning for or providing a safe work site. This document does not relieve the contractor from recognizing and complying with all appropriate Local, State and Federal regulations.

000327

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ATTACHMENT B

PERSONNEL ENVIRONMENTAL MONITORING ACTION LEVELS

RADIOLOGICAL CONTROL ACTION LEVEL

MEASUREMENT	LEVEL	ACTION/RESPIRATORY PROTECTION NOTE 1,5,7
Alpha Probe	100 dpm/100cm^2	Contact RC Technician @ ext. 6889.
Beta/Gamma Probe	1,000dpm/100cm^2	Contact RC Technician @ ext. 6889.
U-238, Th-230, and Th-232	> 0.10 x DAC NOTE 4	Area posted as "Airborne Radioactivity Area"
U-238, Th-230, and Th-232	> 1.0 x DAC	Full-faced air purifying respirator with anti-C hood
U-238, Th-230, and Th-232	> 5.0 x DAC	Hooded air-supplied respirator
U-238, Th-230, and Th-232	> 10.0 x DAC	Contact Radiological Engineering
U-238, Th-230, and Th-232	> 40.0 x DAC	Invivo and/or Invitro sampling required by RC Dosimetry.
Rn-220	> 0.1 WL	Area posted as "Airborne Radioactivity Area"
Rn-220 daughters	< 0.25 Work Level (WL)	None
Rn-220 daughters	0.25 - 5.0 WL	Full-faced air purifying respirator (Hood required)
Rn-220 daughters	> 5.0 WL	Hooded air supplied respirator
	> .033 WL	Area posted as "Airborne Radioactivity Area"
Rn-222 daughters	< 0.075 WL	None
Rn-222 daughters	0.075 - 1.65 WL	Full-faced air purifying respirator (Hood required)
Rn-222 daughters	> 1.65 - 33.0 WL	Hooded air-supplied respirator
Rn-222 daughters	> 33.0 WL	SCBA or air-supplied bubble suit

ACTION LEVELS FOR AIRBORNE RADIOACTIVITY

RADIONUCLIDE	1 DAC NOTE 8 (uCi/ml)	10% DAC NOTE 8 (uCi/ml)	25% DAC NOTE 8 (uCi/ml)	WITHDRAW NOTE 7,8 & 9 (uCi/ml)
Th-230	3 E-12	3 E-13	7.5 E-13	1.5 E-11
Th-232	5 E-13	5 E-14	1.25 E-13	2.5 E-12
U-238	2 E-11	2 E-12	5.0 E-12	1.0 E-10
Rn-220	8 E-09*	0.1 WL	0.25 WL	5.0 WL
Rn-222	3 E-08*	0.033 WL	0.0825 WL	1.65 WL

* Assumed 100% equilibrium with radon daughter products. If air sampling is performed for radon daughter concentrations (i.e., Working Level measurements), the DACs are:

Rn-220 (thoron) daughter activity: 1.0 WL
Rn-222 (radon) daughter activity: 0.33 WL

INDUSTRIAL HYGIENE ACTION LEVELS

CONTAMINANT	MONITORING METHOD	FREQUENCY	ACTION LEVEL	ACTION
Organic Vapors	MicroRAE Personal PID w/10.6 eV lamp	Continuous	8-Hour TWA: Detection to 10 ppm STEL: Detection to 50 ppm Ceiling: Detection to 100 ppm	PAPR
			8-Hour TWA: >10 ppm STEL: >50 ppm Ceiling: >100 ppm	Withdraw and Contact IH

Notes

1. Area shall be posted as an "**Airborne Radioactivity Area**" at the discretion of the RCT.

2. Combination particulate and organic vapor/acid gas filter (black and magenta) cartridge required.

3. See Section 1 for job specifics.

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

5. Air sample results which indicate that individuals may have been exposed to 40 DAC-hours or more per week shall trigger internal dosimetry assessment (e.g. invitro and/or invivo assessments).

6. For a range of 2% to 10% contact Industrial Hygiene. For greater then 10% contact Fire Safety.

7. Invitro and/or invivo assessments may be required at levels less than 40 DAC-hours per week, if deemed necessary by the Radiological Control department.

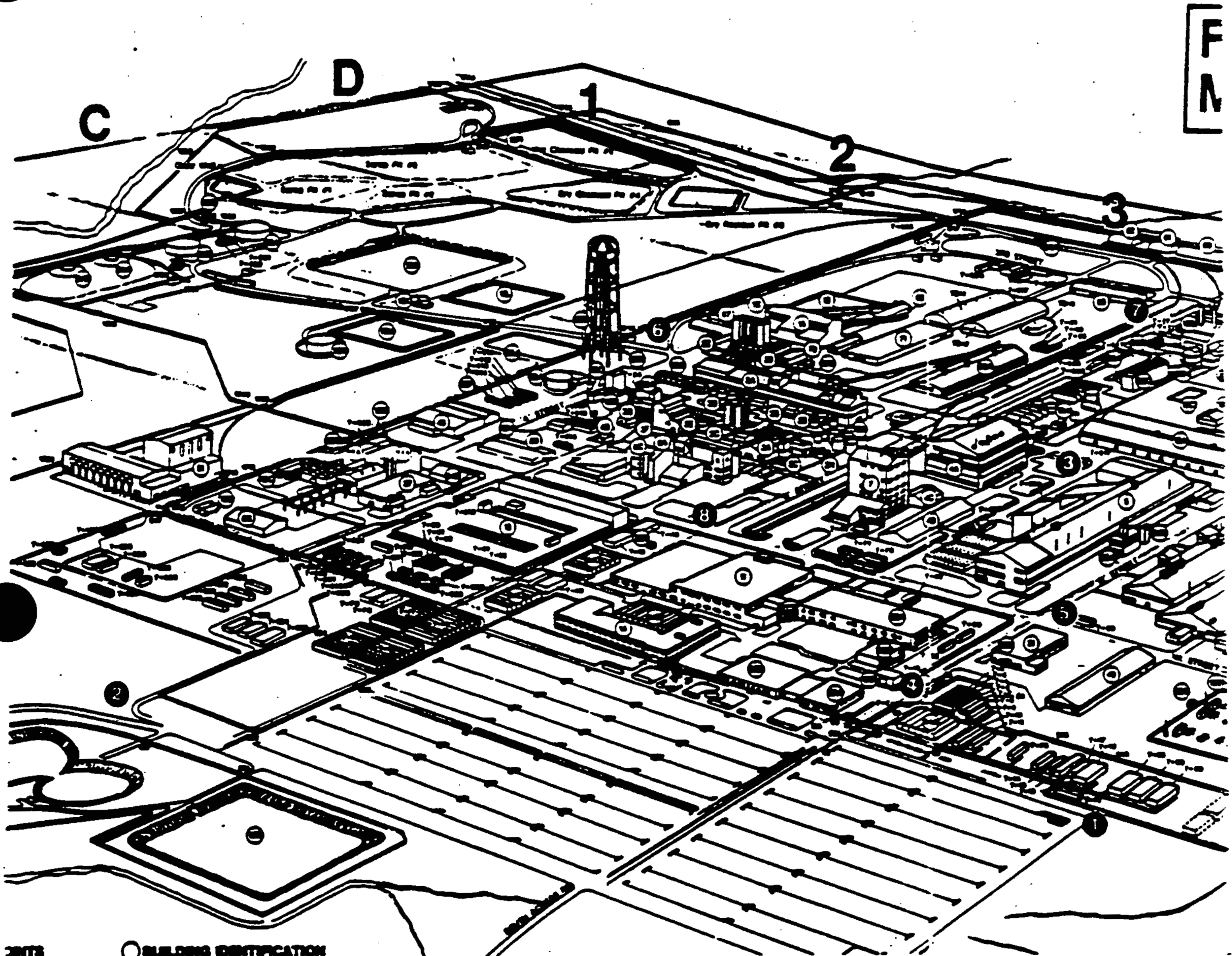
8. Currently, real-time monitoring for long-lived (U-238, Th-230, and Th-232) airborne radioactivity, in the presence of short-lived radon/thoron daughter activity, is not always possible. Refer to "retrospective" seven day count (long-lived) data for the affected area, if this data is available. Otherwise, assigned respiratory protection shall be based on the potential to exceed the Action Levels, or on confirmation of the airborne radioactivity levels present by special counting methods.

9. The "Withdraw" values are based on 5.0 x DAC. Hooded Air Supplied Respirator is required at those levels. If airborne radioactivity levels can exceed 10.0 x DAC, contact Radiological Engineering.

ATTACHMENT C

FEMP RALLY POINTS

Rally Points



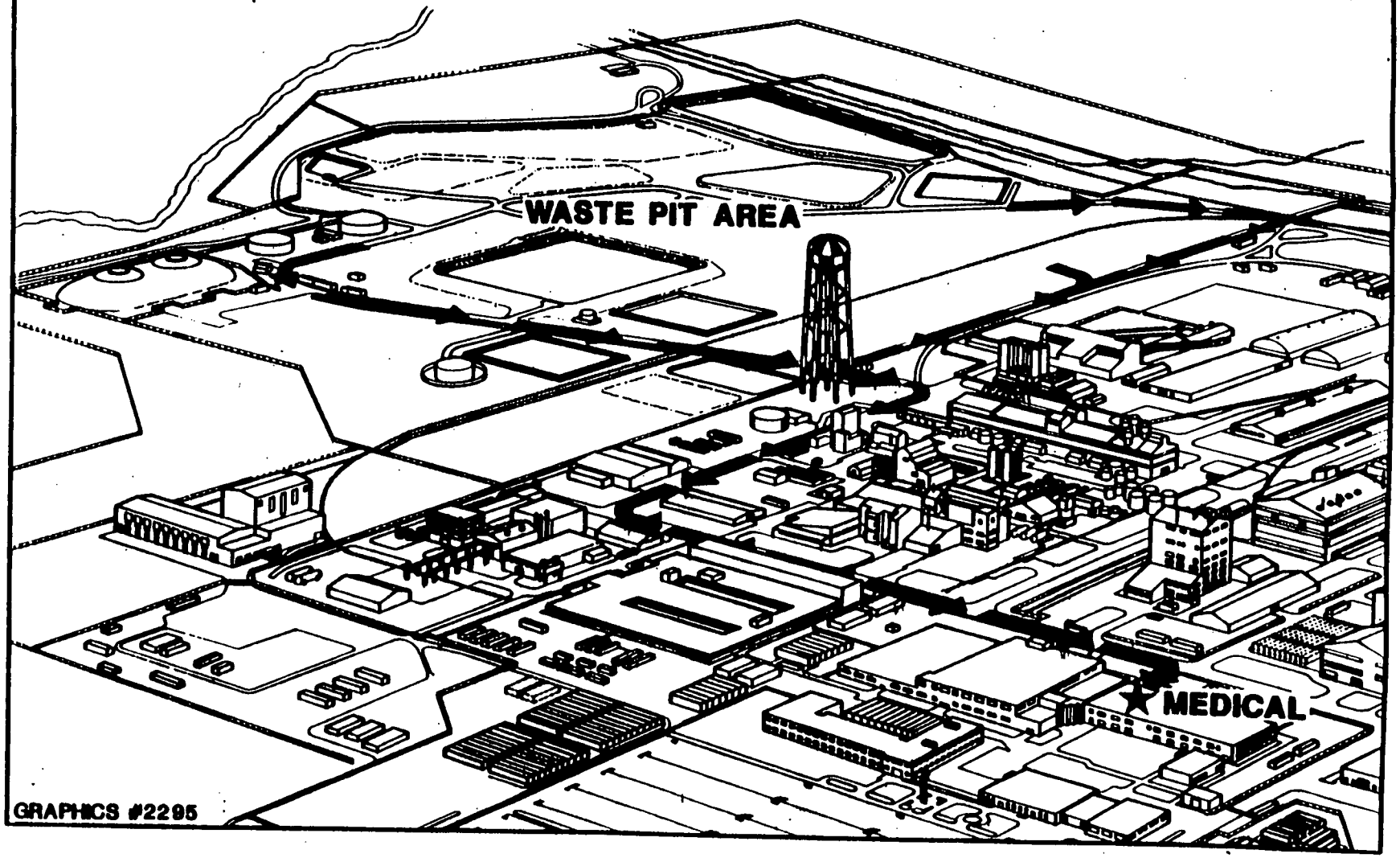
ONTS

BUILDING IDENTIFICATION

ATTACHMENT D

LOCATION OF FEMP MEDICAL FACILITY

"Route From Waste Pit Area to Medical"



ATTACHMENT E

WORK AREA MATERIAL SAFETY DATA SHEETS (MSDSs)

NL Baroid
Environmental, Safety and Transportation Data Sheet

NATIONAL GRANULAR BENTONITE-30 MESH

I PRODUCT IDENTIFICATION	
SUPPLIER NL BAROID/NL INDUSTRIES, INC.	TELEPHONE: MANAGER, MINERAL & CHEMICAL SALES: (713) 987-4970
ADDRESS P.O. BOX 1675 HOUSTON, TEXAS 77251	
TRADE NAME NATIONAL® GRANULAR BENTONITE - 30 MESH	
GENERIC DESCRIPTION WYOMING BENTONITE, SODIUM MONTMORILLONITE	

II HAZARDOUS INGREDIENTS		
MATERIAL OR COMPONENT	%	HAZARD DATA
SILICA		LOW CONCENTRATIONS OF
		CRYSTALLINE SILICA (SiO_2)
		IN THE FORM OF QUARTZ,
		CRISTOBALITE, AND TRIDYMITE
		MAY BE PRESENT
		(SEE SECTION V)

III PHYSICAL DATA		
BOILING POINT (°F) NA	MELTING POINT ND	FREEZING POINT ND
SPECIFIC GRAVITY (H_2O = 1) 2.5	VAPOR PRESSURE (mm Hg) NA	
VAPOR DENSITY (AIR = 1) NA	SOLUBILITY IN H_2O, % BY WT. NA	
% VOLATILES BY VOL. NA	EVAPORATION RATE (BUTYL ACETATE = 1) NA	
APPEARANCE AND ODOR LIGHT TAN TO GRAY SOLIDS, NO ODOR	Density @ 20°C 47 lbs/cubic foot	
pH NA		

NA = Not Applicable ND = Not Determined

HEALTH HAZARD	0
FLAMMABILITY	0
REACTIVITY	0

Occupationally Hazardous Materials (1974)

All information, recommendations and suggestions appearing herein concerning our product are based upon tests and data believed to be reliable. However, it is the user's responsibility to determine the safety, toxicity, and suitability for his own use of the product described herein. Since the actual use by others is beyond our control, no guarantee, expressed or implied, is made by NL Baroid, Inc. as to the effects of such use, the results to be obtained, or the safety and toxicity of the product. Neither NL Baroid, Inc. nor any seller shall be liable for any loss or injury arising out of use of the product. Reference to trade names herein does not imply that the same or equivalent material or chemicals cannot be used if satisfactory in the judgment of the user and in compliance with applicable laws or government regulations.

BEST Sheet

IV FIRE AND EXPLOSION DATA

NATIONAL GRANULAR BENTONITE - 30 MESH IS NOT FLAMMABLE AND NOT EXPLOSIVE. DOES NOT SUPPORT COMBUSTION.

EXTINGUISHING MEDIA: WATER

V HEALTH HAZARD INFORMATION

ACUTE ORAL LD_{50}	ACUTE DERMAL LD_{50}	AQUATIC TOXICITY (LC_{50})
ND	ND	ND

ROUTES OF EXPOSURE AND EFFECTS

TLV FOR RESPIRABLE DUST

$$\frac{10\ MG/M^3}{\%\ RESPIRABLE\ QUARTZ + 2}$$

TLV FOR "TOTAL DUST"

$$\frac{30\ MG/M^3}{\%\ QUARTZ + 3}$$

IF CRISTOBALITE OR TRIDYMITE IS DETECTED, USE ONE-HALF THE VALUE CALCULATED FROM FORMULAE FOR QUARTZ

SKIN: POTENTIAL IRRITANT
EYES: IRRITANT
INHALATION: IRRITATION TO LUNGS, NOSE, AND THROAT; PROLONGED INHALATION MAY CAUSE LUNG INJURY, OR DISEASE

EMERGENCY AND FIRST AID PROCEDURES

SKIN: FLUSH SKIN WITH LARGE AMOUNTS OF WATER
EYES: FLUSH EYES WITH WATER AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, CONTACT PHYSICIAN
INHALATION: MOVE TO FRESH AIR

BEST Sheet

VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

THIS PRODUCT IS STABLE UNDER NORMAL DRILLING CONDITIONS.

INCOMPATIBILITY

NONE

HAZARDOUS DECOMPOSITION PRODUCTS

NONE

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

NONE

VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

NORMAL HOUSEKEEPING, CAUSES SLIPPERY SURFACES WHEN WET.

NEUTRALIZING CHEMICALS

NA

WASTE DISPOSAL METHOD

MUD WASTES SHOULD BE DISPOSED OF IN DESIGNATED DISPOSAL AREAS. (i.e. GENERAL LANDFILLS OR DESIGNATED OCEAN DISPOSAL SITES).

VIII INDUSTRIAL HYGIENE CONTROL MEASURES

VENTILATION REQUIREMENTS

MECHANICAL, GENERAL ROOM VENTILATION
USE LOCAL VENTILATION TO MAINTAIN TLV (SEE SECTION V)

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY

USE A NIOSH APPROVED MECHANICAL FILTER RESPIRATOR FOR NON TOXIC DUSTS.

EYE

SAFETY GLASSES, GOGGLES

GLOVES

NONE REQUIRED

OTHER CLOTHING AND EQUIPMENT

BEST Sheet

IX SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

- AVOID PROLONGED INHALATION.

RECOMMENDED LABEL:

FRONT PANEL: CAUTION
SEE BACK PANEL FOR CAUTION BEFORE USE.

BACK PANEL: CAUTION
THIS PRODUCT CONTAINS FREE SILICA. PROLONGED INHALATION OF THE POWDER MAY RESULT IN LUNG DISEASE. AVOID CREATING DUSTY CONDITIONS AND USE A NIOSH APPROVED DUST RESPIRATOR.

OTHER HANDLING AND STORAGE REQUIREMENTS

NATIONAL GRANULAR BENTONITE - 30 MESH IS NON HAZARDOUS. NO HAZARDS ARE INVOLVED WITH NORMAL HANDLING.

DEPARTMENT OF TRANSPORTATION INFORMATION

PROPER SHIPPING NAME:

HAZARD CLASS: NOT HAZARDOUS

HAZARDOUS SUBSTANCE:

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UNITED STATES DEPARTMENT OF ENERGY
MATERIAL SAFETY DATA SHEET

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Entry Date: 01/01/1981 Revised Date: 01/01/1981

SECTION I -- IDENTIFICATION

Chem. Name: ARSENIC
Chem. Id: 007440-38-2 DOT Class/#: No Info.
Formula: No Info. Chem. Family: No Info.
Hazard Rating (Scale: 0-4): HEALTH-(3); FIRE-(2)
Molecular Weight: No Info.

Synonyms: ARSENIC
ARSENIC,SOLID
ARSENIC COLLOIDAL
METALLIC ARSENIC
ARSENIC BLOCK
GREY ARSENIC
ARSENIC METAL
7440-38-2

SECTION II -- HAZARDOUS INGREDIENTS

Components	CAS #	PEL/TLV	Percentage

NO COMPONENT INFORMATION ENTERED FOR THIS MATERIAL.

SECTION III -- PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: No Info. Specific Gravity: No Info.
Vapor Pressure: No Info. Melting Point: No Info.
Vapor Density: No Info. Solubility: No Info.
Evaporation Rate: No Info. Volatiles by Vol.%: No Info.

Physical Description:

GRAY, SHINY, BRITTLE, METALLIC-LOOKING POWDER.

SECTION IV -- FIRE AND EXPLOSION HAZARD INFORMATION

Flash Point	Auto-Ignition Temp.	Flammable Limits
No Info.	No Info.	LEL: No Info. UEL: No Info.

Special Hazards:

FIRE MAY OCCUR WHEN IN THE FORM OF DUST AND EXPOSED TO HEAT OR FLAME OR BY CHEMICAL REACTION WITH POWERFUL OXIDIZERS.

SECTION V -- REACTIVITY INFORMATION

Conditions to Avoid:

ARSENIC REACTS TO, BROMENE, AZIDE, DIRUBIDIUMACEYLIDE, BROMINETRIFLOURIDE, BROMINE PENTAFLORIDE, CHLORINE TRIFLOURIDE, IODINE PENTAFLOURIDE, ZINC, PALLADIUM,

ALUMINIUM, NITROGEN TRICHLORIDE AND OXIDANTS SUCH AS, SILVER NITRATE, DICHLORINE TRIOXIDE, NITROSYL FLOURIDE, POTASSIUM PERMANGANATE POTASSIUM DIOXIDE AND SODIUM PEROXIDE.

SECTION VI -- HEALTH HAZARD INFORMATION

Toxicity and Exposure Limits:

Inhal. Toxicity: No Info. Dermal Toxicity: No Info.
Oral Toxicity: No Info. Eye Toxicity: No Info.
Exp. Limit: No Info. Exp. Limit Max.: No Info.

Health Effects and Symptoms:

TRIVALENT ARSENIC COMPOUNDS ARE CORROSIVE TO THE SKIN. BRIEF CONTACT HAS NO EFFECT, BUT PROLONGED CONTACT RESULTS IN A LOCAL HYPEREMIA AND LATER VESICULAR OR PUSTULAR ERUPTION. THE MOIST MUCOUS MEMBRANES ARE MOST SENSITIVE TO THE IRRITANT ACTION. CONJUNCTIVA, MOIST AND MACERATED AREAS OF SKIN, THE EYELIDS, THE ANGLES OF THE EARS, NOSE, MOUTH, AND RESPIRATORY MUCOSA ARE ALSO VULNERABLE TO THE IRRITANT EFFECTS. THE WRISTS ARE COMMON SITES OF DERMATITIS, AS ARE THE GENITALIA IF PERSONAL HYGIENE IS POOR. PERFORATION OF THE NASAL SEPTUM MAY OCCUR. ARSENIC TRIOXIDE AND PENTOXIDE ARE CAPABLE OF PRODUCING SKIN SENSITIZATION AND CONTACT DERMATITIS. ARSENIC IS ALSO CAPABLE OF PRODUCING KERATOSES, ESPECIALLY OF THE PALMS AND SOLES. ARSENIC HAS BEEN CITED AS A CAUSE OF SKIN CANCER, BUT THE INCIDENCE IS LOW. THE ACUTE TOXIC EFFECTS OF ARSENIC ARE GENERALLY SEEN FOLLOWING INGESTION OF INORGANIC ARSENICAL COMPOUNDS. THIS RARELY OCCURS IN AN INDUSTRIAL SETTING. SYMPTOMS DEVELOP WITHIN ONE HALF TO 4 HOURS FOLLOWING INGESTION AND ARE USUALLY CHARACTERIZED BY CONSTRICTION OF THE THROAT FOLLOWED BY DYSPHAGIA, EPICASTRIC PAIN, VOMITING, WATERY DIRRHEA, AND BLOOD IN STOOLS AND VOMITUS. INHALATION OF INORGANIC ARSENIC COMPOUNDS IS THE MOST COMMON CAUSE OF CHRONIC POISONING IN THE INDUSTRIAL SITUATION. THIS CONDITION IS DIVIDED INTO THREE PHASES BASED ON SIGNS AND SYMPTOMS. FIRST PHASE, THE WORKER COMPLAINS OF WEAKNESS, LOSS OF APPETITE, SOME NAUSEA, OCCASIONAL VOMITING, A SENSE OF HEAVINESS IN THE STOMACH, AND SOME DIARRHEA. SECOND PHASE, THE WORKER COM- PLAINS OF CONJUNCTIVITIS, A CATARRHAL STATE OF THE MUCOUS MEMBRANES OF THE NOSE, LARYNX, AND RESPIRATORY PASSAGE. CORYZA, HOARSENESS, AND MILD TRACHEOBRONCHITIS MAY OCCUR. PERFORATION OF THE NASAL SEPTUM IS COMMON, AND IS PROBABLY THE MOST TYPICAL LESION OF THE UPPER RESPIRATORY TRACT IN OCCUPATIONAL EXPOSURE TO ARSENICAL DUST. SKIN LESIONS, ECZEMATOID AND ALLERGIC IN TYPE, ARE COMMON. THIRD PHASE, THE WORKER COMPLAINS OF SYMPTOMS OF PERIPHERAL NEURITIS, INITIALLY OF HANDS AND FEET, WHICH IS ESSENTIALLY SENSORY. IN MORE SEVERE CASES, MOTOR PARALYSES OCCUR, THE FIRST MUSCLES AFFECTED ARE USUALLY THE TOE EXTENSORS AND THE PERONEI. IN ONLY THE MOST SEVERE CASES WILL PARALYSIS OF FLEXOR MUSLES OF THE FEET OR OF THE EXTENSOR MUSCLES OF HANDS OCCUR. LIVER DAMAGE FROM CHRONIC ARSENICAL POISONING IS STILL DEBATED, AND AS YET THE QUESTION IS UNANSWERED. IN CASES OF CHRONIC AND ACUTE ARSENICAL POISONING, TOXIC EFFECTS TO THE MYOCARDIUM HAVE BEEN REPORTED BASED ON EKG CHANGES. THESE FINDINGS, HOWEVER, ARE NOW LARGELY LARGELY DISCOUNTED AND THE EKG CHANGES ARE ASCRIBED TO ELECTROLYTE DISTURBANCES CONCOMITANT WITH ARSENICALISM. IHHALATION OF ARSENIC TROXIDE AND OTHER INOR- GANIC ARSENICAL DUSTS DOES NOT GIVE RISE TO RADIOLOGICAL EVIDENCE OF PNEU- MOCONIOSIS. ARSENIC DOES HAVE A DEPRESSANT EFFECT UPON THE BONE MARROW, WITH DISTURBANCES OF BOTH ERYTHROPOIESIS AND MYELOPOIESIS. EVIDENCE IS NOW AVAIL- ABLE INCRIMINATING ARSENIC COMPOUNDS AS A CAUSE OF LUNG CANCER AS WELL AS SKIN

CANCER. THE FEDERAL STANDARD FOR ARSENIC AND ITS COMPOUNDS IS 0.5 MG/M3 OF AIR AS AS. NIOSH HAS RECOMMENDED 0.002 MG/M3 OF AIR AS AS BASED ON ITS CARCINOGENIC EFFECTS. THIS SUBSTANCE WAS FOUND TO BE TERATOGENIC IN MICE. CONSULT THE BNL CARCINOGEN, MUTAGEN, TERATOGEN GUIDE 2.2.1 FOR INFORMATION ON PROPER HANDLING PROCEDURES.

Emergency and First Aid Procedures:

INCASE OF EXPOSURE TO ARSENIC, REMOVE INDIVIDUAL FROM EXPOSURE AND SEEK IMMEDIATE MEDICAL ATTENTION. IF ARSENIC COMES IN CONTACT WITH SKIN, WASH AREA IMMEDIATELY, AND SEEK MEDICAL HELP AT ONCE.

SECTION VII -- PRECAUTIONS FOR SAFE HANDLING AND USE

Shipping and Transportation:

THIS IS A D.O.T REGULATED NOTINAL.
CONSULT SHIPPING DEPARTMENT FOR SHIPPING AND LABELING REQUIREMENTS.

Precautions to be taken in Handling and Storing:

ARSENIC SHOULD BE KEPT IN LOCKED CABINETS.

SECTION VIII -- CONTROL MEASURES

NO CONTROL MEASURES ENTERED FOR THIS MATERIAL.

I. CHEMICAL IDENTITY

Common name: Barium compounds
Formula(s): $Ba(NO_3)_2$; BaO; $BaCO_3$; $BaCl_2$
Synonyms: None
CAS No.: CAS 513-77-9
Carcinogen: N/A

II. REGULATORY INFORMATION

Hazardous substance: EPA
Hazardous waste: EPA
DOT Hazard Class: Poison

III. PHYSICAL CHARACTERISTICS

Boiling point: $Ba(NO_3)_2$—greater than 592 C(greater than 1098F) (decomposes); BaO— 2000 C (3632 F); $BaCO_3$— 1300 C (2372 F) (decomposes); $BaCl_2$— 1560 C (2840 F)
Specific gravity: $Ba(NO_3)_2$— 3.24; BaO— 5.72; $BaCO_3$—4.25; $BaCl_2$— 3.86
Vapor density: N/A
Melting point: $Ba(NO_3)_2$— 592 (1098 F); BaO— 1921 C (3490 F) $BaCO_3$— Decomposes at 1300 C (2372 F) $BaCl_2$— 963 C (1765 F)
Vapor pressure: Essentially zero
Solubility in water: $Ba(NO_3)_2$— 9.2; BaO— Reacts; $BaCO_3$— 0.0022; $BaCl_2$— 36
Evaporation rate: N/A
Appearance and odor: Odorless white solid

IV. PHYSICAL HAZARDS

Flash point: N/A
Autoignition temperature: For barium nitrate, data not available, for other compounds, not applicable
Flammable limits in air (% by vol.): N/A
Extinguishants: Use large amounts of water on adjacent fires

V. HEALTH HAZARDS

Soluble barium compounds can affect the body if they are inhaled, swallowed, or if they come in contact with the eyes or skin.
Effects of short-term exposure: May cause local irritation of eyes, nose, throat, bronchial tubes, and skin; if inhaled or swallowed, may also cause severe stomach pains, slow pulse rate, irregular heart beat, ringing of the ears, dizziness, convulsions, and muscle spasms. Death may occur in severe cases.
Effects of long-term exposure: Not known.

VI. EMERGENCY FIRST AID

Eyes: Wash eyes immediately with large amounts of water, lif the lower and upper lids occasionally; get medical atten immediately; contact lenses should not be worn when wor with solutions of barium compounds.
Skin: Flush contaminated skin area with water; if soaked thro clothing, remove clothing immediately and flush the skin w water; if irritation persists, get medical attention immediat
Breathing: Move the exposed person to fresh air at once breathing is stopped, perform artificial respiration; keep affe person warm and at rest; get medical attention immediately.
Swallowing: If conscious, give the person large quantities of wa immediately. After the water has been swallowed, try to ind vomiting by having the person touch the back of his throat w his finger. If unconscious, do not induce vomiting; get med attention immediately.

VII. PERMISSIBLE EXPOSURE LIMIT

OSHA TWA: 0.5 mg/m³
IDLH: 250 mg/m³

VIII. PRECAUTIONS FOR USE AND SAFE HANDLING

Conditions contributing to instability: For barium nitrate, eleva temperatures may cause melting and decomposition; for oth compounds, none hazardous
Incompatibilities: Contact of barium oxide with water, carb dioxide, or hydrogen sulfide may cause fires and explosio contact of barium carbonate with acids causes formation carbon dioxide gas that may cause suffocation in enclosed spac contact of barium nitrate with organic matter and combustib materials may cause fires and explosions.
Hazardous decomposition products: Toxic gases and vapors (such oxides of nitrogen and carbon monoxide) may be released in a fi involving barium nitrate.
Special precautions: None

IX. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spills: Restrict persons not wearing personal protective equipmen and clothing from areas of spills until cleanup is completed. I case of a spill, take the following steps: ventilate area of spil collect spilled material in the most convenient and safe manne and deposit in a secured sanitary landfill. Liquids containin sodium barium compounds should be absorbed in vermiculite dry sand, earth, or a similar material.

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UNITED STATES DEPARTMENT OF ENERGY
MATERIAL SAFETY DATA SHEET

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Entry Date: 01/01/1981 Revised Date: 01/01/1981

12

SECTION I -- IDENTIFICATION

Chem. Name: BERYLLIUM
Chem. Id: 007440-41-7
DOT Class/#: POISON B, FLAMMABLE SOLID/UN1567
Chem. Family: METAL
Chem. Formula: No Info.
Hazard Rating (Scale: 0-4): HEALTH-(4); FIRE-(1); REACTIVITY-(0)
Molecular Weight: 9.010

Synonyms: BERYLLIUM
BERYLLIUM-9
BE
GLUCINIUM
7440-41-7

SECTION II -- HAZARDOUS INGREDIENTS

Components	CAS #	PEL/TLV	Percentage

NO COMPONENT INFORMATION ENTERED FOR THIS MATERIAL.

SECTION III -- PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: 2970.000 C (AT MMHG)
Vapor Pressure: 7.600 MM HG (AT 1910. C)
Vapor Density: No Info.
Evaporation Rate: No Info.

Specific Gravity: 1.848
Melting Point: 1278.000 C
Solubility: No Info. (SLIGHT - INSOL HOT-COLD WATER)
Volatiles by Vol.%: No Info.

Physical Description:

SILVER-GREY METAL

SECTION IV -- FIRE AND EXPLOSION HAZARD INFORMATION

Flash Point	Auto-Ignition Temp.	Flammable Limits
No Info.	1200.000 F	LEL: No Info. UEL: No Info.

Special Hazards:

DO NOT USE WATER. SMOTHER WITH SUITABLE DRY POWDER.

SECTION V -- REACTIVITY INFORMATION

Incompatibility:

AVOID CONTACT WITH ACIDS AND BASES ESPECIALLY WITH PODWER.

SECTION VI -- HEALTH HAZARD INFORMATION

Toxicity and Exposure Limits:

Inhal. Toxicity: 300.000 MG/CU.M
Comments: TCLO
HUMAN, PULMONARY
Oral Toxicity: No Info.
Exp. Limit: 0.002 MG/CU.M
Comments: TLV

Dermal Toxicity: No Info.
Eye Toxicity: No Info.
Exp. Limit Max.: No Info.

Health Effects and Symptoms:

EXPOSURE MAY OCCUR BY INHALATION OF DUST OR FUMES AND BY SKIN CONTACT. SKIN CONTACT WITH BERYLLIUM DUST AND SOLUBLE BERYLLIUM SALTS MAY CAUSE IRRITATION AND SENSITIZATION. EYE CONTACT MAY RESULT IN IRRITATION AND CONJUNCTIVITIS. GRANULOMATOUS,SLOW-HEALING LESIONS MAY RESULT FROM ACCIDENTAL IMPLANTATION OF BERYLLIUM OR CRYSTALS OF A SOLUBLE BERYLLIUM UNDER THE SKIN THROUGH CUTS OR PUNCTURES. ACUTE EXPOSURE BY INHALATION OF DUST OR FUMES MAY CAUSE A COUGH, SUBSTERNAL PAIN, SHORTNESS OF BREATH AND WEIGHT LOSS. AN INTENSE EXPOSURE MAY RESULT IN SEVERE CHEMICAL PNEUMONITIS WITH PULMONARY EDEMA.
SYMPTOMS RESULTING FROM CHRONIC EXPOSURE TO BERYLLIUM MAY BE DELAYED FROM 5 - 10 YEARS FOLLOWING THE LAST EXPOSURE. PULMONARY GRANULOMATOUS DISEASE IS CAUSED BY INHALATION OF BERYLLIUM DUST OR FUMES AND IS CHARACTERIZED BY RESPIRATORY SYMPTOMS, WEAKNESS, FATIQUE AND WEIGHT LOSS. DIAGNOSIS IS BASED IN PART ON CHANGES IN ROUTINE CHEST X-RAYS.
AVOID SKIN CONTACT AND INHALATION OF DUST. TLV IS 0.002 MG/M3.

Medical Recommendations:

PREMPLOYMENT HISTORY AND PHYSICAL EXAMINATIONS SHOULD INCLUDE LONG TERM SYMPTOMS. ACTH AND CORTISONE TREATMENTS HAVE PRODUCE TEMPORARY SEEK MEDICAL HELP FOR ANY EXPOSURE. NO SPECIFIC TREATMENTS ARE GIVEN FOR LONG TERM SYMPTOMS. ACTH AND CORTISONE TREATMENTS HAVE PRODUCE TEMPORARY CHEST X-RAYS, BASELINE PULMONARY FUNCTION TESTS (FVC AND FEV1) AND MEASUREMENT OF BODY WEIGHT. PERIODIC EXAMINATIONS SHOULD INCLUDE SPIROMETRY, MEDICAL HISTORY QUESTIONAIRE DIRECTED TOWARD RESPIRATORY SYMPTOMS, AND A CHEST X-RAY. GENERAL HEALTH, LIVER AND KIDNEY FUNCTION, AND POSSIBLE SKIN EFFECTS SHOULD BE EVALUATED.

Emergency and First Aid Procedures:

AFTER EXPOSURE TO A BERYLLIUM FIRE, PERSONNEL SHOULD BATHE CAREFULLY. ALL EQUIPMENT AND CLOTHING SHOULD BE WASHED DOWN AND CLOTHING SHOULD BE LAUNDERED SEPARATELY FROM OTHER NONCONTAMINATED MATERIAL AND CLOTHING. WASH SKIN AND EYES WITH WATER FOR AT LEAST 15 MINUTES. INHALATION - MOVE EXPOSED PERSON TO FRESH AIR. PERFORM ARTIFICIAL RESPIRATION IF NEEDED. IF INGESTED CONTACT A PHYSICIAN IMMEDIATELY.

SECTION VII -- PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in case material is released or spilled:

IF DUST OR POWDER IS SPILLED, WEAR A SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING. COLLECT DEBRIS IN A MANNER TO PREVENT RE-ENTRAINMENT OF THE AEROSOL. THIS MAY BE A VACUUM WITH A HEPA FILTER AT THE EXHAUST.

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Waste Disposal Method:

DISSOLVE IN 6M HYDROCHLORIC ACID AND FILTER. TREAT FILTRATE WITH 6M SODIUM OR AMMONIUM HYDROXIDE. BOIL AND LET PRECIPITATE SETTLE FOR 12 HOURS. FILTER, DRY PACKAGE AND SHIP TO SUPPLIER

Shipping and Transportation:

BERYLLIUM DUST, FLAKES, OR POWDER IS REGULATED BY DOT. LISTED IN OPTIONAL HAZARDOUS MATERIALS TABLE. SHIP AS POISON B MATERIAL.

Precautions to be taken in Handling and Storing:

CONTAINERS OF BERYLLIUM DUST OR POWDER SHOULD BE PROTECTED FROM PHYSICAL DAMAGE. KEEP DRY AND ISOLATE FROM ACIDS, CAUSTICS AND CHLORINATED HYDROCARBONS. SEPARATE FROM OXIDIZING MATERIALS.

Other Precautions:

Environmental Precautions:
AQUATIC TOXICITY TLM96(100-10 PPM).

SECTION VIII -- CONTROL MEASURES

Protection Measures:

WEAR PROTECTIVE GLOVES AND CLOTHING, GOGGLES AND A FACESHIELD. USE ONLY A WELL VENTILATED AREA (FUME HOOD) OR WEAR A SCBA.

Work/Hygienic Practices:

AVOID ALL CONTACT WITH DUST.

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DATE: 01/22/91 ACCT: 878202-01
INDEX: N/A CAT NO: C382500 PO NBR: N/A

COBALT OXIDE
COBALT OXIDE
COBALT OXIDE

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796-7100

EMERGENCY NUMBER: (201) 796-7100
CHEMTREC ASSISTANCE: (800) 424-9300

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 1308-06-1

SUBSTANCE: **COBALT OXIDE**

TRADE NAMES/SYNONYMS:
COBALT OXIDE (CO3O4); COBALTIC-COBALTOUS OXIDE; COBALTO-COBALTIC OXIDE (CO3O4); COBALT-COBALTIC TETROXIDE; COBALTOSIC OXIDE; COBALT TETRAOXIDE; COBALTO-COBALTIC OXIDE; TRICOBALT TETROXIDE; CO3O4; ACC05294

CHEMICAL FAMILY:
METAL OXIDE

MOLECULAR FORMULA: CO3-O4

MOLECULAR WEIGHT: 240.80

CERCLA RATINGS (SCALE 0-3): HEALTH=U FIRE=0 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=0 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: COBALT OXIDE PERCENT: 100.0
CAS# 1308-06-1

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
COBALT METAL, FUME AND DUST (AS CO):
0.05 MG/M3 OSHA TWA

SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

PHYSICAL DATA

DESCRIPTION: BLACK OR GRAY, HYGROSCOPIC, CUBIC CRYSTALLINE SOLID.

MELTING POINT: 1652-1742 F (900-950 C) (DECOMPOSES) SPECIFIC GRAVITY: 6.07

SOLUBILITY IN WATER: INSOLUBLE

SOLVENT SOLUBILITY: SOLUBLE IN SULFURIC ACID, FUSED SODIUM HYDROXIDE, ALKALIES; INSOLUBLE IN AQUA REGIA, HYDROCHLORIC ACID, NITRIC ACID. HYDROCHLORIC ACID, NITRIC ACID.

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
NEGLIGIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

FIREFIGHTING MEDIA:
EXTINGUISH USING AGENT SUITABLE FOR TYPE OF SURROUNDING FIRE.

FIREFIGHTING:
NO ACUTE HAZARD. MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. AVOID BREATHING VAPORS OR DUSTS; KEEP UPWIND.

TOXICITY

COBALT OXIDE:
CARCINOGEN STATUS: NONE.
THE TOXICITY OF COBALT OXIDE HAS NOT BEEN QUANTIFIED. POISONING BY COMPOUNDS CONTAINING COBALT MAY AFFECT THE RESPIRATORY, GASTROINTESTINAL, AND

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DATE: 01/22/91 ACCT: 878202-01
INDEX: N/A CAT NO: C382500 PO NBR: N/A

CARDIOVASCULAR SYSTEMS.

HEALTH EFFECTS AND FIRST AID

INHALATION:
COBALT OXIDE:
20 MG(CO)/M3 IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.
ACUTE EXPOSURE- METAL FUME FEVER, AN INFLUENZA-LIKE ILLNESS, MAY OCCUR DUE TO THE INHALATION OF FRESHLY FORMED METAL OXIDE PARTICLES SIZED BELOW 1.5 MICRONS AND USUALLY BETWEEN 0.02-0.05 MICRONS. SYMPTOMS MAY BE DELAYED 4-12 HOURS AND BEGIN WITH A SUDDEN ONSET OF THIRST, AND A SWEET, METALLIC OR FOUL TASTE IN THE MOUTH. OTHER SYMPTOMS MAY INCLUDE UPPER RESPIRATORY TRACT IRRITATION ACCOMPANIED BY COUGHING AND A DRYNESS OF THE MUCOUS MEMBRANES, LASSITUDE AND A GENERALIZED FEELING OF MALAISE. FEVER, CHILLS, MUSCULAR PAIN, MILD TO SEVERE HEADACHE, NAUSEA, OCCASIONAL VOMITING, EXAGGERATED MENTAL ACTIVITY, PROFUSE SWEATING, EXCESSIVE URINATION, DIARRHEA AND PROSTRATION MAY ALSO OCCUR. TOLERANCE TO FUMES DEVELOPS RAPIDLY, BUT IS QUICKLY LOST. ALL SYMPTOMS USUALLY SUBSIDE WITHIN 24-36 HOURS.
CHRONIC EXPOSURE- ANIMAL STUDIES FAILED TO FIND COBALT OXIDE TOXIC BY INTRATRACHEAL INJECTION WHEN GIVEN THREE EQUAL DOSES FOR A TOTAL OF 150 MG PER 600 GRAM GUINEA PIG. OTHER STUDIES INDICATE PROLONGED EXPOSURE MAY RESULT IN SOME PULMONARY INVOLVEMENT POSSIBLY INCLUDING TRANSIENT PNEUMONITIS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
COBALT OXIDE:
ACUTE EXPOSURE- NO SPECIFIC DATA AVAILABLE. DUST CONTAINING COBALT MAY CAUSE IRRITATION AND SENSITIZATION DERMATITIS IN PERSONS PREVIOUSLY EXPOSED. BOTH URTICARIAL ERUPTIONS AND ERYTHEMATOUS PAPULAR TYPES HAVE BEEN DESCRIBED AND USUALLY OCCUR IN SKIN AREAS SUBJECTED TO FRICTION, SUCH AS THE ELBOW FLEXURES, ANKLES, AND NECK.
CHRONIC EXPOSURE- NO SPECIFIC DATA AVAILABLE. REPEATED OR PROLONGED CONTACT TO COBALT DUST MAY CAUSE SENSITIZATION DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
COBALT OXIDE:
ACUTE EXPOSURE- NO DATA AVAILABLE. DUST MAY BE IRRITATING.
CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
COBALT OXIDE:
ACUTE EXPOSURE- NO SPECIFIC DATA AVAILABLE. INGESTION OF LARGE AMOUNTS OF COBALT MAY CAUSE VOMITING, DIARRHEA, AND A SENSATION OF HOTNESS.
CHRONIC EXPOSURE- NO SPECIFIC DATA AVAILABLE. CARDIOMYOPATHY HAS BEEN CAUSED BY EXCESSIVE INTAKE OF COBALT. SIGNS OF THIS ILLNESS MAY INCLUDE GASTROINTESTINAL DISTURBANCES, SHORTNESS OF BREATH, PERSISTENT COUGH, THORACIC AND RIGHT UPPER QUADRANT ABDOMINAL PAIN, LOWERED BLOOD PRESSURE, HEART ENLARGEMENT, RAPID HEART RATE, ELECTROCARDIOGRAPHIC ABNORMALITIES AND DEATH. THERAPEUTIC ADMINISTRATION HAS CAUSED NAUSEA, VOMITING, SKIN RASH, TINNITUS, NERVE DEAFNESS, THYROID HYPERPLASIA, POLYCYTHEMIA, MYXEDEMA, CONGESTIVE HEART FAILURE, AND DEATH.

FIRST AID- TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD LOWER THAN HIPS TO PREVENT ASPIRATION.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:
COBALT OXIDE:
HYDROGEN PEROXIDE: POSSIBLE VIOLENT DECOMPOSITION REACTION.
NITROETHANE: LOWERS IGNITION TEMPERATURE OF ALKANE.
NITROMETHANE: LOWERS IGNITION TEMPERATURE OF ALKANE.
NITROPROPANE: LOWERS IGNITION TEMPERATURE OF ALKANE.

DECOMPOSITION:
THERMAL DECOMPOSITION MAY RELEASE TOXIC AND/OR HAZARDOUS GASES.

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OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

****

CONDITIONS TO AVOID

PREVENT DISPERSION OF DUST IN AIR.

****

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
FOR LARGE SPILLS, SWEEP UP WITH A MINIMUM OF DUSTING AND PLACE INTO SUITABLE CLEAN, DRY CONTAINERS FOR RECLAMATION OR LATER DISPOSAL.

RESIDUE SHOULD BE CLEANED UP USING A HIGH-EFFICIENCY PARTICULATE FILTER VACUUM.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION AND/OR GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR:
THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

COBALT:

0.5 MG(CO)/M3- ANY DUST AND MIST RESPIRATOR EXCEPT SINGLE-USE RESPIRATORS.

1.0 MG(CO)/M3- ANY DUST AND MIST RESPIRATOR EXCEPT SINGLE-USE AND QUARTER-MASK RESPIRATORS.
ANY DUST, MIST, AND FUME RESPIRATOR.
ANY SUPPLIED-AIR RESPIRATOR.
ANY SELF-CONTAINED BREATHING APPARATUS.

2.5 MG(CO)M3- ANY POWERED AIR-PURIFYING RESPIRATOR WITH A DUST AND MIST FILTER.
ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.
ANY POWERED AIR-PURIFYING RESPIRATOR WITH A DUST, MIST, AND FUME FILTER.

5.0 MG(CO)/M3- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.

20 MG(CO)/M3- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN

SUBSTANCE.

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DATE: 01/22/91 ACCT: 878202-01
INDEX: N/A CAT NO: C382500 PO NBR: N/A

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 09/22/88 REVISION DATE: 03/21/90

-ADDITIONAL INFORMATION-

THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

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OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

C.F.R. TITLE 29

CHAPTER XVII PART 1910

MATERIAL SAFETY DATA SHEET

The information requested will be kept confidential and disclosed only as necessary to meet requirements of the Occupational Safety and Health Act of 1970 or as required by any other Federal, State or Local regulations.

SECTION I

MANUFACTURER'S NAME: Sur-Seal Gasket & Packing, Inc.	EMERGENCY TELEPHONE NO.: (513) 621-6600
ADDRESS (Number, Street, City, State, and ZIP Code): 1242 W. Mehring Way, Cincinnati, OH 45203	
CHEMICAL NAME AND SYNONYMS: Sheet Lead	TRADE NAME AND SYNONYMS: P6
CHEMICAL FAMILY: Lead	FORMULA:

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
Pigments			Base Metal	100	
Catalyst			Alloys		
Vehicle			Metallic Coatings		
Solvents			Filler Metal Plus Coating or Core Flux		
Additives			Others		
Others					

HAZARDOUS MIXTURES OF OTHER SOLVENTS	%	TLV (Units)
TLV - ACGIH 8-hr. TWA .05 MG/M^3		

SECTION III - PHYSICAL DATA

Boiling Point (°F)	3164	Specific Gravity (H_2O = 1)	11.3
Vapor Pressure (mm Hg.)		Percent Volatile by Volume (%)	
Vapor Density (Air = 1)		Evaporation Rate (_____ = 1)	
Solubility in Water		Melting Point (°F)	621
Appearance and Odor	Gray; odorless		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

			LEL	UEL
Flash Point (Method used)	N/A	Flammable Limits	N/A	N/A

Extinguishing Media Dry Chemicals or Sand should be used with molten metal

Special Fire Fighting Procedures Fire Fighters should wear full protective clothing

Unusual Fire and Explosion Hazards Do not use water on molten metals

FIG. 1.

SECTION V - HEALTH HAZARD DATA

Threshold Limit Value AGGIH 8 hr. TWA .05MG/M^3

Effects of Overexposure Short term exposure symptoms may include stomach cramps, persistant vomiting, sever anemia, peripheral neuropathy & acute encephalopathy followed by coma, cardiorespiratory arrest & death. Long term exposure symptoms are the above with a metallic taste in mouth. Weakness of extensor muscles of the wrist and ankles is noticeable in serious cases.

Emergency and First Aid Procedures

No immediate first aid is generally necessary. Biological monitoring under the direction of a physician is required in accordance with OSHA regulations.

SECTION VI - REACTIVITY DATA

Stability	Unstable		Conditions to Avoid N/A
	Stable	X	

Incompatability (*Materials to avoid*)

Hazardous Decomposition Products High temperatures may produce heavy metal fume vapor and/or dust

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled Special care should be taken when handling molton metal. Accumulations of dust should be vacuumed or wet-swept to prevent airbo exposers.

Waste Disposal Method Metal turnings, grindings, drippings, or drosses should be recycled.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Respiratory Protection (*Specify type*) NIOSH Certified

Ventilation	Local Exhaust Preferred	Special
	Mechanical (*General*)	Other

Protective Gloves Industrial type | Eye Protection Safety Glass w/shield

Other Protective Equipment compliance with OSHA Regulations & other accepted safety and hygiene practices.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing Mat'l in storate can becom- wet from condensation. It must be thoroughly dried before adding to molten metal.

Other Precautions See other sections, references and sources.

FIG. 1. cont.

10999

CHEM REPORT
05/23/1986

CHEM ID	CHEM NAME
***	
* 007440-61-1	URANIUM

ENTRY INFORMATION
05/23/1986

PREPARER	REVIEWER	ENTRY DATE	REVISED
***			
* D. AVERILL	J. BROWER	02/13/1985	05/16/1986

DOE CHEMICAL HAZARDS EMERGENCY MANAGEMENT SYSTEM
05/23/1986

HEALTH AND SAFETY INFORMATION AUTHORITY

CHEMICAL NAME OR SYNONYM
***
* URANIUM
* URANIUM METAL
* U238
* URANIUM METAL PYROPHORIC
* 7440-61-1

TWA .2 mg/m3 .6 STEL

DOT

DISPOSAL

RECOVERY FOR REPROCESSING IS THE PREFERRED METHOD FOR HANDLING WASTE URANIUM. SHIP TO LISCENCED RECOVERY FACILITY. SCRAP URANIUM SHOULD BE COVERED WITH OIL.

DECOMPOSITION PRODUCTS

THERMAL DECOMPOSITION - URANIUM OXIDES.

ENVIRONMENTAL EFFECTS

NO CRITERIA SET, BUT EPA HAS SUGGESTED A PERMISSIBLE CONCENTRATION IN WATER OF 3 UG/L BASED ON HEALTH EFFECTS.

EMERGENCY PROCEDURES

PERSONS NOT WEARING PROTECTIVE EQUIPMENT AND CLOTHING SHOULD BE RESTRICTED FROM AREAS OF SPILLS UNTIL CLEANUP HAS BEEN COMPLETED. IF URANIUM MATERIALS ARE SPILLED, 1. VENTILATE AREA OF SPILL. 2. COLLECT SPILLED MATERIAL IN MOST CONVENIENT AND SAFE MANNER AND DEPOSIT IN SEALED CONTAINERS FOR RECLAMATION. LIQUID CONTAINING URANIUM OR INSOLUBLE COMPOUNDS SHOULD BE ABSORBED IN VERMICULITE, DRY SAND, EARTH, OR A SIMILAR MATERIAL. URANIUM CHIPS OR TURNINGS WHICH ARE SPILLED SHOULD BE COVERED WITH OIL.

FIRST AID

WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER. GET MEDICAL ATTENTION. CONTACT LENSES SHOULD NOT BE WORN WHEN WORKING WITH THIS CHEMICAL. SKIN EXPOSURE - PROMPTLY WASH CONTAMINATED SKIN USING SOAP OR MILD DETERGENT AND WATER. IF IRRITATION IS PRESENT AFTER WASHING, GET MEDICAL ATTENTION. INHALATION - IF A PERSON BREATHES IN LARGE AMOUNTS OF URANIUM MOVE THE EXPOSED PERSON TO FRESH AIR AT ONCE. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP THE AFFECTED PERSON WARM AND AT REST. GET MEDICAL ATTENTION IMMEDIATELY . SWALLOWING - GIVE THE PERSON LARGE QUANTITIES OF WATER IMMEDIATELY. AFTER THE WATER HAS BEEN SWALLOWED, TRY TO GET THE PERSON TO VOMIT BY TOUCHING THE BACK OF THE THROAT WITH A FINGER. DO NOT MAKE AN UNCONSCIOUS PERSON VOMIT. GET MEDICAL ATTENTION IMMEDIATELY.

FIRE HAZARD

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URANIUM IS A DANGEROUS FIRE HAZARD IN THE FORM OF A SOLID OR DUST WHEN EXPOSED TO HEAT OR FLAME. IT IS A MODERATE EXPLOSION HAZARD IN THE FORM OF DUST WITH A MINIMUN EXPLOSIVE CONCENTRATION OF 60 GRAMS/ CU.M. EXTINGUISH WITH DRY POWDER, DRY SAND OR [illegible]

CARBON DIOXIDE.

HEALTH HAZARD

HIGHLY TOXIC AND RADIOACTIVE.
URANIUM AND/OR IT INSOLUBLE COMPOUNDS ARE TOXIC IF THEY ARE INHALED, SWALLOWED, OR IF THEY COME IN CONTACT WITH THE EYES OR SKIN. URANIUM METAL AND ITS INSOLUBLE COMPOUNDS ARE LESS TOXIC THAN THE SOLUBLE COMPOUNDS. IT IS WEAKLY RADIOACTIVE AND IS PRINCIPALLY AND ALPHA PARTICLE EMITER. IT IS NOT A SIGNIFICANT EXTERNAL RADIATION HAZARD. IT POSES AN INTERNAL RADIATION AND CHEMICAL HAZARD. EXPOSURE MAY CAUSE AN INCREASE IN CANCER OF THE LYMPHATIC AND BLOOD-FORMING TISSUES IN MAN. PROLONGED CONTACT WITH THE SKIN MIGHT CAUSE RADIATION DAMAGE TO THE SKIN AND/OR SKIN RASH (DERMATITIS). PROLONGED INHALATION HAS CAUSED DAMAGE TO THE LUNGS OF ANIMALS. URANIUM IS HIGHLY TOXIC TO THE KIDNEYS AND LIVER.

CHEMICAL INCOMPATIBILITIES

CONTACT WITH CO2 MAY CAUSE FIRE.
URANIUM METAL IS INCOMPATIBLE WITH HALOGENS. U POWDER IGNITES IN FLORINE AT ROOM TEMPERATURE, IN CHLORINE AT 150-180 DEGREES C, AND IN IODINE VAPOR AT 260 DEGREE C. MAY EXPLODE OR IGNITE IN BRF3 AND CCL4. URANIUM REACTS EXPLOSIVELY WITH NITRIC ACID, AND DINITROGEN TETRAOXIDE. U METAL GLOWS AND PRODUCES HEAT IN AMMONIA, SULFUR VAPOR, AND IN CONTACT WITH SELENIUM.

MEDICAL RECCOMMENDATIONS

SPECIAL ATTENTION SHOULD BE GIVEN TO THE BLOOD, LUNGS, KIDNEY, AND LIVER IN PREEMPLOYMENT MEDICAL EXAMS. PERIODIC MEDICAL EXAM SHOULD INCLUDE A CHEST X-RAY, URINALYSIS, COMPLETE BLOOD COUNT AND CHEMISTR

PHYSICAL DESCRIPTION

A HARD, SILVERY WHITE RADIOACTIVE METAL

PROTECTION MEASURES

GOOD ENGINEERING CONTROLS SHOULD BE USED TO REDUCE ENVIRONMENTAL CONCENTRATIONS TO THE PERMISSIBLE EXPOSURE LEVEL (PEL). ABOVE THE PEL RESPIRATORY PROTECTION MUST BE WORN. AT A CONCENTRATION OF 2.5 MG/M3 OR LESS WEAR FUME RESPIRATOR OR HIGH EFFICENCY PARTICULATE RESPIRATOR APPROVED FOR RADIONUCLIDES. A SUPPLIED-AIR RESPIRATOR, OR A SCBA. EMPLOYEES SHOULD WEAR IMPERVIOUS CLOTHING, GLOVES, AND GOGGLES TO PREVENT SKIN CONTACT WITH URANIUM. EATING AND SMOKING SHOULD NOT BE PERMITTED IN AREAS WHERE SOLIDS OR LIQUIDS CONTAINING URANIUM OR INSOLUBLE COMPOUNDS ARE HANDLED, PROCESSED, OR STORED. EMPLOYEES WHO HANDLE URANIUM SHOULD WASH THEIR HANDS THOROUGHLY WITH SOAP OR MILD DETERGENT AND WATER BEFORE EATING, SMOKING OR USING TOILET FACILITIES.

SAMPLING METHODS

NO STANDARD MEASUREMENT METHODS FOR URANIUM OR INSOLUBLE COMPOUNDS HAVE BEEN PUBLISHED BY NIOSH. MAY BE SAMPLED AND USING A CELLULOSE ESTER FILTER AND ANALYZED BY ATOMIC ABSORPTION.

SHIPPING INFORMATION

SHIP AS URANIUM METAL, PYROPHORIC. LABEL AS RADIOACTIVE AND FLAMMABLE SOLID.

STORAGE RECOMMENDATIONS

STORE AS RADIOACTIVE MATERIAL. KEEP FROM EXPOSURE TO AIR, MOISTURE, HALOGENS, ACIDS, AMMONIA, SULFUR. SCRAP URANIUM SHOULD BE COVERED WI DI

USE

URANIUM METAL HAS LIMITED USES IN ALLOYS AND PHOTOELECTRIC TUBES. URANIUM COMPOUNDS ARE USED AS FUEL IN NUCLEAR REACTORS. IN PLUTONIUM PRODUCTION, IN THE ARE PRODUCTION OF OTHER RADIOACTIVE ISOTOPES, AND AS FEEDS FOR GASEOUS DIFFUSION PLANTS.

```
***
* CARCINOGEN                    HUMAN
* CHEMICAL                      ACTINIDE METAL
* HAZARD CODE                   REACTIVITY                    U
* HAZARD CODE                   HEALTH                        2
* HAZARD CODE                   FIRE                          3
* HEALTH HAZARD                 KIDNEY TOXIN
* PHYSICAL HAZARD               PYROPHORIC
* PHYSICAL HAZARD               RADIOACTIVE
* TRANSPORTATION                RADIOACTIVE AND FLAMMABLE     UN2979
                                 SOLID
CHEM NAME* URANIUM
```

CHEMICAL ATTRIBUTES
05/23/1984

ATTRIBUTE	VALUE	UNITS	QUALITY	COMMENTS
***				
* IGNITION TEMP	150.000	TO 175C		SOLID
* CHEM FORMULA			U	
* MOL WEIGHT	238.030	G/MOL		
* PHYSICAL STATE			SOLID	AT 20 - 25 C
* HALF LIFE	4.500	10E9 YEARS		
* IGNITION TEMP	20.000	C	MINIMUM	DUST CLOUD
* MELTING POINT	1133.000	C		
* BOILING POINT	3818.000	C		
* SPECIFIC GRAVITY	19.050		WATER=1	AT 25 C
* SOLUBILITY			INSOLUBLE	IN WATER
* EXPOSURE LIMIT	0.250	MG/CU.M	PEL	AS U
* EXPOSURE LIMIT	0.200	MG/CU.M	TLV	AS U

SELECTED MATERIALS THAT ARE RELATED TO OR CONTAIN THE SUBSTANCE
05/23/1984

CHEM NAME* URANIUM

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***
* URANIUM COMPOUNDS
* URANIUM DICARBIDE
* URANIUM DIOXIDE
* URANIUM HEXAFLUORIDE
* URANIUM HYDRIDE
* URANIUM OCTAOXIDE
* URANIUM OXYFLUORIDE
* URANIUM TETRAFLUORIDE
* URANYL FLUORIDE
* URANYL NITRATE
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CHEMICAL NAME
THORIUM METAL, PYROPHORIC

FORMULA
TH

SYNONYMS
THORIUM
THORIUM-232
NA 9170
OHS23460

PERMISSIBLE EXPOSURE LIMIT
NONE ESTABLISHED
CERCLA HAZARD RATINGS - TOXICITY 3 - IGNITABILITY 3 - REACTIVITY 1
PERSISTENCE 3

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONCENTRATION
NONE SPECIFIED

PHYSICAL DESCRIPTION
SILVERY-GRAY METAL POWDER

CHEMICAL AND PHYSICAL PROPERTIES
MOLECULAR WEIGHT: 232.04
BOILING POINT AT 1 ATM, F: 8132 F
SOLUBILITY IN WATER, G/100 G WATER AT 20C: INSOLUBLE
FLASH POINT, CLOSED CUP, F (OR OPEN CUP IF OC): SPONT FLAMMABLE
MELTING POINT, F: 3294-3402 F
SPECIFIC GRAVITY: 11.72

INCOMPATIBILITIES
SPONTANEOUSLY FLAMMABLE IN AIR
STRONG OXIDIZERS
SULFUR
PHOSPHOROUS
CHLORINE

PERSONAL PROTECTIVE EQUIPMENT
NO NIOSH/OSHA DATA; RECOMMEND
PREVENT ANY POSSIBILITY OF SKIN CONTACT
WEAR FLAME RESISTANT CLOTHING
WEAR IMPERVIOUS CLOTHING
WEAR GLOVES
WEAR FACESHIELD (8 INCH MINIMUM)

PLACE CONTAMINATED CLOTHING IN CLOSED CONTAINERS FOR STORAGE UNTIL LAUNDERED OR DISCARDED
IF CLOTHING IS TO BE LAUNDERED, INFORM PERSON PERFORMING OPERATION CONTAMINANT'S HAZARDOUS PROPERTIES

GOGGLES
NO STANDARD REQUIREMENT, BUT ADVISE EYE PROTECTION TO

PREVENT ANY POSSIBILITY OF EYE CONTACT
WEAR FACE SHIELD OR VENTED GOGGLES

WASHING CHEMICALS FROM THE SKIN
NO STANDARD REQUIREMENT, BUT ADVISE WASHING
IMMEDIATELY WHEN SKIN BECOMES CONTAMINATED

ROUTINE CHANGING OF WORK CLOTHING
NO STANDARD REQUIREMENT, BUT ADVISE CHANGING
IF THERE IS ANY POSSIBILITY THAT CLOTHING MAY BE CONTAMINATED

CLOTHING REMOVAL FOLLOWING ACCIDENTAL CONTAMINATION
NO STANDARD REQUIREMENT, BUT ADVISE REMOVING
IMMEDIATELY IF IT BECOMES CONTAMINATED TO PREVENT FLAMMABILITY/EXP
IVITY HAZARD

SPECIFIC EMERGENCY PROVISIONS
NO NIOSH/OSHA DATA, ADVISE:
EYE-WASH FOUNTAIN WITHIN IMMEDIATE WORK AREA WHERE EMPLOYEES' EYES
BE EXPOSED TO SUBSTANCE
QUICK DRENCHING FACILITIES WITHIN IMMEDIATE WORK AREA WHERE EMPLOY
MAY BE EXPOSED TO SUBSTANCE
FIRE RESISTANT INSULATED FOOTWEAR, SAFETY TOES, AND HELMETS

RESPIRATOR SELECTION (UPPER LIMIT DEVICES PERMITTED)

NO SPEC ADVISE
- HIGH-EFFICIENCY PARTICULATE RESPIRATOR
  WITH A FULL FACE-PIECE
- SUPPLIED-AIR RESPIRATOR
  WITH A FULL FACE-PIECE, HELMENT, OR HOOD
- SELF-CONTAINED BREATHING APPARATUS
  WITH A FULL FACE-PIECE

HIGH LEVELS
- TYPE 'C' SUPPLIED-AIR RESPIRATOR
  WITH A FULL FACE-PIECE
  OPERATED IN PRESSURE-DEMAND OR POSITIVE-PRESSURE MODE
- TYPE 'C' SUPPLIED-AIR RESPIRATOR
  WITH A FULL FACE-PIECE
  OPERATED IN CONTINUOUS-FLOW MODE

FIREFIGHTING
- SELF-CONTAINED BREATHING APPARATUS
  WITH A FULL FACE-PIECE
  OPERATED IN PRESSURE-DEMAND OR POSITIVE-PRESSURE MODE

ROUTE OF ENTRY INTO BODY
INHALATION
SKIN OR EYE CONTACT
INGESTION
SYMPTOMS
DERMATITIS
CANCER

FIRST AID PROCEDURES FOLLOWING EXPOSURE
IF THIS CHEMICAL GETS INTO THE EYES, IMMEDIATELY WASH THE EYES WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING THE LOWER AND UPPER LIDS. GET MEDICAL ATTENTION IMMEDIATELY. CONTACT LENSES SHOULD NOT BE WORN WHEN WORKING WITH THIS CHEMICAL.

IF THIS CHEMICAL GETS ON THE SKIN, IMMEDIATELY WASH CONTAMINATED SKIN WITH SOAP OR MILD DETERGENT & WATER. IF THIS CHEMICAL SOAKS CLOTHING, IMMEDIATELY REMOVE CLOTHING & WASH SKIN WITH SOAP OR MILD DETERGENT & WATER. GET MEDICAL ATTENTION PROMPTLY.

IF A PERSON BREATHES IN LARGE AMOUNTS OF THIS CHEMICAL, MOVE THE EXPOSED PERSON TO FRESH AIR AT ONCE. IF BREATHING HAS STOPPED PERFORM ARTIFICIAL RESPIRATION. KEEP THE AFFECTED PERSON WARM AND AT REST. GET MEDICAL ATTENTION AS SOON AS POSSIBLE.

WHEN THIS CHEMICAL HAS BEEN SWALLOWED, DO NOT INDUCE VOMITING. REMOVE BY GASTRIC LAVAGE AND CATHARSIS.

ORGANS
SKIN

STATUS OF REGULATORY ENFORCEMENT
OSHA STANDARD 29CFR1910.1200 HAZARD COMMUNICATION
REQUIRES CHEMICAL MANUFACTURERS AND IMPORTERS TO ASSESS THE HAZAF OF CHEMICALS WHICH THEY PRODUCE OR IMPORT, AND ALL EMPLOYERS HAVING WORKPLACES IN THE MANUFACTURING DIVISION, STANDARD INDUSTRIAL CLASS IFICATION CODES 20 THROUGH 39, TO PROVIDE INFORMATION TO THEIR EMPL CONCERNING HAZARDOUS CHEMICALS BY MEANS OF HAZARD COMMUNICATION PRC INCLUDING LABELS, MATERIAL SAFETY DATA SHEETS, TRAINING, AND ACCESS WRITTEN RECORDS
48FR53280 11/25/83

FOLLOWING OSHA STANDARDS APPLICABLE TO SUBSTANCES LISTED 29CFR1910. OTHERWISE ADVISE:

OSHA STANDARD 29CFR1910.94 VENTILATION

OSHA STANDARD 29CFR1910.134 RESPIRATORY PROTECTION
OSHA STANDARD 29CFR1910.20 ACCESS TO EMPLOYEE EXPOSURE AND MEDICA RECORDS

OSHA STANDARD 29CFR1910.132 PERSONAL PROTECTIVE EQUIPMENT

OSHA STANDARD 29CFR1910.141 SANITATION

000357

OSHA STANDARD 29CFR1910.151 MEDICAL SERVICES AND FIRST AID

OSHA STANDARD 29CFR1910.133 EYE AND FACE PROTECTION

40CFR717 RECORDS AND REPORTS OF ALLEGATIONS THAT CHEMICAL SUBSTANC
CAUSE SIGNIFICANT ADVERSE REACTIONS TO HEALTH OR THE ENVIRONMENT
REQUIRES MANUFACTURERS AND CERTAIN PROCESSORS OF CHEMICAL SUBST
AND MIXTURES TO KEEP RECORDS OF SIGNIFICANT ADVERSE REACTIONS TO H
OR THE ENVIRONMENT ALLEGED TO HAVE BEEN CAUSED BY A SUBSTANCE OR
MIXTURE. EPA MAY INSPECT AND REQUIRE REPORTING OF SUCH RECORDS.
48FR38178 08/22/83

49CFR172.101 TABLES OF HAZARDOUS MATERIALS, THEIR DESCRIPTION,
PROPER SHIPPING NAME, CLASS, LABEL, PACKAGING, AND OTHER RE-
QUIREMENTS
DESIGNATED IN HAZARDOUS MATERIALS TABLE AS HAZARDOUS MATER-
IAL FOR THE PURPOSE OF TRANSPORTATION.
41FR15996 04/15/76
45FR34588 05/22/80 (AMENDMENT)
45FR46420 07/10/80 (AMENDMENT)
45FR62080 09/18/80 (AMENDMENT)
45FR74649 11/10/80 (AMENDMENT)
46FR17739 03/19/81 (AMENDMENT)
46FR19235 03/30/81 (AMENDMENT)

40CFR261.24 CHARACTERISTIC OF EP TOXICITY
SUBSTANCE LISTED RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)
45FR33084 05/19/80

SUBSTANCE LISTED TOXIC SUBSTANCES CONTROL ACT INVENTORY

MEDICAL SURVEILLANCE REQUIRED
NO NIOSH/OSHA DATA; ADVISE:
EKG RECOMMENDED IF EMPLOYEE TO WEAR FULL-FACE RESPIRATOR
GENERAL MEDICAL HISTORY
40CFR717 RECORDS AND REPORTS OF ALLEGATIONS THAT CHEMICAL SUBSTANC
CAUSE SIGNIFICANT ADVERSE REACTIONS TO HEALTH OR THE ENVIRONMENT
TOXIC SUBSTANCES CONTROL ACT (TSCA) SECTION 8(C) RULE REQUIRES
MANUFACTURERS AND CERTAIN PROCESSORS OF CHEMICAL SUBSTANCES AND MI
TO KEEP RECORDS OF SIGNIFICANT ADVERSE REACTIONS TO EMPLOYEE HEALT
30 YEARS
48FR38187 08/22/83
48FR39225 08/30/83 (EFFECTIVE DATE CORRECTION)
PHYSICIAN EXAMINATION
INDUSTRIAL EXPOSURE HISTORY
PRE-PLACEMENT AND ANNUAL EXAMS
MEDICAL WARNING FOR REFUSAL OF MEDICAL EXAMINATION

CERTIFICATIONS
NO FEDERAL AGENCY REQUIREMENT, BUT DUE TO HAZARDOUS NATURE OF
SUBSTANCE, ADVISE FOLLOWING:

HEALTH STATUS CLASSIFICATION

OSHA RESPIRATOR CERTIFICATION 29CFR1910.134

DEPARTMENT OF TRANSPORTATION IF OPERATES HEAVY EQUIPMENT

EMPLOYEE HAZARDOUS MATERIALS EDUCATION RECEIPT
EMPLOYEE MEDICAL RECORDS RECEIPT

TOXIC SUBSTANCES CONTROL ACT (TSCA) SECTION 8(C) RULE
REQUIRES MANUFACTURERS AND CERTAIN PROCESSORS OF CHEMICAL
SUBSTANCES AND MIXTURES TO KEEP RECORDS OF SIGNIFICANT
ADVERSE REACTIONS TO EMPLOYEE HEALTH FOR 30 YEARS.
CONTACT: JACK P. MCCARTHY, OFFICE OF TOXIC SUBSTANCES,
EPA (800)424-1404. 48FR38178 8/22/83

MEDICAL WARNING REQUIRED FOR MEDICAL EXAM REFUSAL SIGNED
BY EMPLOYEE

SPECIAL DIAGNOSTIC TESTS
NONE IN COMMON USE

LEAKS AND SPILL PROCEDURES

A REPORTABLE QUANTITY OF ONE HUNDRED POUNDS APPLIES TO THIS SUBSTAN
ADJUSTED UNDER SECTION 102(A) OF THE COMPREHENSIVE ENVIRONMENTAL
RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (CERCLA) BY EXHIE
ONE OR MORE OF THE CHARACTERISTICS OF IGNITABILITY, CORROSIVITY, OF
REACTIVITY IDENTIFIED IN 40CFR261.21 THROUGH 261.23. SECTIONS 103(A
AND 103(B) REQUIRE THAT PERSONS IN CHARGE OF A VESSEL OR FACILITY F
WHICH A HAZARDOUS SUBSTANCE HAS BEEN RELEASED IN A QUANTITY EQUAL T
GREATER THAN THE REPORTABLE QUANTITY FOR THAT SUBSTANCE IMMEDIATELY
NOTIFY THE NATIONAL RESPONSE CENTER (800) 424-8802; IN THE WASHINGT
D.C. METROPOLITAN AREA (202) 426-2675
50FR13456 04/04/85

****

DEPARTMENT OF TRANSPORTATION HAZARD CLASS
49CFR172.101 HAZARDOUS MATERIALS TABLE

RADIOACTIVE MATERIAL

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS
49CFR172.101 (SUBJECT TO ADDITIONAL LABELING REQUIREMENTS OF
49CFR172.402)

RADIOACTIVE MATERIAL
FLAMMABLE SOLID

****

INTERGOVERNMENTAL MARITIME ORGANIZATION HAZARD CLASS
49CFR172.102 OPTIONAL HAZARDOUS MATERIALS TABLE

NONE

****

FOLLOWING INFORMATION FROM BUREAU OF EXPLOSIVES "EMERGENCY HANDLIN
HAZARDOUS MATERIALS":

IF MATERIAL ON FIRE OR INVOLVED IN FIRE:
* CONTACT LOCAL, STATE, OR DEPARTMENT OF ENERGY RADIOLOGICAL RESP
TEAM
* DO NOT USE WATER
* USE GRAPHITE, SODA ASH, POWDERED SODIUM CHLORIDE OR SUITABLE DR
POWDER

IF MATERIAL IS NOT ON FIRE AND IS NOT INVOLVED IN FIRE:
* KEEP UPWIND
* AVOID BREATHING DUST/VAPORS/FUMES FROM MATERIAL
* WEAR FULL PROTECTIVE CLOTHING (FIREMANS GEAR INADEQUATE)
* WEAR SELF-CONTAINED BREATHING APPARATUS WHEN FIGHTING FIRE VC
THIS MATERIAL
* DO NOT HANDLE BROKEN PACKAGES WITHOUT PROTECTIVE EQUIPMENT
* WASH AWAY ANY MATERIALS WHICH MAY HAVE CONTACTED THE BODY WITH
COPIOUS AMOUNTS OF WATER OR SOAP AND WATER

EVACUATION PROCEDURE:
* KEEP UNNECESSARY PEOPLE OUT OF INCIDENT AREA UNTIL AREA DECLARE
BY RADIOLOGICAL RESPONSE TEAM

WASTE

THIS MATERIAL LISTED AS HAZARDOUS SUBSTANCE, AS DEFINED IN SECTION 101(14) OF THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSTATION, LIABILITY ACT (CERCLA) OF 1980, PURSUANT TO ONE OR MORE OF THE FOLLOWING:

* FEDERAL WATER POLLUTION CONTROL ACT (FWPCA) SECTION 311(B)(2)(A
* SOLID WASTE DISPOSAL ACT SECTION 3001
* CLEAN WATER ACT (CWA) SECTION 307(A)
* CLEAN AIR ACT (CAA) SECTION 112
* TOXIC SUBSTANCES CONTROL ACT (TSCA) SECTION 7
* COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILI
ACT (CERCLA) SECTION 102

EPA HAZARDOUS WASTE NUMBER D001
WASTE WHICH EXHIBITS THE CHARACTERISTIC OF IGNITABILITY 40CFR2 21

40CFR260 HAZARDOUS WASTE MANAGEMENT SYSTEM: GENERAL

PROVIDES DEFINITIONS OF TERMS, GENERAL STANDARDS, AND OVERVIEW INFORMATION APPLICABLE TO 40CFR PARTS 260-265

40CFR261 IDENTIFICATION AND LISTING OF HAZARDOUS WASTE

IDENTIFIES THOSE SOLID WASTES WHICH ARE SUBJECT TO REGULATION AS HAZARDOUS WASTES UNDER 40CFR PARTS 262-263, 270, 271, AND 124 AND ARE SUBJECT TO THE NOTIFICATION REQUIREMENTS OF SECTION 3010 OF THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) AND IDENTIFIES ONLY S OF THE MATERIALS WHICH ARE HAZARDOUS WASTES UNDER SECTIONS 3007 AND OF RCRA

40CFR262 STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE

ESTABLISHES STANDARDS FOR GENERATORS OF HAZARDOUS WASTE

40CFR263 STANDARDS APPLICABLE TO TRANSPORTERS OF HAZARDOUS WASTE

ESTABLISHES STANDARDS WHICH APPLY TO PERSONS TRANSPORTING HAZARDO WASTE WITHIN THE UNITED STATES IF THE TRANSPORTATION REQUIRES A MAN UNDER 40CFR262

40CFR264 STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

ESTABLISHES MINIMUM NATIONAL STANDARDS WHICH DEFINE THE ACCEPTABL MANAGEMENT OF HAZARDOUS WASTE

40CFR265 INTERIM STATUS STANDARDS FOR OWNERS AND OPERATORS OF HAZA WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

ESTABLISHES MINIMUM NATIONAL STANDARDS WHICH DEFINE THE ACCEPTABL MANAGEMENT OF HAZARDOUS WASTE DURING THE PERIOD OF INTERIM STATUS

40CFR267 INTERIM STANDARDS FOR OWNERS AND OPERATORS OF NEW HAZARDO WASTE LAND DISPOSAL FACILITIES

ESTABLISHES MINIMUM NATIONAL STANDARDS THAT DEFINE THE ACCEPTABLE MANAGEMENT OF HAZARDOUS WASTE FOR NEW LAND DISPOSAL FACILITIES

40CFR270 EPA ADMINISTERED PERMIT PROGRAMS: THE HAZARDOUS WASTE PER PROGRAM

ESTABLISHES PROVISIONS FOR THE HAZARDOUS WASTE PERMIT PROGRAM UND SUBTITLE C OF THE SOLID WASTE DISPOSAL ACT, AS AMENDED BY THE RESOU CONSERVATION AND RECOVERY ACT

CAS NUMBER
7440-29-1
REGISTRY TOXIC CHEMICALS NUMBER

000361

X06400000

BULLETINS

SPECIAL INFORMATION
MAY BE IGNITED BY FRICTION AND BURN WITH INTENSE FLAME.
POWDERED FORM IS SPONTANEOUSLY FLAMMABLE IN AIR.

Material Safety Data Sheet
May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

71

IDENTITY (As Used on Label and List): ALCONOX

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name: ALCONOX, INC.	Emergency Telephone Number: (212) 473-1300
Address (Number, Street, City, State, and ZIP Code): 215 PARK AVENUE SOUTH	Telephone Number for Information: (212) 473-1300
NEW YORK, N.Y. 10003	Date Prepared: JULY 1, 1989
	Signature of Preparer (optional):

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
THERE ARE NO INGREDIENTS IN ALCONOX WHICH APPEARED ON THE OSHA STANDARD 29 CFR 1910 SUBPART Z.				

Section III — Physical/Chemical Characteristics

Boiling Point	N.A.	Specific Gravity (H_2O = 1)	N.A.
Vapor Pressure (mm Hg.)	N.A.	Melting Point	N.A.
Vapor Density (AIR = 1)	N.A.	Evaporation Rate (Butyl Acetate = 1)	N.A.

Solubility in Water: APPRECIABLE (GREATER THAN 10 PER CENT)

Appearance and Odor: WHITE POWDER INTERSPERED WITH CREAM COLORED FLAKES - ODORLESS

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used): NONE	Flammable Limits	LEL: N.A.	UEL: N.A.

Extinguishing Media: WATER, CO_2, DRY CHEMICAL, FOAM, SAND/EARTH

Special Fire Fighting Procedures: FOR FIRES INVOLVING THIS MATERIAL DO NOT ENTER WITHOUT PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS.

Unusual Fire and Explosion Hazards: NONE

OSHA 174, Sept. 1985

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid NONE
	Stable	XX	

Incompatibility (*Materials to Avoid*) AVOID STRONG ACIDS

Hazardous Decomposition or Byproducts MAY RELEASE CO_2 GAS ON BURNING

Hazardous Polymerization	May Occur		Conditions to Avoid NONE
	Will Not Occur	XX	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? YES Skin? NO Ingestion? YES

Health Hazards (*Acute and Chronic*) INHALATION OF POWDER MAY PROVE LOCALLY IRRITATING TO MUCOUS MEMBRANES. INGESTION MAY CAUSE DISCOMFORT AND/OR DIARRHEA.

Carcinogenicity: NTP? NO IARC Monographs? NO OSHA Regulated? NO

Signs and Symptoms of Exposure EXPOSURE MAY IRRITATE MUCOUS MEMBRANES. MAY CAUSE SNEEZING.

Medical Conditions Generally Aggravated by Exposure RESPIRATORY CONDITIONS MAY BE AGGRAVATED BY POWDER.

Emergency and First Aid Procedures
EYES-FLUSH WITH PLENTY OF WATER FOR 15 MINUTES SKIN-FLUSH WITH PLENTY OF WA
INGESTION-DRINK LARGE QUANTITIES OF WATER.GET MEDICAL ATTENTION FOR DISCOMFORT

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled MATERIAL FOAMS PROFUSELY. SHOVEL AND RECOVER AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.

Waste Disposal Method
SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR NON-HAZARDOUS DETERGENT.

Precautions to Be Taken in Handling and Storing STORE IN A DRY AREA TO PREVENT CAKING.

Other Precautions NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL.

Section VIII — Control Measures

Respiratory Protection (*Specify Type*) DUST MASK

Ventilation	Local Exhaust NORMAL	Special N.A.
	Mechanical (*General*) N.A.	Other N.A.

Protective Gloves USEFUL-NOT REQUIRED	Eye Protection USEFUL-NOT REQUIRED

Other Protective Clothing or Equipment NOT REQUIRED

Work/Hygienic Practices NO SPECIAL PRACTICES REQUIRED

• USGPO 1986-491-529/45775

ATTACHMENT F

WORK AREA MAP

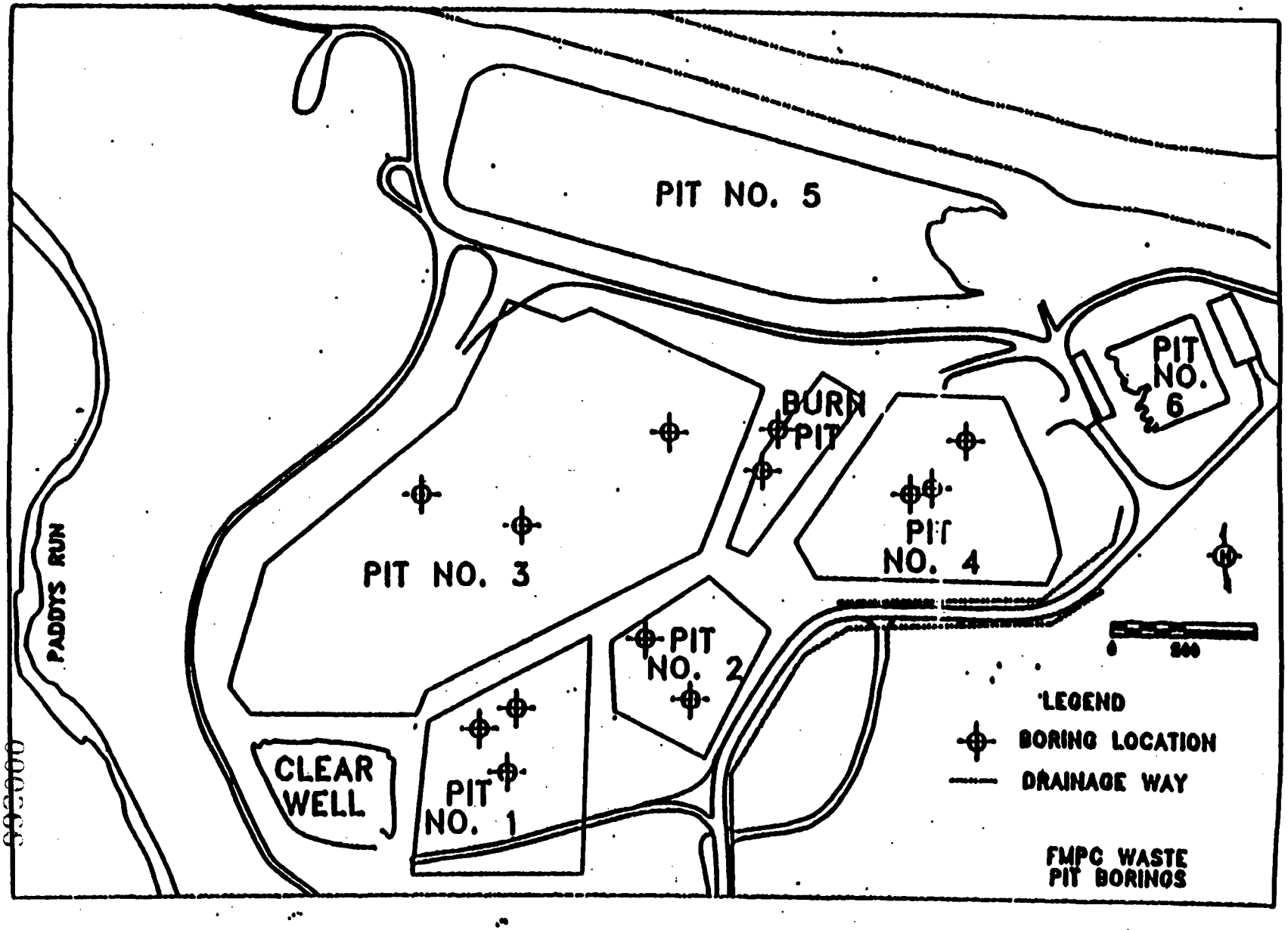
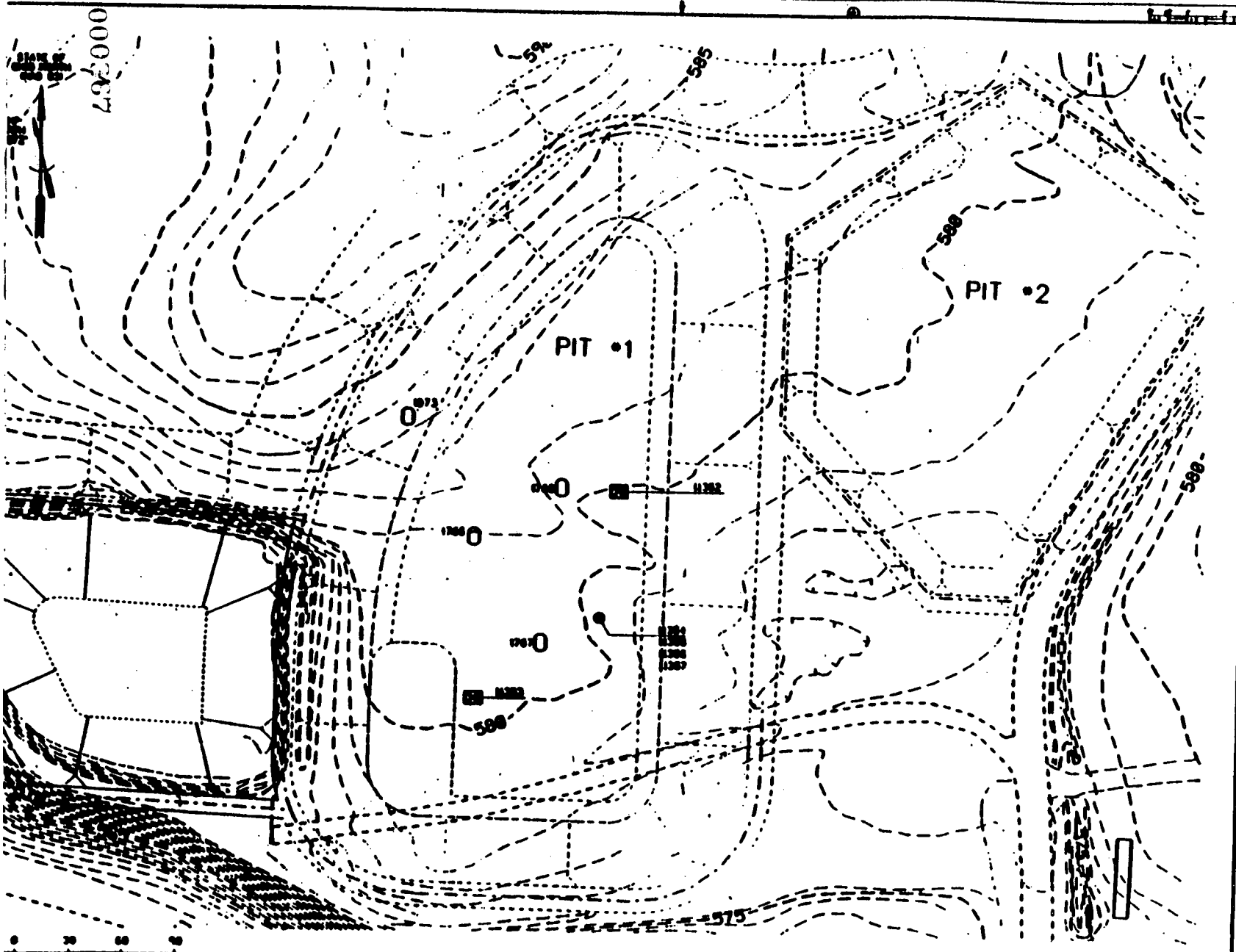


FIGURE 1. FMPC WASTE PITS AND BORING LOCATIONS



LEGEND

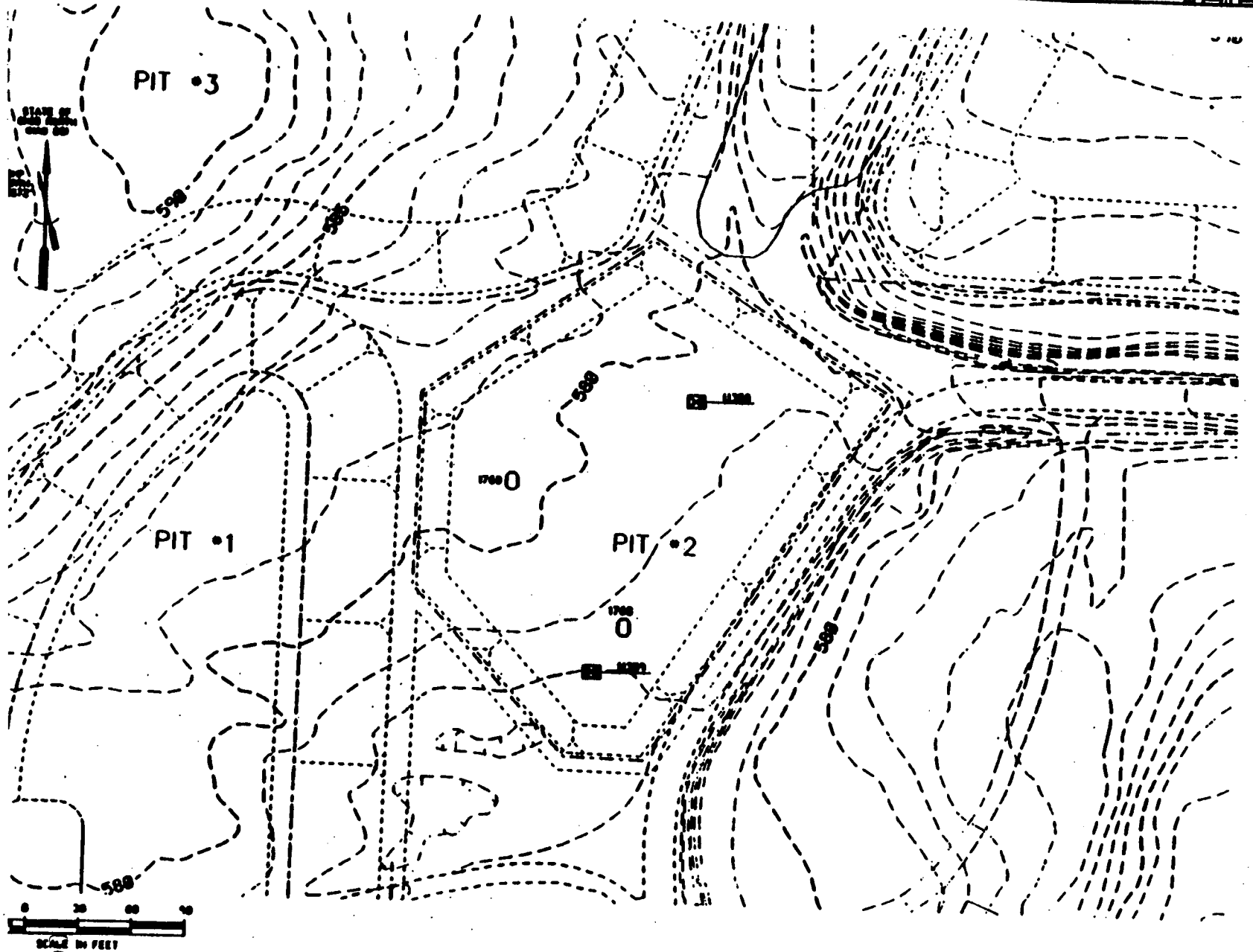
BORING LOCATION

BORING NO	NORTH	EAST
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

U.S. DEPARTMENT OF ENERGY

WASTE [illegible]
BORING LO[illegible]



LEGEND

BORING LOCATION

BORING NO	NORTH	EAST
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

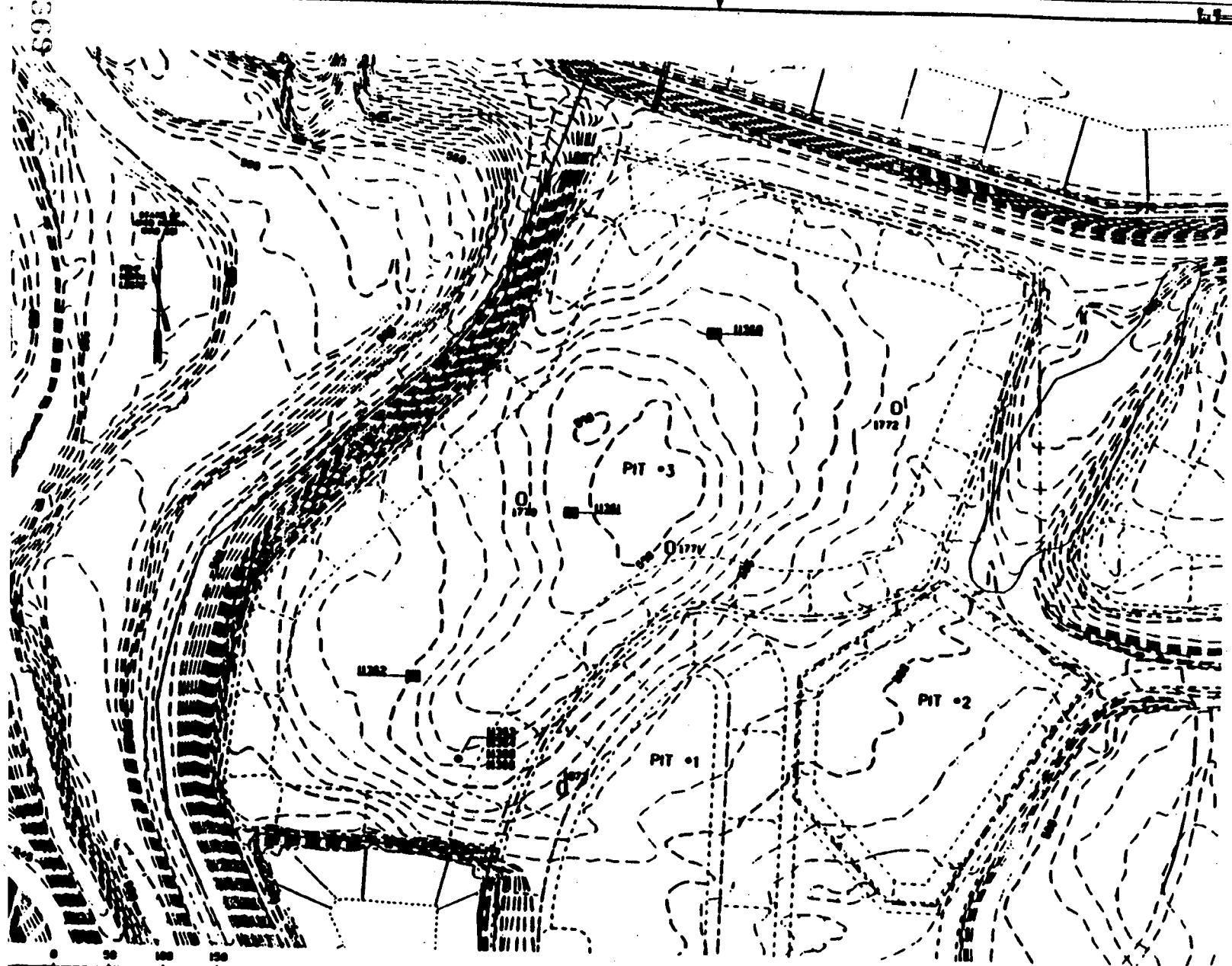
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

U.S. DEPARTMENT OF ENERGY

WASTE PIT 2
BORING LOCATION

FIGURE

I 2



LEGEND

- O LEACHATE WELL FOR BLAS TESTING
- ● SEPTIC, DURING AND AFTER DEMARCATING OFF
- ■ STANDARD PENETRATION TEST

BORING LOCATION

BORING NO	NORTH	EAST
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

NOTE: FERNALD G.A.D. DRAWING NOT TO BE REVISED

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

Fernald

Environmental Management Project

U.S. DEPARTMENT OF ENERGY

WASTE PIT 3
BORING LOCATION

FIG.

ATTACHMENT G

OSHA AND DOE EMPLOYEE RIGHTS POSTER

Occupational Safety and Health Protection for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities

Policy:

U.S. Department of Energy (DOE) contractor employees shall be provided with safe and healthful working conditions in accordance with the standards prescribed pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, and the Department of Energy Organization Act of 1977: said standards shall be consistent with those promulgated under the Occupational Safety and Health Act of 1970, Public Law 91-596. Please refer to the Order DOE 5483.1A for details.

DOE Contractors:

DOE has determined that _____
Fernald Environmental Restoration Management Corporation
is subject to DOE Acquisition Regulation (DEAR), Subpart 970.23, and is, therefore, required to comply with applicable DOE-prescribed Occupational Safety and Health Administration (OSHA) standards listed therein. This Order and the standards are available for employee review at _____
Safety & Health Building #53
As delineated by the Order DOE 5483.1A, the DOE contractor is required to:

1. Furnish to employees, employment and a place of employment which are as free from occupational safety and health hazards as possible.

2. Establish and implement programs and procedures to comply with the Order DOE 5483.1A. These shall include programs and procedures to monitor the workplace for known toxic materials and harmful physical agents which are used or produced at the facility, and maintain records of the data. As part of these programs and procedures:

(a) Advise employees or their representatives that they are to be provided with an opportunity to (1) observe monitoring or measuring for toxic materials or harmful physical agents, and (2) have access to the results thereof.

*(b) Provide to each employee, former employee, or designated representative, within 15 days of the receipt of a written request, access to or copies of any monitoring or bioassay records relevant to the employee's potential exposure to toxic materials or harmful physical agents during employment.

(c) Notify employees promptly of any information indicating that an exposure to toxic materials or harmful physical agents may have exceeded the limits specified by the DOE-prescribed OSHA standards.

*(d) Provide to each employee, former employee, or designated representative, within 15 days of the receipt of a written request, access to or copies of the employee's cumulative recorded occupational radiation dose during employment.

(e) Notify employees promptly of any information indicating that a radiation dose may have exceeded the limits specified by the DOE-prescribed OSHA standards.

*For purposes of access to an employee's monitoring, bioassay, or radiation exposure records, if the representative is not the recognized/certified collective bargaining agent, then he or she must have the employee's written authorization for such access.

Employees:

All employees are required to:

1. Observe the DOE-prescribed OSHA standards applicable to their work.

2. Report promptly to the contractor any condition which may lead to a violation of these standards.

3. Respond to warning signals which may be activated in the event of fire, radiation, or other possible emergencies.

4. Report emergencies using established procedures.

Inspections:

All activities under this contract are subject to inspection by DOE. When an inspection under the Order DOE 5483.1A is conducted, a contractor management representative and a representative authorized by the employees will be given an opportunity to accompany the DOE inspector.

Where there is no representative authorized by the employees, the DOE inspector will consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaints:

Employees may file a complaint with the contractor management or with the local DOE office using the form DOE F 5480.4 to request an inspection of the workplace. Complaints also may be filed by letter, telegram, or oral means. DOE F 5480.4 is available from
FDP Safety Department
_____

When an employee requests anonymity from the contractor, DOE shall honor this request.

Imminent Danger

For any condition or practice which presents an immediate hazard that could reasonably be expected to cause death or serious physical harm (permanent or prolonged impairment of the body or temporary disablement requiring hospitalization), the contractor and/or DOE shall take immediate and effective remedial actions to remove employees from the hazard and/or eliminate the hazard. As soon as possible, an inspection shall be conducted by the contractor and/or DOE to assure that appropriate actions have been taken to preclude recurrence of the hazard.

Nondiscrimination:

No contractor shall discharge or in any manner discriminate against any employee by virtue of the filing of a complaint, or in any other fashion exercising on behalf of himself or herself or others any action set forth in the Order DOE 5483.1A.

Inquiries:

Inquiries should be addressed to the contractor; however, additional inquiries may be addressed to the following local DOE official.

- J. Phil Hamric, Manager
  Department of Energy
- Fernald Field Office
  P. O. Box 398705
- Cincinnati, OH 45239-8705

Posting Requirements:

Copies of this notice must be posted in a sufficient number of places in Government-owned plants and facilities operated by DOE contractors subject to DOE Acquisition Regulation (DEAR), Subpart 970.23, to permit employees working in or frequenting any portion of the plant to observe a copy on the way to or from their workplace.

U.S. Department of Energy

EN F 5480.1(8-80)

ATTACHMENT H

ACKNOWLEDGEMENT FORM

ACKNOWLEDGEMENT STATEMENT

This Project Specific Health and Safety Plan was developed for the use of FERMCO employees and subcontractors. Its use is intended for Environmental Media Sampling Program activities.

Project: Dewatering Excavation Evaluation Project Geotechnical Investigation

The undersigned persons have read, received training to, and understood the preceding Project Specific Health and Safety Plan and agree to abide by all provisions (See Note 1):

NAME (printed)	SIGNATURE	DATE
FIELD LEAD		
SC HEALTH AND SAFETY MANAGER		

ACKNOWLEDGEMENT STATEMENT (Cont.)

NAME (printed)	SIGNATURE	DATE

Note 1: Compliance with the provisions of this Project Specific Health and Safety Plan may be audited through announced or unannounced site visits. Be sure that you are implementing the provisions of the safety plan and documenting the reasons for field actions/changes when they are necessary. Site visits may be performed:

X By FERMCO

X By DOE

X By OSHA

APPENDIX G

PROCEDURES

FERMCO	SITE CHARACTERIZATION AND DATA MANAGEMENT (SCDM) DEPARTMENT PROCEDURES	PROC. NO: SCDM FO-001
		EFFECTIVE DATE: 5/20/94
		REV. NO: 0
		PAGE 1 OF 53

PROCEDURE APPROVAL

PROCEDURE TITLE: PROCEDURE FOR AUGER DRILLED BORINGS AND SOLIDS SAMPLING WITH A SPLIT-BARREL OR THIN-WALLED TUBE

PROCEDURE NUMBER: SCDM FO-001

CONTROLLED

PREPARED BY: Dan Stropes — SUBJECT EXPERT(S)/TECHNICAL WRITER(S) — 5/20/94 DATE

APPROVAL: DEPARTMENT MANAGER — 5/20/94 DATE

APPROVAL: DIVISION MANAGER — 5/20/94 DATE

G:\WPSC\94-071

G:\WPSC\94-168

REVISION SUMMARY

Revision	Date	Description of Revision
Draft	4/20/94	New procedure for Auger Drilled Borings and Solids Sampling with a Split-Barrel or Thin-Walled Tube
0	5/20/94	Changed from a Division procedure to Department procedure

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1.0 PURPOSE

This procedure establishes methods for the drilling of borings and the recovery and sampling of solid soil, subsoil, and waste materials utilizing the hollow-stem auger drilling technique by employee and subcontractor personnel of the Fernald Environmental Restoration Management Corporation (FERMCO), Environmental Division, Site Characterization and Data Management (SCDM) Department, at the Fernald Environmental Management Project (FEMP). It provides accurate specifications to confirm that all aspects of the auger drilled borings, solid soil/waste material recovery and sampling are satisfactory, documented, and verifiable.

2.0 SCOPE

This procedure provides guidance to all FERMCO SCDM employees and subcontractor personnel during the performance of Comprehensive Environmental Response Compensation and Liability Act (CERCLA)/ Resource Conservation and Recovery Act (RCRA) site characterization field work. Such site characterization field work consists of utilizing the hollow-stem auger drilling technique for borings, recovery, and sampling of solid soil/waste material from within glacial overburden sediments and waste collection areas contained within glacial overburden sediments at and in the vicinity of the FEMP.

3.0 DEFINITIONS

Auger Drilling Technique - Drilling method characterized by the use of a drill rig, and a series of hollow stem auger flights, which allow the penetration of geologic/waste materials for the investigation of the nature of the subsurface, the presence of perched water, and of unconsolidated strata.

Data Quality Objectives - Qualitative and quantitative statements which specify the quality of the data required to support decisions during remedial response activities.

Drilling Personnel - FERMCO subcontractor personnel who are employed by an FEMP drilling services subcontractor and who are directly assigned to the daily operation of a drill rig.

Geologist-In-Charge - A person who is qualified, by a combination of education and experience in the science of geology, to directly manage an FEMP field operations project.

Glacial Overburden - Unconsolidated geologic strata consisting of materials derived from, deposited by, or created from the actions of glacial processes. Such materials consist of soils, subsoils, loess, lacustrine, sand, gravel, and glacial erratic commingled geologic strata. These materials are usually encountered at the land surface and, if present, are located physically and stratigraphically above pre-existing sediments of the Great Miami Aquifer. At the FEMP, glacial overburden sediment corresponds in elevation to the Type 1 soil boring zone.

3.0 DEFINITIONS (CONT.)

N-Value - The blowcount representation of the penetration resistance of the soil. The N-value, reported in blows per foot, equals the sum of the number of blows required to drive the sampler over the depth interval of 6 to 18 inches.

Notice-To-Proceed - Formal notification, in writing, from a designated responsible DOE-FN/FERMCO employee assigned to the auger drilled boring project, allowing and authorizing commencement of a field project.

Project-Specific Plan (PSP) - Scoping documents required for any media sampling program or project. Project-specific plans for FEMP sampling and analysis activities include elements defined in Section 6 of the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ). Project-specific plans may include but are not limited to, work plans, field sampling plans, Health and Safety Plans, and standard operating procedures.

Sampler Head - Device which serves to couple a thin-walled tube to insertion equipment and, together with the thin-walled tube, comprises the thin-walled tube sampler.

Sampling Technicians - A person who is qualified, by a combination of education and experience in the area of environmental science, to perform daily routine duties of field projects at the FEMP which require the sampling of various environmental media and necessary documentation associated with the sampling.

SCQ - The Sitewide CERCLA Quality Assurance Project Plan which establishes minimum standards of performance for ongoing and future environmental sampling and analysis projects at the FEMP.

Split-Barrel Sampler - A hollow tubular sampling device driven by a 140 pound weight to retrieve representative samples from unconsolidated strata or solid waste materials. An analogous term for split-barrel also often used is split-spoon.

Standard Penetration Test (SPT) - Procedure for driving a split-barrel sampler to obtain a representative soil sample and a measure of the resistance of the soil to penetration of the sampler.

Thin-Walled Tube Sampler - Device used in conjunction with a drilling rig to obtain a representative core sample of unconsolidated strata, or solid waste material. Thin-Walled tubes shall be of a diameter range of 2 to 5 inches, a length of 36 to 54 inches, and a wall thickness range of 0.049 to 0.120 inches. An analogous term for thin-walled also often used is Shelby tube.

Waste Collection Areas - Areas where waste materials (by products) of FEMP production activities have been accumulated/deposited/stored, some in below grade "pits", some in above grade "pits".

4.0 PREREQUISITE ACTIONS

4.1 Background

The FEMP periodically has a need to bore into the soil and subsoil to determine the presence of contaminants, geology, and soil material type(s) within the Type 1, or glacial overburden, soil boring zone at and in the vicinity of the facility. In order to adequately provide auger drill rig Type 1 soil borings which meet quality assurance and quality control criteria, detailed procedures are necessary. A PSP provides information about the need for, number of, and location of auger drilled borings. This standard operating procedure provides the level of detail necessary to ensure that the borings, and concurrent split-barrel, or thin-walled tube environmental media sampling, are performed in a consistent manner which achieves project data quality objectives, as specified in the PSP.

4.2 Planning and Coordination

The following planning and coordination functions are necessary actions prior to performing auger drilled borings and solids sampling with a split-barrel or thin-walled tube at the FEMP. Responsible personnel and organizations who shall expedite planning and coordination functions have been identified. Also, applicable planning and coordination functions have been identified.

4.2.1 Responsibilities of Division Manager

[1] Designate a Department Manager to direct the drilling of auger borings, and sampling, in accordance with the PSP and this procedure.

[2] Authorize the use of this procedure and signify concurrence by signing the appropriate approval block on the procedure.

[3] Delegate to managers the responsibility for the proper drilling of auger borings, and sampling, as specified by the PSP and this procedure.

4.2.2 Responsibilities of Department Manager

[1] Assign the organization and completion of this drilling to the appropriate FEMP Field Project Manager.

[2] Ensure in coordination with the FEMP Field Project Manager, that the auger drilled borings, and sampling, contained in the PSP are safe, realistic, concise, and achievable.

[3] Develop sufficient project justification and resource cost and scheduling information and present to the Change Control Board for approval if considered new scope.

4.0 PREREQUISITE ACTIONS (CONT.)

4.2.3 Responsibilities of FEMP Field Project Manager

[1] Assign a Geologist-in-Charge to directly manage the field operation of auger drilled borings and sampling.

[2] Ensure, in coordination with the Department Manager, that the proposed steps for conducting the auger drilled borings, and sampling contained in the PSP are safe, realistic, concise, and achievable.

[3] Perform periodic on-site field inspections to ascertain that the auger drilled borings and sampling are being performed in accordance with the requirements of this procedure.

[4] Ensure that the subcontractor(s) have necessary resources, personnel, materials, and training necessary for the satisfactory completion of the project.

[5] Conduct a Readiness Review to verify that all personnel involved in any auger drilled borings and solids sampling demonstrate the training, experience and knowledge of health and safety issues, applicable procedures, and task-specific duties necessary to successfully accomplish their respective project task.

4.2.4 Responsibilities of Geologist-in-Charge

[1] Acquire a proficient working knowledge of the auger drilled boring and sampling requirements of the PSP and this procedure.

[2] Directly manage the active field operations associated with auger drilled borings and sampling.

[3] Perform detailed assessments of auger drilled borings and sampling to ensure compliance with the requirements of this procedure.

[4] Document on the appropriate boring forms the drilling history and construction details.

[5] Determine, in consultation with site Quality Assurance staff, the FEMP Field Project Manager, and drilling personnel, the need for modification or changing some aspect of the auger boring project.

[6] Ensure that all project performance requirement documents such as PSP, Health and Safety Plan, procedures, and permits are valid and current.

4.0 PREREQUISITE ACTIONS (CONT.)

4.2.5 Responsibilities of Sampling Technicians

[1] Familiarize themselves with the PSP thin-walled tube and split-barrel sampling requirements.

[2] Ensure that all equipment, materials, and documentation requirements of the PSP sampling events are available, decontaminated, and in serviceable condition.

[3] Follow the PSP sampling requirements, as directed by the Geologist-in-Charge, and the PSP.

[4] Perform all assigned duties in accordance with project and FEMP requirements.

4.2.6 Responsibilities of Drilling Personnel

[1] Adhere to the auger drilled boring and sampling requirements of this procedure and the PSP.

[2] Perform the field work necessary to accomplish the drilling and sampling of the borings, as directed by the Geologist-in-Charge.

[3] Possess, through a combination of experience and training, the skills necessary to adequately perform the field work associated with auger drilled borings.

[4] Notify the Geologist-in-Charge immediately if, in the drilling personnel's opinion, any aspect of the auger drilled boring and sampling field work is unsafe, suspect, or in error.

4.3 Performance Documents

This subsection describes the applicable documents which are required before commencement of the auger drilled boring field activities.

4.3.1 Project-Specific Plan

The PSP describes project data quality objectives. The successful adherence to and completion of the project data quality objectives ensures that the project field activities will achieve all objectives specified in the approved PSP. The FEMP Field Project Manager shall:

[1] Obtain an approved PSP which describes the auger drilled boring field activities to be performed.

[2] Ensure that the PSP is the current revision.

4.0 PREREQUISITE ACTIONS (CONT.)

[3] Contact the appropriate FEMP CRU, Division or Department PSP authors about any issues/problems/contingencies discovered during the preparation for field activities.

[4] Determine that any PSP discrepancies have been satisfactorily resolved prior to the performance of any potentially affected activity.

[5] Ensure that all necessary subcontractor, equipment, and material procurements have been performed.

4.3.2 Required PSP Information

In order to correctly install borings and perform split-barrel or thin-walled tube sampling, the FEMP Field Project Manager shall also ensure that the PSP contains the following information.

- Anticipated depth of each boring.
- Anticipated depth of each interval (depth) to be sampled, if more than one sample from the same boring is necessary.
- Specific geological information regarding the nature and types of strata to be encountered.
- Volume of sample required for laboratory analysis purposes.
- Type of sample (split-barrel, thin-walled tube) required.
- Location(s) identified by the State Planar Coordinates System.

In the absence of the above specified information, the PSP author shall perform an analysis of available information from nearby or similar locations and convey this information to the FEMP Field Project Manager.

4.3.3 Standard Operating Procedures

Standard Operating Procedures (SOPs) exist, in part, to provide standard, approved methodology for performing field work required by a PSP. However, a PSP usually contains some field activities which are not described in SOPs. In order to ensure that the PSP field activities do not result in a nonconformance with other existing SOPs, the FEMP Field Project Manager shall:

4.0 PREREQUISITE ACTIONS (CONT.)

[1] Identify from the PSP and other Environmental Division and FEMP sources, all Department, Division or site SOPs applicable to the performance of the auger drilled boring activities.

[2] Notify the appropriate FEMP CRU, Division or Department PSP authors about any existing approved SOP which, if the auger drilled boring activities proposed in the PSP are followed, may result in a nonconformance with the existing SOP.

4.3.4 Health And Safety Plan

Prior to the performance of any auger drilled boring field activities, a Project/Task-specific Health and Safety Plan is necessary. The FEMP Field Project Manager shall:

[1] Obtain a Project/Task-specific Health and Safety Plan, in accordance with the requirements of SCDM procedure **SCDM HS-001, "SOP for Acquisition of a Project/Task-specific Health and Safety Plan."**

[2] Ensure all field personnel assigned to the project have received training specific to the Health and Safety Plan.

[3] Document, in writing, that all assigned field personnel have participated in training unique to the Project/Task-specific Health and Safety Plan.

[4] Ensure that the Project/Task-specific Health and Safety Plan is immediately available for review by field staff/site visitors at the project location.

[5] Interface with the project health and safety technician about any project health and safety issue which is identified.

4.0 PREREQUISITE ACTIONS (CONT.)

WARNING:

NO AUGER DRILLED BORING FIELD PROJECT SHALL BEGIN WITHOUT A PROJECT/TASK-SPECIFIC HEALTH AND SAFETY PLAN WHICH HAS BEEN APPROVED BY THE RESPONSIBLE FERMCO ENVIRONMENTAL SAFETY AND HEALTH PERSON.

WARNING:

NO AUGER DRILLED BORING FIELD PROJECT SHALL BEGIN WITHOUT A TRAINING SESSION SPECIFIC TO THE PROJECT/TASK-SPECIFIC HEALTH AND SAFETY PLAN. THE TRAINING SESSION SHALL INCLUDE ALL PERSONNEL WHO MAY BE INVOLVED WITH THE AUGER DRILLED BORING PROJECT.

4.3.5 Training

Prior to commencement of any monitoring well installation field activities the FEMP Field Project Manager shall:

[1] Verify that all field personnel meet all site-specific training requirements and remain current throughout the duration of the project.

4.0 PREREQUISITE ACTIONS (CONT.)

[2] Verify through a Readiness Review, that all personnel involved in any auger drilled boring field project demonstrate project-specific training, knowledge, and experience necessary to successfully accomplish their respective project tasks.

WARNING:

NO AUGER DRILLED BORING FIELD ACTIVITIES SHALL BEGIN WITHOUT A TRAINING SESSION SPECIFIC TO THE PROJECT-SPECIFIC PLAN. THE TRAINING SESSION MUST INCLUDE ALL PERSONNEL WHO MAY BE INVOLVED WITH THE AUGER DRILLED BORING PROJECT.

4.4 Required Approvals And Notifications

Prior to the performance of any auger drilled boring field activities, a determination of all necessary approvals/permits/notifications shall be made and applicable approvals/permits/notifications shall be expedited.

4.4.1 DOE-FN Requirements

No field work, including mobilization procurement activities preparatory to the auger drilled boring field work, shall begin until receipt of PSP approval from DOE-FN and written Notice-to-Proceed has been obtained.

4.4.2 Regulatory Agency Requirements

As directed by DOE-FN, the PSP author, FEMP CRU, Division, or Department requesting the field work may be required to obtain prior approval for the project from state, or federal regulatory agency.

4.4.3 On-Site Requirements

Prior to the implementation of auger drilled boring field activities at the FEMP, the Department Manager shall:

[1] Arrange, through the appropriate FERMCO procurement departments, any necessary project subcontractor support.

4.0 PREREQUISITE ACTIONS (CONT.)

[2] Ensure that the necessary procurement subcontractor support duration, or period of performance, is sufficient for the expected time required to perform the auger drilled boring field activities.

Prior to implementation of auger drilled boring field activities, the FEMP Project manager shall:

[1] Obtain the following FEMP Permits (Attachments A through H), if necessary, for the PSP field activities:

- FERMCO Work Permit (FS-F-2939)
- FERMCO Asbestos Work Permit (FS-F-2940)
- FERMCO Confined Space Evaluation/Permit and Chemical Hazardous Materials Work Permit (FS-F-2745)
- FEMP Construction Excavation/Penetration Permit (FS-F-2711)
- FEMP Facility Outage Permit (FS-F-2757)
- FERMCO Open Flame and Welding Hazardous Work Permit (FS-F-352)
- FEMP Radiological Work Permit (FS-F-1372).

WARNING:

IF OVERHEAD POWER OR TELEPHONE LINES ARE LOCATED WITHIN 20 FEET OF THE AUGER DRILLED BORING LOCATION, FIELD ACTIVITIES SHALL NOT BEGIN UNTIL THE FEMP FIELD PROJECT MANAGER, IN CONSULTATION WITH THE GEOLOGIST-IN-CHARGE, DRILLING PERSONNEL, AND THE HEALTH AND SAFETY TECHNICIAN, HAS DETERMINED THAT ADEQUATE CLEARANCE EXISTS BETWEEN THE POWER OR TELEPHONE LINES AND THE DRILL RIG TO ENSURE THAT NO ELECTRICAL SHOCK HAZARD EXISTS.

4.0 PREREQUISITE ACTIONS (CONT.)

[2] Make prior arrangements regarding the handling, storage, and disposal of all project related wastes, as addressed in the PSP, before initiation of the auger drilled boring field activities.

NOTE *The FERMCO Waste Characterization Section, Environmental Protection Department, Environmental Safety & Health Division, should be contacted prior to the beginning of auger drilled boring field activities to arrange the handling, storage, and disposal of project related wastes.*

NOTE *The National Environmental Policy Act (NEPA) Compliance Section, Environmental Planning Department, Regulatory and Technical Programs Division, must be contacted to determine the applicability of NEPA to ground disturbing activities associated with auger drilled boring field activities. Contact must be initiated prior to beginning auger drilled boring field activities.*

NOTE *Private landowner access must be arranged through the Real Estate Management Section, Property Management Department, Acquisitions and Finance Division. The Real Estate Office should be contacted as early as possible in the planning process. Proper access must be processed and approved prior to beginning field activities.*

[3] Ensure that all auger drilled boring locations have been properly located, surveyed, and recorded prior to auger drilled boring.

[4] Visit all auger drilled boring sites with a FEMP health and safety technician to determine if any unforeseen health and safety concerns, issues or contingencies may exist which need to be addressed prior to commencement of auger drilled boring activities.

4.4.4 Off-Site Requirements

The performance of off-site auger drilled boring field activities are governed, at a minimum, by the same restrictions as on-site auger drilled boring activities, except that the FEMP permit requirements specified in Subsection 4.4.3, may not be required. In addition, when off-site auger drilled boring field activities are to be performed, the Department Manager shall evaluate the need for the following:

[1] Ensure that appropriate private landowner approval, in writing, has been obtained. Approval shall be obtained from the landowner where auger drilled boring field activities are to be performed, and also from any adjacent landowner whose property may be impacted by access or other activities ancillary to field activities.

NOTE *The Real Estate Office should be contacted as early as possible before any access to licensed pasture land on-site.*

4.0 PREREQUISITE ACTIONS (CONT.)

NOTE *The NEPA Compliance Section, Environmental Planning Department, Regulatory and Technical Programs Division must be contacted to determine the applicability of NEPA to ground disturbing activities associated with auger drilled boring field activities. Contact must be initiated prior to beginning field activities.*

[2] Ensure that private landowner approval will remain current through the duration of the field activities.

[3] Obtain through FERMCO procurement or project subcontractors, all equipment, parts, and other items necessary for the completion of field activities.

The FEMP Field Project Manager shall:

[1] Schedule through the appropriate FERMCO Environmental Safety and Health Division/Department, all required field site health and safety technician and radiological technician support.

[2] Obtain any necessary security personnel, barricades or signs to ensure adequate after hours site security.

[3] Inform the Ohio Utilities Protection Service (1-800-362-2764), Butler Rural Electric Cooperative (513-867-4400), and Southwest Regional Water District (513-863-0828) of all proposed auger drilled boring location(s) a minimum of 48 hours prior to beginning the field activities.

WARNING:

DO NOT BEGIN OFF-SITE AUGER DRILLED BORING FIELD ACTIVITIES UNTIL APPROVALS FROM THE OHIO UTILITIES PROTECTION SERVICE, BUTLER RURAL ELECTRIC COOPERATIVE, AND SOUTHWEST REGIONAL WATER DISTRICT HAVE BEEN OBTAINED.

[4] Ensure that adequate clearance from overhead or nearby obstacles or hazards exists for all equipment to be used during the performance of the auger drilled boring field activities.

4.0 PREREQUISITE ACTIONS (CONT.)

WARNING:

IF OVERHEAD POWER OR TELEPHONE LINES ARE LOCATED WITHIN 20 FEET OF THE AUGER DRILLED BORING LOCATION, FIELD ACTIVITIES SHALL NOT BEGIN UNTIL THE FEMP FIELD PROJECT MANAGER, IN CONSULTATION WITH THE GEOLOGIST-IN-CHARGE, DRILLING PERSONNEL, AND THE HEALTH AND SAFETY TECHNICIAN, HAS DETERMINED THAT ADEQUATE CLEARANCE EXISTS BETWEEN THE POWER OR TELEPHONE LINES AND THE DRILLING RIG TO ENSURE THAT NO ELECTRICAL SHOCK HAZARD EXISTS.

[5] Ensure that all auger drilled boring locations have been properly located, surveyed, and recorded prior to auger drilled borings.

[6] Visit all auger drilled boring sites with a FEMP health and safety technician to determine if any unforeseen health and safety concerns, issues or contingencies may exist which need to be addressed prior to commencement of auger drilled boring activities.

4.5 Drilling Site Preparation

Factors such as drilling site condition, accessibility, vegetation, presence of overhead and buried utilities, surface and subsurface contamination, and topography shall be evaluated by FERMCO staff and the drilling subcontractor during preparation of the work site. If necessary to facilitate auger drilled boring, the FEMP Field Project Manager may need to:

[1] Improve site access by arranging the construction of access roads.

[2] Improve site access by grading or filling areas of topographic highs or lows.

[3] Remove or relocate any structure or feature which could obstruct the field activities.

[4] Identify any buried or overhead utilities which could potentially impact the field activities.

[5] Request moving a borehole location if any unsafe or unsatisfactory condition cannot be eliminated.

NOTE *Vehicles requiring access to the drilling site shall use existing access roads.*

4.0 PREREQUISITE ACTIONS (CONT.)

4.5.1 Drill Site Selection Criteria

Drill site selection criteria shall be determined from the PSP, evaluation of project data quality objectives, and a walk-through inspection of the drilling site prior to the mobilization of the drilling rig to the site.

4.5.2 Drill Site Relocation Criteria

During the performance of project field work, it may be necessary to relocate the drilling site. The site relocation may be identified either prior to mobilization of the drilling rig to the site, or after the drilling rig has been mobilized to the site and drilling or field activities have begun.

Following determination that drill site relocation is necessary, the Geologist-in-Charge shall notify the FEMP Field Project Manager. The FEMP Field Project Manager shall cease all field activities and immediately notify the Department Manager and the responsible FEMP CRU, Division or Department PSP authors who originally requested the field work.

Actual drilling rig demobilization, relocation and remobilization shall be initiated by the FEMP Field Project Manager only upon receipt of a variance from the responsible FEMP CRU, Division or Department PSP author originally requesting the field work.

Direction to relocate a drilling site shall be in the form of a Variance Request and shall be considered a PSP amendment. A Variance Request can be obtained from the Quality Assurance department. The Variance Request initiated by the responsible FEMP CRU, Division or Department PSP author, shall be signed by that responsible person and the designated representative of FERMCO Quality Assurance.

In lieu of receipt of an approved Variance Request, the FEMP Field Project Manager may expedite, through verbal authorization, drilling site relocation in order to efficiently utilize project resources. Written approval must be obtained within five working days of receipt of verbal approval.

4.6 Required Equipment

All equipment and materials used in the installation of auger drilled borings shall be decontaminated in accordance with the PSP and inspected by the FEMP Field Project Manager prior to utilization.

4.6.1 Drilling Equipment

The following drilling equipment may be required to conduct auger drilled boring field activities:

- Truck, platform, or trailer mounted mechanical or hydraulic drill rig
- Hollow stem auger sections

4.0 PREREQUISITE ACTIONS (CONT.)

- Pilot bit
- Auger teeth
- Auger connector
- Center plug
- Center rod
- Drive cap
- Rod to cap adapter
- Split-barrel sampler (type and size specified in the PSP)
- Thin-Walled tube sampler (type and size specified in the PSP)
- Weighted hammer
- Drive weight assembly
- Anvil.

NOTE *NEPA requirements specify that drilling equipment and associated vehicles/equipment be no greater than 10 tons in weight.*

NOTE *Except under emergency conditions, ground disturbing activities shall take place only in dry weather.*

4.6.2 Sampling Equipment

[1] Soil, waste or geologic material encountered within the glacial overburden, during auger drilled boring, shall be continuously sampled and field screened.

[2] Instrumentation used for field screening for radiological activity and the presence of volatile organic constituents shall include:

- Photoionization detector (PID) - exact model and screening methodology to be described in the PSP.

4.0 PREREQUISITE ACTIONS (CONT.)

- Radiation meter - exact model and screening methodology to be described in the PSP.

[3] For soil/waste material sampling, a split-barrel sampler or thin-walled tube sampler shall be used. The PSP shall identify the type of sampler to be used.

4.6.3 Auger Drilled Boring Sample Equipment and Material

The following equipment may be required for auger drilled boring sample collection, depending upon project-specific requirements specified in the PSP:

- Disposable latex gloves
- Herculite plastic
- Non-reactive work surface
- Hammer
- Custody tape
- Sample containers (size and type per PSP)
- Sample labels
- Synthetic ice and ice chest
- Large and small plastic bags
- Lint-free wipes
- Large stainless steel spoon, knife, trowel, and scoop
- Large stainless steel bowl
- Metric scale
- Indelible ink pen
- Geologic characterization tools (Munsell chart, penetrometer, etc.)
- Plastic glove bag with High Efficiency Particulate Air (HEPA) vacuum.

4.0 PREREQUISITE ACTIONS (CONT.)

The following decontamination materials may be necessary to adequately decontaminate sampling equipment:

- Tubs made of nonreactive material
- Cleaning brushes of various sizes
- Sprayers
- Large and small plastic bags
- Duct tape
- Decontamination agents (Deionized water, methanol, HCL, etc.).

4.6.4 Health And Safety Equipment

[1] The level of personal protection is dependant on the location where drilling activities are to be performed and the nature of the materials that may be encountered in the activity, including solid, liquid and vapor components.

[2] The Project/Task-specific Health and Safety Plan identifies all health and safety and industrial hygiene equipment required at each boring location.

[3] Provide, at a minimum, the following health and safety equipment for personnel assigned to the drilling rig:

- Hard hat
- Standard issue work coveralls
- Steel-toed boots
- Safety glasses or goggles
- Gloves
- Portable eye wash station
- Ropes/cones/stanchions for delineating exclusion and controlled access perimeters

4.0 PREREQUISITE ACTIONS (CONT.)

NOTE *Additional safety equipment may be required depending on the location and condition of the drilling site.*

[4] Additional field screening instrumentation, identified in Section 5.4 of this procedure, shall also be used to provide real time monitoring for sample field screening, Action Levels for employee exposure, radiological and organic vapor parameter health and safety purposes.

[5] Ensure that health and safety Action Levels for radiological and organic vapor parameters shall be identified in the Task/Project-specific Health and Safety Plan.

5.0 PROCEDURE

5.1 Mobilization

Attachment K of this procedure, titled "Auger Boring Project Preparation Flowchart," shows the logical and sequential steps necessary prior to the mobilization of personnel, equipment, and materials for auger drilled boring.

WARNING:

INSPECTION BY FERMCO QUALITY ASSURANCE OF THE DRILLING RIG FOR COUNTERFEIT PARTS MUST BE PERFORMED PRIOR TO DRILL RIG UTILIZATION.

Drilling Personnel

[1] Verify, through the Department Manager, that written Notice-to-Proceed for the auger drilled boring field activities has been obtained.

[2] Confirm, through the Department Manager, that Change Control Board approval of the auger drilled boring field activities project baseline and funding has been obtained.

[3] Inspect the drilling rig and all associated components for serviceability.

5.0 PROCEDURE (CONT.)

[4] Inventory all drilling rig components anticipated to be used during the soil boring.

[5] If the drilling rig is being initially brought onto the FEMP, or is being brought back onto the FEMP after removal from the FEMP, deliver the drilling rig to the FERMCO Fire and Safety staff for inspection.

[6] Following inspection, decontaminate the drill rig in accordance with the PSP decontamination criteria.

Attachment L of this procedure, titled "Auger Boring Project Performance Flowchart," shows the logical and sequential steps necessary during the performance of auger drilled boring. Specific sections and subsections of this procedure provide more detailed information relative to performance.

5.2 Drill Site Establishment

Drilling Personnel

[1] Mobilize the drill rig to the drill site location identified in the PSP.

[2] Set up the drill rig in accordance with the drill rig manufacturer's or drilling subcontractor's specifications.

WARNING:

FAILURE TO FOLLOW THE DRILL RIG MANUFACTURER'S OR DRILLING SUBCONTRACTOR'S SPECIFICATIONS WHEN SETTING UP THE DRILL RIG COULD RESULT IN THE CREATION OF AN UNSAFE OR UNSATISFACTORY DRILLING CONDITION.

5.0 PROCEDURE (CONT.)

[3] Establish the site access control zones, in accordance with the Project/Task-specific Health and Safety Plan and the drill rig manufacturer's or drilling subcontractor's specifications.

WARNING:

FAILURE TO PROPERLY ESTABLISH SITE ACCESS CONTROL ZONES COULD RESULT IN UNAUTHORIZED ENTRY INTO THE EXCLUSION ZONE INCREASING POTENTIAL FOR PERSONNEL EXPOSURE OR INJURY.

5.3 Drilling

Drilling operations shall be conducted so a minimum of contaminants are introduced into the environment or spread between target monitoring zones. Surface casing may be set when a potentially contaminated zone is drilled prior to reaching the target monitoring zone. When drilling through areas where near surface contamination is indicated through past use or during screening of samples while drilling, surface casings shall be grouted in place and made a part of the permanent installation. In outlying areas not suspected of being contaminated, large diameter temporary casings may be advanced as necessary for borehole control.

Drilling Personnel

[1] Assemble the hollow-stem auger column, consisting of:

- Pilot or cutter bit
- Auger teeth
- Auger head
- Auger connector
- Hollow-stem auger sections
- Center rod

5.0 PROCEDURE (CONT.)

- Auger connector
- Drive cap
- Rod to cap adapter
- Center plug (not used if sampling).

[2] Connect the assembled auger column to the drill spindle.

> **CAUTION:**
>
> **THE USE OF LUBRICANTS FOR AUGER DRILLING RIG MOVING PARTS WHICH WILL BE LOWERED DOWN THE BOREHOLE OR USED IN CLOSE PROXIMITY TO THE OPEN BOREHOLE IS PROHIBITED. POTABLE WATER IS THE ONLY ALLOWABLE LUBRICANT.**

[3] Initiate rotation of the auger column by engaging the drill rig power source to the drill spindle.

> **CAUTION:**
>
> **FOR SPLIT-BARREL AND THIN-WALLED TUBE SAMPLING, BOTTOM DISCHARGE DRILL BITS SHALL NOT BE USED DURING AUGER BORING.**

[4] Adjust the rate of auger column advancement in accordance with the drill rig manufacturer's or subcontractor's specifications.

[5] Remove accumulated solid material as it is carried to the surface in the vicinity of the auger flights.

5.0 PROCEDURE (CONT.)

[6] Place accumulated solid material into the approved waste container designated for that purpose.

NOTE *Sample and screen the solid material in accordance with PSP requirements during auger drilling.*

NOTE *It may be necessary to grout surface casing to avoid cross contamination, if required by the PSP, or determined by the Geologist-in-Charge.*

[7] Add more auger flights, as the borehole is advanced, in accordance with the drill rig manufacturer's or drilling subcontractor's specifications.

[8] Remove, disassemble, and decontaminate the auger column and components following reaching total depth of the borehole.

Geologist-in-Charge

[1] Record the lithology, depth, and other pertinent characteristics of the borehole during auger boring advancement.

5.4 Sampling, Field Screening

The PSP determines the frequency and interval of subsurface soil/waste material field screening and sampling. Unless otherwise specified in the PSP, split-barrel sampling and field screening shall be performed continuously through the thickness of the glacial overburden. Field screening parameters of concern, Action Levels, and types of instrumentation to be used are also contained in the PSP.

5.4.1 Radiological Activity Determination

Sampling Technician(s)

[1] Calibrate the instrument(s) in accordance with the applicable FEMP procedure, PSP or the instrument manufacturer's specifications.

[2] Perform a 5 minute background count and calculate the time required to obtain the desired minimum detectable activity.

[3] Count the sample for the predetermined count time and record the net counts or count rate on the appropriate form.

[4] If required by the PSP, split the sample lengthwise and screen the sample for the presence of radiological activity.

5.0 PROCEDURE (CONT.)

[5] Select samples for radiological analysis based on results of field screening at frequency specified in the PSP.

[6] Select samples for laboratory analysis that exhibit the highest relative PID readings for a given location and horizon, as specified in the PSP.

5.4.2 Organic Vapor Determination

Sampling Technician(s)

[1] Calibrate the PID in accordance with the applicable FEMP procedure, PSP or the instrument manufacturer's specifications.

[2] Perform a background organic vapor determination, ensuring that no other organic vapor source is present to affect the background readings of the PID.

[3] Recover the split-barrel sampler, open it and screen the sample for the presence of organic vapors, in accordance with the PSP requirements.

[4] If required by the PSP, split the sample lengthwise and screen the sample for the presence of organic vapors.

[5] Record the organic vapor screening results and the background organic vapor results on the appropriate field form.

[6] Select and sample for laboratory analysis that interval which displays the highest relative readings for a given location and horizon, as specified in the PSP.

5.5 Sampling, Split-Barrel

As specified in the PSP, subsurface soil/waste material and glacial overburden sampling may be required. All split-barrel sampling, and associated equipment and handling shall be accomplished in accordance with ASTM-D-1586-84, and PSP requirements. Dimensions of the split-barrel sampler to be used during the performance of auger drilled boring shall be specified in the PSP.

A split-barrel sampler consists of a tube shaped sampler body, of variable length and diameter, which is capable of being split open lengthwise into two separate equal volume components. The top of the split-barrel sampler consists of a top assembly, which is threaded, and can be screw-attached to the sampler body and a drive shoe, which is threaded and can be screw-attached to the base or bottom of the sampler body.

5.0 PROCEDURE (CONT.)

5.5.1 Split-Barrel Attachment

Drilling Personnel

[1] Obtain a clean or decontaminated split-barrel sampler which is equipped with a threaded coupling to fit a standard drill rod.

NOTE *Excessive cuttings must be removed from the borehole prior to split-barrel sampling.*

NOTE *Use a split-barrel sampler with an interior liner installed prior to sampling, if required by the PSP.*

NOTE *Ensure, if a liner is used, that the liner has been properly decontaminated in accordance with the decontamination criteria specified in the PSP.*

[2] Attach the split-barrel sampler to the bottom of the drill (sampling) rod string which extends from the top of the auger or borehole to the bottom of the borehole.

[3] Attach the weighted hammer to the top of the drill rod string.

5.5.2 Sample Collection

Drilling Personnel

[1] Slowly lower the attached split-barrel sampler to the bottom of the boring, ensuring that the base of the split-barrel sampler does not drop onto the soil/waste material to be sampled.

[2] Position the hammer above and attach the anvil to the top of the sampling rods. This may be done before the sampling rods and sampler are lowered into the borehole.

[3] Rest the dead weight of the sampler, rods, anvil, and drive weight on the bottom of the boring and apply a seating blow.

NOTE *If excessive cuttings are encountered at the bottom of the boring, remove the sampler and sampling rods from the boring and remove the cuttings.*

[4] Mark the drill rods in 3 successive 6 inch increments so that the advance of the sampler under the impact of the hammer can be easily observed for each 6 inch increment.

5.0 PROCEDURE (CONT.)

[5] Push or drive the sampler into the undisturbed subsurface soil material at the bottom of the boring, by alternately raising and lowering the hammer on an attached rope, which passes around a rotating cathead, and allow the hammer to free-fall 30 inches, ± 1 inch, by suddenly releasing the tension of the rope.

NOTE *The cathead shall be essentially free of rust, oil or grease and have a diameter in the range of 6 to 10 inches.*

NOTE *The cathead should be operated at a minimum speed of rotation of 100 revolutions per minute, or the approximate speed of rotation shall be reported on the boring log.*

NOTE *No more than 2¼ rope turns on the cathead may be used during the performance of the penetration test.*

NOTE *For a hammer blow, a 30 inch lift and drop shall be employed by drilling personnel. The operation of pulling and throwing the rope shall be performed rhythmically without holding the rope at the top of the stroke.*

NOTE *If the auger drill rig is not equipped with a cathead lift assembly, a trip, automatic or semi-automatic hammer drop system which lifts the hammer and allows it to drop 30 inches, ± 1 inch may be used.*

[6] Count the number of blows applied in each 6 inch increment until one of the following occurs:

[a] A total of 50 blows have been applied during any one of the 3 to 6 inch increments described in Step 4 of this Subsection.

[b] A total of 100 blows have been applied.

[c] There is no observed advance of the sampler during the application of 10 successive blows of the hammer.

[d] The sampler is advanced the complete 18 inches without the limiting blow counts occurring as described in the previous three bullets of this subsection.

NOTE *If the material to be sampled contains significant amounts of liquid, the split-barrel sampler may not be able to recover a complete sample.*

5.0 PROCEDURE (CONT.)

NOTE *If the material to be sampled contains significant amounts of detritus, boulders, cobbles or slabs of consolidated rock, the split-barrel sampler may not be able to recover a complete sample.*

CAUTION:

PERIODICALLY THE ATTACHED ROPE SHALL BE INSPECTED TO ENSURE THAT IT IS IN SERVICEABLE CONDITION.

[7] While driving the sampler, the Geologist-in-Charge shall record the number of blows required to advance the sampler the distance of each 6 inch increment.

NOTE *The first 6 inch increment is considered to be a seating drive. The sum of the number of blows required for the second and third 6 inches of penetration is termed the "standard penetration resistance" or the "N-value."*

NOTE *If the split-barrel sampler is driven less that 18 inches, the number of blows per each complete 6 inch increment and per each partial increment shall be recorded on the boring log. For partial increments, the depth of penetration shall be reported to the nearest 1 inch, in addition to the number of blows.*

NOTE *If the sampler advances below the bottom of the boring under the static weight of the drill rods or the weight of the drill rods plus the static weight of the hammer, this information should be noted on the boring log.*

5.0 PROCEDURE (CONT.)

5.5.3 Sample Recovery

Drilling Personnel

[1] Raise the sampler out of the boring by reversing direction of the rope on the cathead and alternate applying and releasing pressure.

[2] Remove the sampler from the bottom of the drill rod string.

[3] Detach the top assembly and drive shoe from the split-barrel sampler.

Sampling Technician(s)

[1] Open the sampling body by removing one half of the split-barrel.

[2] Perform radiological and organic vapor screening in accordance with the PSP and Subsections 5.4.1 and 5.4.2 of this procedure.

[3] Remove and containerize the interval of sampled subsurface soil/waste material, in accordance with the PSP requirements for sampling.

NOTE *If the sampling results in a partial recovery, the depth of sample collection will be the upper portion of the interval through which the sampling device was driven.*

5.6 Sampling, Thin-Walled Tube

As specified in the PSP, subsurface soil/waste material and glacial overburden sampling using a thin-walled tube may be required, particularly when geotechnical laboratory analysis is required. All thin-walled tube sampling, and associated equipment and handling shall be accomplished in accordance with ASTM-D-1587-83, and PSP requirements.

A thin-walled tube is a one piece hollow tube of variable diameter and length. Thin-walled tube sampling is typically performed if it is necessary to obtain an undisturbed representative sample of the soil material or undisturbed strata, prior to auger drilling being performed through the sampling interval.

5.6.1 Thin-Walled Tube Attachment

For thin-walled tube sampling, the drilled open borehole diameter and the inside diameter of driven casing or hollow stem auger shall not exceed 3½ times the outside diameter of the thin-walled tube.

5.0 PROCEDURE (CONT.)

Drilling Personnel

[1] Obtain a clean or decontaminated tube sampler, and couple the tube to the drill rod with a sampler head.

CAUTION:

IT IS RECOMMENDED THAT TUBES HAVE A PROTECTIVE COATING, OR THE TUBES BE COMPOSED OF AN ALLOY WHICH WILL PROTECT THE TUBE WALL FROM THE EFFECTS OF CORROSION. PROTECTIVE COATING OR ALLOY TYPE IS DEPENDANT ON THE NATURE OF THE MATERIAL TO BE SAMPLED. PROTECTIVE COATING OR ALLOY TYPE SHALL BE SPECIFIED IN THE PSP.

CAUTION:

IF THIN-WALLED TUBE COATING IS USED, CARE SHOULD BE TAKEN TO AVOID THE POSSIBILITY OF CROSS CONTAMINATION OF SOLID MATERIALS LABORATORY ANALYSIS.

5.0 PROCEDURE (CONT.)

CAUTION:

THE SAMPLER HEAD SHALL CONTAIN A SUITABLE CHECK VALVE AND A VENTING AREA TO THE OUTSIDE EQUAL TO OR GREATER THAN THE AREA THROUGH THE CHECK VALVE. ATTACHMENT OF THE SAMPLER HEAD TO THE TUBE SHALL BE CONCENTRIC AND COAXIAL TO ASSURE UNIFORM APPLICATION OF FORCE TO THE TUBE BY THE SAMPLER INSERTION EQUIPMENT.

[2] Ensure proper attachment of the tube and sampler head to the drill rod.

5.6.2 Sample Collection

Drilling Personnel

[1] Lower the attached tube sampler to the bottom of the boring so that the tube base rests on the bottom of the borehole.

[2] Push or press the tube sampler, without impact or rotation, into the undisturbed soil/waste material, or unconsolidated strata, at the bottom of the boring by applying a continuous and rapid motion (usually accomplished by the application of hydraulic pressure) to a depth which is specified in either the PSP or by the Geologist-in-Charge.

NOTE *If the material to be sampled contains significant amounts of liquid, the tube sampler may not be able to recover a complete sample.*

NOTE *If the material to be sampled contains significant amounts of detritus, boulders, cobbles or slabs of consolidated rock, the thin-walled tube sampler may not be able to recover a complete sample.*

NOTE *Care should be taken to ensure that no void spaces exist within the tube after the sample has been collected.*

[3] Determine the length of advance by the resistance and condition of the formation.

NOTE *Length of advance shall never exceed 5 to 10 diameters of the tube in sands and 10 to 15 diameters of the tube in clays.*

5.0 PROCEDURE (CONT.)

NOTE *If the formation is too hard for push type insertion, the tuber may be driven, or ASTM D 3550 may be used. Other methods, as directed by the Geologist-in-Charge, or FEMP Field Project Manager may be used.*

NOTE *If driving methods are used, the data regarding weight and fall of the hammer and penetration achieved must be documented. Driven tubes shall be prominently labeled "Driven Sample."*

5.6.3 Sample Recovery

Sampling Technician(s)

[1] Raise the tube sampler out of the boring.

NOTE *The tube may be rotated to shear the base of the sample after pressing is complete.*

CAUTION:

THE TUBE SHALL BE REMOVED AS CAREFULLY AS POSSIBLE FROM THE BOREHOLE IN ORDER TO MINIMIZE DISTURBANCE OF THE SAMPLE.

[2] Remove the tube sampler and sampler head from the drill rod.

[3] Measure and record the length of the sample in the tube.

[4] Remove the disturbed soil/waste material or undisturbed strata, which may have accumulated in the top of the tube sampler.

[5] Measure and record the length of the sample in the tube.

[6] Seal the top of the tube, as specified in the PSP, or by following Steps 10 and 11 of this Subsection.

[7] Remove at least 1 inch of soil/waste material, or unconsolidated strata, from the base of the tube sampler.

5.0 PROCEDURE (CONT.)

NOTE *As specified in the PSP, the sample of soil/waste material or unconsolidated strata, may be used for a soil/waste description.*

NOTE *As specified in the PSP, or by the Geologist-in-Charge, after measurement, the tube may be sealed without removal of the soil/waste from the ends of the tube.*

[8] Measure and record the length of the sample in the tube.

[9] Seal the base of the tube, as specified in the PSP, or by following Steps 10 and 11 of this Subsection.

[10] Place an impervious disk into both the top and base of the thin-walled tube sample.

[11] Cap the tube ends and tape and seal the cap with wax.

[12] Containerize the tube sampler for shipment to the analytical laboratory in accordance with PSP requirements.

NOTE *To ensure that thin-walled tube contents remain undisturbed, it is important to store and transport the device in an upright position (i.e., in the same orientation in which it was removed from the borehole).*

5.7 Total Depth Determination

All soil/waste material, or unconsolidated strata, sampling shall cease when the Geologist-in-Charge has determined that all applicable PSP data quality objectives at the auger drilled boring location have been met.

CAUTION:

NO AUGER DRILLED FIELD INSTALLATION SHALL BE ADVANCED THROUGH THE GLACIAL OVERBURDEN AND INTO THE GREAT MIAMI AQUIFER. FAILURE TO MAINTAIN AUGER DRILLED BORINGS WITHIN THE GLACIAL OVERBURDEN COULD RESULT IN CROSS CONTAMINATION FROM GLACIAL OVERBURDEN SEDIMENTS, OR WASTE MATERIALS, INTO THE UNDERLYING GREAT MIAMI AQUIFER.

5.0 PROCEDURE (CONT.)

5.8 Monitoring Well Installation

As specified by the PSP or Geologist-in-Charge, an auger drilled boring may be converted into a Type 1 monitoring well. This shall be accomplished in accordance with SCDM procedure **SCDM FO 002, "SOP for Type 1 Monitoring Well Installations."**

5.9 Soil Boring Plugging and Abandonment

Soil boring plugging and abandonment field activities shall be performed in accordance with SCDM procedure **SCDM FO-006, "SOP for Subsurface Opening Plugging and Abandonment."**

5.10 Demobilization

Attachment M of this procedure, titled "Auger Boring Project Completion Flowchart," shows the logical and sequential steps necessary to the demobilization of personnel, equipment and materials for auger drilled borings.

[1] Drill rig demobilization at the FEMP shall be performed under the following circumstances:

- The drill rig is moving to a new auger drilled boring location
- The drill rig is being moved off-site and will no longer be used at the FEMP.

The following demobilization actions will be taken only after the FEMP Field Project Manager and the Geologist-in-Charge have verified that all PSP data quality objectives for the borehole have been successfully completed.

Drilling Personnel

[1] Break down the drill rig in accordance with the drill rig manufacturer's or drilling subcontractor's specifications.

[2] Decontaminate the drill rig in accordance with the PSP decontamination criteria established.

[3] Transport the drill rig to the designated location in order for FERMCO Health and Safety staff to perform an inspection of the drill rig to ensure that it has been adequately decontaminated.

[4] Relocate the drill rig to the next auger drilled boring location, or;

[5] Remove the drill rig from the FEMP if the drill rig will no longer to be used at the FEMP.

6.0 RECORDS

[1] Original hard copy and electronic disc copy of this procedure transmitted to and maintained by Department Procedure Controller.

7.0 REFERENCES

7.1 Drivers

- U.S. Department of Energy (DOE), DOE Order 5480.19, "Conduct of Operations Requirements for DOE Facilities."
- FEMP Site Procedure No. 3.4.7, Revision No. 0, "Private Property Access Permits for Construction and NEPA Compliance Reviews," FERMCO Construction Division.
- FEMP Quality Assurance Program Description, RM-0012, Revision 2, April 30, 1993.
- FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ) (FD-1000), Revision 0.1, April 1993.

7.2 References

- American Society for Testing and Materials (ASTM) Designation: D 1586-84, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils," October 1992.
- American Society for Testing and Materials (ASTM) Designation: D 1587-83, "Standard Practice for Thin-Walled Tube Sampling of Soils," October 1983.
- U.S. Department of Energy, DOE Standard DOE-STD-1029-92, "Writer's Guide for Technical Procedures," December 1992.
- U.S. Environmental Protection Agency, EPA/600/4-89/034, "Handbook of Suggested Practices for the Design and Installation of Ground Water Monitoring Wells," February 1990.

ATTACHMENT A

FERMCO WORK PERMIT (FS-S-2939)

FERMCO
WORK PERMIT

[illegible]

SECTION A - BACKGROUND INFORMATION (Completed by Supervisor-in-Charge)

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

SECTION B - TYPES OF PERMITS REQUIRED (Completed by Supervisor in Charge)

- ☐ OUTAGE
- ☐ ASBESTOS (posted)
- ☐ CONFINED SPACE (posted)
- ☐ HAZARDOUS WORK (posted)
- ☐ PENETRATION
- ☐ CHEM/HAZ MATERIAL (posted)
- ☐ OPEN FLAME/WELDING (posted)
- ☐ RADIATION (posted)

SECTION C - GENERAL PRECAUTIONS (Completed by Supervisor-in-Charge)

	REF'D.	N/A
PRELIMINARY		
1. Check for Utilities	☐	☐
2. Health & Safety Plan	☐	☐
3. Work Plan	☐	☐
4. Working surface safe for load (especially roof work)	☐	☐
5.	☐	☐
ENERGY CONTROL (Lock & Tag)		
6. Electrical	☐	☐
7. Chemical	☐	☐
8. Mechanical	☐	☐
9. Other (Steam, etc.)	☐	☐
10. Specific Equipment Plan Required	☐	☐
11.	☐	☐
ACCIDENT PREVENTION		
12. Fire Extinguisher	☐	☐
13. Safety Shower Operable & Less Than 100 ft. Away	☐	☐
14. Eye Wash Operable & Less than 100 ft. Away	☐	☐
15. Spill Protection	☐	☐
16. Communications	☐	☐
17. Magnetic Survey for Buried Utilities/Objects	☐	☐
18.	☐	☐
19.	☐	☐
AREA ISOLATION		
20. Area Barricades	☐	☐
21. Signs (PPE)	☐	☐
22. Signs (Warning)	☐	☐
23.	☐	☐
24.	☐	☐
OTHER CONTROLS		
25. Exhaust Ventilation	☐	☐
26. Supplied Air Ventilation	☐	☐
27. GFCI	☐	☐
28. Screen/Shield	☐	☐
29. Non-Sparking Tools	☐	☐
30. Intrinsically Safe Equipment	☐	☐
31.	☐	☐

SECTION C (CONTINUED)

EGRESS/FALL PROTECTION	REF'D.	N/A
32. Ladder	☐	☐
33. Scaffolds/Railings	☐	☐
34. High Lift Platform	☐	☐
35. Safety Belt	☐	☐
36. Safety Harness	☐	☐
37. Safety Line	☐	☐
38. Tread/Retrieval System	☐	☐
39.		
40.		

SECTION D1 - TASK/AREA/LOCATION (& PPE requirements defined on back)

1.
2.
3.
4.

SECTION D2 - PPE REQUIRED (Completed by OS&H)

HEAD PROTECTION ☐ None	___ Hard Hat ___ Goggles	___ Face Shield ___ Welding Goggles	___ Glasses
GLOVES ☐ None	___ Cotton ___ Nitrile ___ Hard Liner	___ Leather Palm ___ Viton ___ Other:	___ Rubber ___ Neoprene
PROTECTIVE CLOTHING ☐ None	___ Level A ___ Level B ___ Level C ___ Level D	___ Poser ___ Tyvek ___ Saranex ___ Other:	___ Acid Splash Suit ___ Fire Retardant ___ Shoe Covers
RESPIRATOR ☐ None	___ Full Face ___ Half Mask ___ PAPR	___ Belt-Mount Half Mask ___ Air Line w/Escape ___ Air Line w/Equal Flow	___ Hooded Air Line ___ SCBA
CARTRIDGE ☐ None	___ HEPA ___ NF Canister ___ Ammonia	___ Organic/HEPA Comb ___ Organic Vapor	___ Acid Gas ___ Mercury
OTHER ☐ None	___ Ear Plugs ___ Ear Muffs	___ Cool Vest	___ Steel-Toe Boots

SUPERVISOR-IN-CHARGE SIGNATURE	[illegible]	DATE
CREW SIGNATURE	[illegible]	DATE

WORK TASK REVIEWER APPROVAL TO PERFORM WORK

FACILITY OWNER'S SIGNATURE	[illegible]	DATE

IN CASE OF EMERGENCY: CALL "CONTROL" BY RADIO, PHONE 6911, OR USE NEAREST FIRE ALARM BOX.

PERMIT TERMINATION (WORK COMPLETED/JOB CONDITIONS HAVE CHANGED)

SUPERVISOR-IN-CHARGE SIGNATURE	DATE

NO.	DISTRIBUTION OF COPIES
1	Post at Job (OS&H Copy)
2	Supervisor in Charge
3	OS&H Field Copy

FS-S-2939 (REV. 4/27/93)

Return Copy 1 to OS&H (MS 011)

G:\WPSC\94-136

Title: PROCEDURE FOR AUGER DRILLED BORINGS AND SOLIDS SAMPLING WITH A SPLIT-BARREL OR THIN-WALLED TUBE	PROCEDURE NO: SCDM FO-001	
	Date: 5/20/94	Revision No: 0
COMPLIANCE WITH THIS PROCEDURE IS MANDATORY WHEN EXECUTING ACTIVITIES WITHIN ITS SCOPE	Page 40 of 53	

ATTACHMENT B

FERMCO ASBESTOS WORK PERMIT (FS-F-2940)

FERMCO ASBESTOS WORK PERMIT

This permit is only valid when it is attached to the FERMCO Work Permit Form which has Section A through D completed.

PLANCO WORK PLANNER NUMBER:

SECTION A - BACKGROUND AND REGULATORY INFORMATION *(To be completed by supervisor-in-charge)*

1. Exact location:
2. Exact description of work to be conducted:
3. Amount of asbestos to be removed (in linear or square feet):
4. Regulatory approval received to begin work: ☐ YES ☐ DNA ☐ Inadequate
   - If yes, regulatory approval for this job starts _____ (Date) and stops _____ (Date).
5. Does job description meet requirements for small-scale, short-duration work? ☐ YES ☐ NO

Section B contains items which shall be complied with on this job as indicated.

SECTION B - PRE-JOB REQUIREMENTS SPECIFIED BY: _____ (TECHNICIAN INITIALS) _____ (DATE) _____ (TIME)

PREPARATION OF WORK SITE *(All Asbestos Jobs)*

	REQ'D	DNA
1. Work area barricaded and/or roped off		
2. Asbestos warning signs placed at work site		
3. Pre-cleaning of work area required		
4. All other items removed from designated work area		
5. Large equipment secured and covered with plastic		
6. Floor and ledges covered with plastic		
7. Area ventilation systems locked and tagged out		
8. Shower established adjacent to work area		
9. Waste water filtered (5 micron filter) **		
10. Perimeter air sampling required during work		
11. Negative building pressure shall be reached of asbestos work to prevent uncontrolled release to work area		
12. Contact IH Technician to inspect work area preparation before asbestos removal begins		

WORK PRACTICES

	REQ'D	DNA
1. Personal air samples required (Samples collected for entire shift when possible)		
2. No smoking, eating or drinking permitted in work area		
3. HEPA-Filtered vacuum required for cleanup		
4. HEPA vacuum required at point of generation		
5. Glove bag removal of pipe insulation required		
6. Transite panels shall be removed whole		
7. Asbestos material shall not be allowed to dries		
8. Transite panels shall be wet down/decontaminated before removal		
9. Amended water shall be used to wet other material		
10. Asbestos material thoroughly wet down before removal		
11. Removed material promptly bagged (not allowed to dry out)		
12. Surfaces shall be cleaned with a solvent to encapsulate any remaining fibers		
13. Work area cleaned after completion of work each day		
14. Tools and equipment shall be cleaned of all residual dust before removal from work area.		
15. Personnel to decontaminate at each departure from work area		
16. Bag contaminated clothing and waste promptly		
17. Bagged waste material shall be placed in containers and labeled as asbestos waste (exterior of containers shall be clean and asbestos-free)		
18. Shower before lunch and at end of shift		

PREPARATION OF WORK SITE *(For Total Enclosure Jobs Only)*

	REQ'D	DNA
1. Floor and wall penetrations covered and sealed		
2. Negative air enclosure set-up around work area		
3. Negative air machine operating continuously		
4. Negative pressure achieved at 0.02 inches or greater		

SECTION C - FINAL INSPECTION REQUIREMENTS

	REQ'D	DNA
1. Visual inspection of work area for residual dust required after completion of job (contact IH Technician)		
2. General area air samples required after completion of job (contact IH Technician)		
3. Obtain IH Technician approval before removal of barriers & warning signs		

SECTION D - SIGNATURES *(Employees assigned to job)*

I have read and understand all requirements of this permit.

EMPLOYEE(S) SIGNATURE(S)	BADGE NO.	DATE	EMPLOYEE(S) SIGNATURE(S)	BADGE NO.	DATE
1.			4.		
2.			5.		
3.			6.		

APPROVAL TO BEGIN WORK			APPROVAL TO REMOVE BARRIERS AND WARNING SIGNS		
IH TECHNICIAN SIGNATURE:	DATE:	TIME:	IH TECHNICIAN SIGNATURE:	DATE:	TIME:

NO.	DISTRIBUTION OF COPIES
1	POST AT JOB
2	SUPERVISOR IN CHARGE
3	INDUSTRIAL HYGIENE/INDUSTRIAL SAFETY
4	EMPLOYEE REPRESENTATIVE

WORK AUTHORIZATION REVIEWED AND FOUND ACCEPTABLE FOR USE		
SUPERVISOR/COMPETENT PERSON* SIGNATURE:	DATE:	TIME:

* *This Asbestos Work Permit expires when removal of barriers and warning signs is approved, preparation of additional work area is needed, employees assigned to the job are changed, or job conditions require changes in permit requirements. In no case shall the permit be valid beyond the date in Section A.4. above.*

** *For a job which requires the removal of asbestos-containing materials, the signature in this box indicates the supervisor has been trained as an asbestos qualified "Competent Person" per OSHA and as an "On-Site Representative" per NESHAP.*

ATTACHMENT C

FERMCO CONFINED SPACE AND CHEMICAL HAZARDOUS MATERIALS WORK PERMIT (FS-F-2745)

FERMCO
CONFINED SPACE AND
CHEMICAL HAZARDOUS MATERIALS WORK PERMIT

SECTION A - BACKGROUND INFORMATION (This permit is only valid when attached to a FERMCO WORK PERMIT)

SECTION B - CONFINED SPACE PERMIT

CONTACT INDUSTRIAL HYGIENE IF THERE IS ANY CHANGE IN WORK ACTIVITY!
CONFINED SPACE ENTRY PERMIT (Valid for NOT MORE THAN 12 HOURS)

ATMOSPHERIC TEST RESULTS

Gas	Initial Concentration	Final Concentration	Peak Concentration	TWA
Oxygen %				
L.E.L. %				
CO				
H_2S				
NO_2				
SO_2				
TOX				

Entry/Exit Points Evaluated ☐ YES ☐ NO
Physical Hazards Evaluated ☐ YES ☐ NO
Monitoring Required ☐ Continuous ☐ Periodic ☐ None
Standby to Worker Communication ☐ Voice ☐ Sight ☐ Radio ☐ Other
Standby to EMT Communication ☐ Radio ☐ Phone ☐ Fire Alarm

PRECAUTIONS	REQ'D.	DONE	N/A
Mechanical Ventilation	☐	☐	☐
Additional Lighting	☐	☐	☐
Explosion-Proof Lights	☐	☐	☐
Safety Line & Harness	☐	☐	☐
Rescuers Equipment	☐	☐	☐
Standby Rescue Procedure	☐	☐	☐

SPECIAL INSTRUCTIONS

PERMIT VOID IF CONDITIONS CHANGE FROM GENERAL ISSUANCE CONDITIONS
CALL IN TO PICK UP EQUIPMENT AND CLOSE PERMIT WHEN FINISHED

SECTION C - CHEMICAL/HAZARDOUS MATERIAL PERMIT

1. TYPE OF HAZARD ☐ Chemical ☐ Biological ☐ Physical
2. PHYSICAL STATE ☐ Solid/Dust ☐ Liquid/Mist ☐ Gas/Vapor
3. TYPE OF OPERATION ☐ Sampling ☐ Clean Up ☐ Repair ☐ Inspection ☐ Other
4. MSDS REVIEWED ☐ Yes ☐ No ☐ N/A ☐ Not Available
5. POTENTIAL HAZARDS ☐ Skin ☐ Inhalation/Ingestion ☐ Eye ☐ Oxygen Deficiency ☐ Explosive (contact FS if "Yes")
6. MONITORING REQUIRED ☐ HZ ☐ GA ☐ Personnel ☐ Clearance ☐ None ☐ Other
7. WORKER-TO-RESCUE COMMUNICATION ☐ Radio ☐ Phone (6511) ☐ Pull Box
8. HYGIENE REQUIREMENTS ☐ Wash Hands at Breaks ☐ Shower at Lunch/End of Shift ☐ Other

SPECIAL INSTRUCTIONS

PERMIT VOID IF CONDITIONS CHANGE FROM SIGNIFICANTLY DURING THE JOB

SECTION D - SIGNATURES (Employees assigned to sub)

I HAVE READ AND UNDERSTAND ALL REQUIREMENTS OF THIS PERMIT.

EMPLOYEES SIGNATURES	BADGE NUMBER	DATE
1.		
2.		
3.		
4.		
5.		
6.		

WORK AUTHORIZATION REVIEWED AND FOUND ACCEPTABLE FOR USE

DISTRIBUTION OF COPIES	
1	Post at Job
2	Supervisor in Charge
3	Industrial Hygiene/Industrial Safety
4	Employee Representative

IN CASE OF EMERGENCY CALL "CONTROL" BY RADIO PHONE 6511, OR USE NEAREST FIRE ALARM BOX.

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ATTACHMENT D

FERMCO CONFINED SPACE EVALUATION/PERMIT AND CHEMICAL HAZARDOUS MATERIALS WORK PERMIT (FS-F-2745)

FERMCO
CONFINED SPACE EVALUATION/PERMIT AND
CHEMICAL HAZARDOUS MATERIALS WORK PERMIT

WORK PERMIT NUMBER

SECTION A - BACKGROUND INFORMATION (This permit is only valid when attached to a FERMCO WORK PERMIT)

TODAY'S DATE | TIME | ESTIMATED COMPLETION DATE

BUILDING/PLANT | LEVEL | COORDINATES | PLANT JOB NUMBER

SECTION B - CONFINED SPACE EVALUATION

HAZARDS OF SPACE
- ☐ HAZARDOUS ATMOSPHERE
- ☐ MECHANICAL/MOVING PARTS
- ☐ SPACE CONFIGURATION/ENTRAPMENT
- ☐ ELECTRICAL
- ☐ ENGULFMENT
- ☐ OTHER: _____

ATMOSPHERIC TEST RESULTS

GAS	ACCEPTABLE ENTRY CONDITIONS	INITIAL CONCENTRATION	PEAK CONCENTRATION	TIME
Oxygen %	19.5 to 23.5			
L.E.L. %	<10%			
CO (ppm)	<25			
H_2S (ppm)	<10			
ALT	<5			

INSTRUMENT ID NUMBER | FIELD CALIBRATION DATE

SPACE HAS BEEN EVALUATED AND
☐ IS ☐ IS NOT A PERMIT-REQUIRED CONFINED SPACE FOR THIS WORK.

IH SIGNATURE | BADGE NO.

Contact Industrial Hygiene if there is any change in work activity.

CONFINED SPACE ENTRY PERMIT

Entry/Exit Points Evaluated ☐ Yes

Monitoring Required ☐ Continuous ☐ Periodic

Standby to Worker Communication ☐ Voice ☐ Sight ☐ Radio ☐ Other: _____

Standby to ERT Communication ☐ Radio ☐ Phone ☐ Fire Alarm

PRECAUTIONS	REQ'D.	ONA
Mechanical Ventilation	☐	☐
Additional Lighting	☐	☐
Explosion-Proof Lights	☐	☐
Safety Line & Harness	☐	☐
Rescue Equipment	☐	☐

SPECIAL INSTRUCTIONS

IH SIGNATURE | BADGE NUMBER

PERMIT ISSUE DATE | TIME | PERMIT EXPIRATION DATE | TIME

Permits void if conditions change from original issuance conditions!
Call IH to pick up equipment and close permit when finished

PERMIT TERMINATION (Work Completed/Job Conditions Have Changed)

IH SIGNATURE | DATE

SECTION C - CHEMICAL/HAZARDOUS MATERIAL PERMIT

NAME OF MATERIAL | HAZARDOUS COMPONENT:

NAME OF MATERIAL | HAZARDOUS COMPONENT:

NAME OF MATERIAL | HAZARDOUS COMPONENT:

1. TYPE OF HAZARD ☐ Chemical ☐ Biological ☐ Physical
2. PHYSICAL STATE ☐ Solid/Dust ☐ Liquid/Mist ☐ Gas/Vapor
3. TYPE OF OPERATION ☐ Sampling ☐ Clean Up ☐ Repair ☐ Inspection ☐ Other _____
4. MSDS REVIEWED ☐ Yes ☐ ONA ☐ Not Available (Hazards Reviewed)
5. POTENTIAL HAZARDS ☐ Skin ☐ Inhalation/Ingestion ☐ Eye ☐ Oxygen Deficiency ☐ Explosive (Consult FS if >4%)
6. MONITORING REQUIRED ☐ BZ ☐ GA ☐ Pyrometer ☐ Clearance ☐ None ☐ Other _____
7. WORKER-TO-RESCUE COMMUNICATION ☐ Radio ☐ Phone (6511) ☐ Pull Box
8. HYGIENE REQUIREMENTS ☐ Wash Hands at Breaks ☐ Shower at Lunch/End of Shift ☐ Other _____

SPECIAL INSTRUCTIONS

IH SIGNATURE | BADGE NUMBER

PERMIT ISSUE DATE | TIME | PERMIT EXPIRATION DATE | TIME

Permits Void If Conditions Change Significantly During The Job

SECTION D - SIGNATURES (Employees assigned to job)

I have read and understand all requirements of this permit.

EMPLOYEE(S) SIGNATURE(S)	BADGE NO.	DATE
1.		
2.		
3.		
4.		
5.		
6.		

WORK AUTHORIZATION REVIEWED AND FOUND ACCEPTABLE FOR USE

SUPERVISOR IN CHARGE | DATE | TIME

DISTRIBUTION OF COPIES
1. Place at Job
2. Supervisor in Charge
3. Industrial Hygiene/Industrial Safety
4. Employee Representative

FS-F-2745 (REV 3/13/93)

IN CASE OF EMERGENCY CALL "CONTROL" BY RADIO PHONE 6511, OR USE NEAREST FIRE ALARM BOX.

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ATTACHMENT E

CONSTRUCTION EXCAVATION/PENETRATION PERMIT (FS-F-2711)

FEMP

CONSTRUCTION EXCAVATION/PENETRATION PERMIT

ISSUED TO:	DATE ISSUED:
FERMCO PERMIT NUMBER:	SUBCONTRACTOR P.O. NUMBER:
FERMCO PROJECT TITLE/NUMBER:	
PLANT: / LOCATION:	
SCOPE OF WORK:	

This permit is issued on the basis of available information and may not be a complete description of all obstructions. Stop work immediately and contact the FERMCO Project Engineer if obstructions other than those defined are encountered.

The following utilities are known to exist in the EXCAVATION/PENETRATION area and a sketch or drawing defining the same utilities is attached for verification to this permit.

Drawings: _____

Special Hazards and/or Precautions: _____

Disposal of Excavated Material: ☐ Yes ☐ No

If NO is checked, excavated dirt may be used for backfill provided it meets engineering specifications for backfill. Construction rubble from EXCAVATION/PENETRATION must be disposed of as described below:

MATERIAL TYPE	DISPOSAL AREA	MATERIAL TYPE	DISPOSAL AREA

NOTE: Contractors shall notify appropriate utilities for work outside the plant boundaries in accordance with Ohio Underground Utility Damage Act. All drilling and cutting tools shall be grounded in accordance with OSHA regulations.

The following approvals are required as determined and checked by the FERMCO Project Engineer.

	CIVIL ENGINEER:		ELECTRICAL ENGINEER:
	UTILITIES ENGINEER:		OTHER:

The following approvals are required on all CONSTRUCTION EXCAVATION/PENETRATION PERMITS:

FERMCO PROJECT ENGINEER:	PHONE NUMBER:
OPERATIONAL SUPERVISOR:	PHONE NUMBER:
WASTE MANAGEMENT OPERATIONS:	PHONE NUMBER:
INDUSTRIAL SAFETY:	PHONE NUMBER:
HEALTH PHYSICS:	PHONE NUMBER:
ENVIRONMENTAL COMPLIANCE:	PHONE NUMBER:

FS-F-2711 (REV. 3/93)

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ATTACHMENT F (CONT.)

FACILITY OUTAGE PERMIT (FS-F-2757)
Page 2 of 2

FEMP
CONS - CE - T/A
FACILITY OUTAGE PERMIT - CONTINUED

Page 2 of 2

7. PERMIT APPROVALS:	PRELIMINARY APPROVAL		FINAL APPROVAL		EXTENSION APPROVAL	
POSITION/ORGANIZATION	SIGNATURE	TIME/DATE	INITIALS	TIME/DATE	INITIALS	TIME/DATE
Facility Owner						
Utility Engineer						
As Required:						
CM/CE						
ESH (Safety)						
EDO						
Others						
QA						
Security						
Maintenance						
Nuclear Safety						
Radiological						
Fire Protection						

8. RESTRICTIONS OR SPECIAL INSTRUCTIONS:

9.	PERMIT APPROVED	BEGIN:	TIME:	DATE:	PIC:
		END:	TIME:	DATE:	
10.	EXTENSION APPROVED	BEGIN:	TIME:	DATE:	PIC:
		END:	TIME:	DATE:	

11.	FACILITY OWNER APPROVAL TO START WORK:	DATE/TIME:

12.	WORK COMPLETED:	TIME:	DATE:	PIC:
	FACILITY OWNER NOTIFIED:	TIME:	DATE:	
13.	PERMIT CLOSED AND APPROVERS NOTIFIED:	TIME:	DATE:	PIC:

FS-F-2757 REV. 10/18/93

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ATTACHMENT F

FACILITY OUTAGE PERMIT (FS-F-2757)
Page 1 of 2

FEMP
CONS · CE · T/A
FACILITY OUTAGE PERMIT

PERMIT NO.:

Page 1 of 2

1. REQUESTED OUTAGE PERIOD:

	TIME:	DATE:
BEGIN:		
END:		

PIC:

ORGANIZATION:

PHONE:

DATE SUBMITTED FOR PREPLANNING:

CONSTRUCTION CONTRACTOR:

OUTAGE TYPE:		PROCESS
	ELECTRICAL	EXCAVATION
	UTILITIES	GAS
	FIRE PROTECTION	PPE
	EVAUCATION ALARM	HVAC
	OTHER:	

2. LOCATION OF OUTAGE/EXCAVATION (BLDG BUILDING, ROOM, PANEL NUMBERS, ETC., AND ATTACH OR REFERENCE DRAWINGS)

3. DETAILED DESCRIPTION OF WORK TO BE DONE:

TELEPHONE SURVEY REQUIRED? ☐ YES ☐ NO

4. DETAILED DESCRIPTION OF EQUIPMENT, SYSTEMS OR ROADS TO BE TAKEN OUT OF SERVICE OR SHUTDOWN:

TAGOUTS REQUIRED? ☐ YES ☐ NO

5. BACKUP OR EMERGENCY SYSTEMS REQUIRED/CHECKS NECESSARY TO ENSURE COMPLETE PLANT RECOVERY:

6.

PIC:	DATE:	PHONE:
CMACE:	DATE:	PHONE:

FS-F-2757 (REV. 10/19/93)

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ATTACHMENT G

FERMCO OPEN FLAME AND WELDING HAZARDOUS WORK PERMIT (FS-F-352)

FERMCO
OPEN FLAME AND WELDING HAZARDOUS WORK PERMIT

WORK PERMIT NUMBER

SECTION A - BACKGROUND INFORMATION *(This permit is only valid when attached to a FERMCO WORK PERMIT)*

TODAY'S DATE	TIME	ESTIMATED COMPLETION DATE

BUILDING-PLANT	LEVEL	COORDINATES	PLANT JOB NUMBER

SECTION B - OPEN FLAME/WELDING PERMIT

PRECAUTIONS*	YES	DNA
1. Combustibles, magnesium, and uranium removed, covered or shielded.	☐	☐
2. Flammable liquids removed or isolated.	☐	☐
3. Wall and floor openings covered or protected.	☐	☐
4. Flame retardant tarp suspended underneath work.	☐	☐
5. Combustible gas check.	☐	☐
6. Combustibles removed from opposite sides. (Work on walls or casings)	☐	☐
7. Fire watch will remain posted during breaks and for 30 minutes after work is completed.	☐	☐
8. Fire watch has an extinguisher and knows how to activate the nearest alarm.	☐	☐
9. Fire & Safety Inspector shall be present during the burning operation.	☐	☐
10. Fire & Safety Inspector shall be present to monitor when the system is initially opened.	☐	☐
11. Combustible Gas Test Results		%LEL
12. Equipment/Area checked.	☐	☐
13. Special Instructions/Precautions	☐	☐
14. MSDS Reviewed.	☐	☐
15. FERMCO WORK PERMIT "C" Items: ___ ___ ___ ___ ___ ___ Checked.	☐	☐
16. Applicable PPE in use.	☐	☐

("Fire Watch has required training") NAME:	BADGE NUMBER:
FP/H SIGNATURE (REQUIRED) ☐ YES ☐ NO:	BADGE NUMBER:
OS&H SIGNATURE:	BADGE NUMBER:
PERMIT ISSUE DATE:	TIME:
PERMIT EXPIRATION DATE:	TIME:

NO.	DISTRIBUTION OF COPIES
1	Post at Job (OS&H Copy)
2	Supervisor In Charge
3	OS&H Field Copy

IN CASE OF EMERGENCY CALL "CONTROL" BY RADIO, PHONE 6511, OR USE NEAREST FIRE ALARM BOX.

FS-F-352 (REV 6/8/93)

SECTION C - HAZARDOUS WORK PERMIT

EXCAVATIONS (Personnel in Hole)	YES	NO	DNA
1. Shored or Sloped to 34 degrees	☐	☐	☐
2. Maximum vertical step 24 inches	☐	☐	☐
3. Ladder(s) in place	☐		☐
4.	☐	☐	☐
5. Atmospheric Tests Required	☐		☐
"COMPETENT PERSON" AUTHORIZING EXCAVATION WORK:			
ELEVATED WORK (greater than 6 feet)			
1. Railings, toeboards	☐	☐	☐
2. Solid footing under scaffold	☐		☐
3. Ladders tied off	☐	☐	☐
4.	☐	☐	☐
CRANE WORK			
1. Pad Date O.K.	☐	☐	☐
2. Electric lines deenergized	☐	☐	☐
3.	☐	☐	☐
1. FERMCO WORK PERMIT "C" Items: ___ ___ ___ ___ ___ ___ Checked.	☐		☐
2. Applicable PPE in use.	☐		☐
3. Special Instructions/Precautions	☐		☐

OS&H SIGNATURE:	BADGE NUMBER:
PERMIT ISSUE DATE:	TIME:
PERMIT EXPIRATION DATE:	TIME:

SECTION D - SIGNATURES *(Employees assigned to job)*

I HAVE READ AND UNDERSTAND ALL REQUIREMENTS OF THIS PERMIT.

EMPLOYEE(S) SIGNATURE(S)	BADGE NUMBER	DATE
1.		
2.		
3.		
4.		
5.		
6.		

WORK AUTHORIZATION REVIEWED AND FOUND ACCEPTABLE FOR USE

SUPERVISOR IN CHARGE	DATE	TIME

RETURN EXPIRED COPY #1 TO OS&H (MS 31)

ATTACHMENT H

FEMP RADIOLOGICAL WORK PERMIT (FS-F-1372)
Page 1 of 2

FEMP
RADIOLOGICAL WORK PERMIT
This permit is only valid when attached to a FERMCO WORK PERMIT.

(1) WORK PERMIT NUMBER:	PAGE 1 OF

PART I - RADIOLOGICAL CONTROL REQUIREMENTS

(2) TODAY'S DATE:	(3) TIME:	(4) ESTIMATED COMPLETION DATE:	
(5) BUILDING/PLANT:	(6) LEVEL:	(7) COORDINATES:	(8) PLANT JOB NUMBER:
(9) SUPERVISOR IN CHARGE:		(10) PHONE EXT./RADIO:	(11) ESTIMATED JOB MAN-HOURS:

(12) STAY TIME:	(13) STAY TIME BASIS (Determined by Radiological Engineering):		
	SKIN	LIMITING DOSE RATE	mrem/hr
	WHOLE BODY	IF AIRBORNE	%DAC
	EXTREMITY	SURVEY I.D. NUMBER	
HOURS/WEEK	AIRBORNE		

NOTICE *Post most recent survey data at the work site.* *NOTICE*

(14) COVERAGE REQUIREMENTS	(15) AIR MONITORING REQUIREMENTS	(16) CONTAMINATION CONTROL
INTERMITTENT COVERAGE	CONTINUOUS AIR MONITOR (Type:)	HEPA VENTILATION: #
CONTINUOUS COVERAGE	BREATHING ZONE AIR SAMPLER (PAS)	HEPA VACUUM: #
NOTIFY RC EACH SHIFT WHEN RWP IS USED	GENERAL AREA AIR SAMPLING	AREA ISOLATION
OTHER:	OTHER:	CONTAINMENT DEVICE
OTHER:	OTHER:	OTHER:

(17) COMPLETE AN ALARA ASSESSMENT AS PER SP-A-35-067, ALARA REVIEW AND EVALUATION.
Is an ALARA Review Required? ☐ YES ☐ NO (If YES, THEN attach form)

(18) PRE-JOB BRIEF REQUIRED? ☐ YES ☐ NO

(19) DOSIMETRY		(20) REQUIRED TRAINING	
Special Bioassay *(See Comments)*	Job Specific TLD	Rad Worker I	Respirator Training
Direct Reading Dosimeter	Extremity Dosimetry	Rad Worker II	Other: *(Specify Below)*

(21) COMMENTS:

(22) WORK PERMIT PPE REQUIREMENTS ATTACHED:
☐ YES ☐ NO

APPROVALS *Signee verifies FERMCO Work Permit, PPE Requirements, Health & Safety Plan, or other additional documentation have been reviewed and approves of the requirements of the RWP.*

(23) RCT SUPERVISOR:	DATE:	(24) RADIOLOGICAL ENGINEERING:	DATE:
(25) RADIOLOGICAL COMPLIANCE:	DATE:	(26) REQUESTOR (CONCURRENCE):	DATE:

(27) RCT SIGNATURE:	RCT OFFICE LOCATION:	DATE ISSUED:	TIME ISSUED:
RCT PRINTED NAME:	RCT PHONE:		

PART II - BRIEFING GUIDANCE SHEET *(APPLICABLE ONLY IF BRIEFING IS REQUIRED)*

SCOPE OF WORK TO BE PERFORMED	RADIOLOGICAL CONTROL HOLD POINTS
RADIOLOGICAL CONDITIONS OF THE WORKPLACE	COMMUNICATION AND COORDINATION WITH OTHER GROUPS
PROCEDURAL AND RWP REQUIREMENTS	PROVISIONS FOR HOUSEKEEPING AND FINAL CLEANUP
SPECIAL AND RADIOLOGICAL CONTROL REQUIREMENTS	EMERGENCY RESPONSE PROVISIONS
RADIOLOGICALLY LIMITING CONDITIONS (Radiation and/or contamination levels that may void the RWP)	PROVISIONS FOR HOUSEKEEPING AND FINAL CLEANUP
COMMUNICATIONS AND COORDINATION WITH OTHER GROUPS	EMERGENCY RESPONSE PROVISIONS

NO.	DISTRIBUTION OF
1.	JOB SITE
2.	RCT SUPERVISOR
3.	DOSIMETRY MANAGER

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FS-F-1372 (REV. 10/7/93)

☐ RWP CONTINUED ON NEXT PAGE

ATTACHMENT H (CONT.)

FEMP RADIOLOGICAL WORK PERMIT (FS-F-1372)
Page 2 of 2

FEMP
RADIOLOGICAL WORK PERMIT
This permit is only valid when attached to a FERMCO WORK PERMIT.

(1) WORK PERMIT NUMBER:

PAGE:

PART III - WORKER VERIFICATION
Signature verifies worker has read, understood, and will comply with the requirements of this RWP.

NAME			BADGE NUMBER	BRIEFED PER PART II?	RESPIRATOR FIT TEST CURRENT?	RADIATION WORKER TRAINING
PRINTED	SIGNATURE	DATE				
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II

NO.	DISTRIBUTION OF
1.	JOB SITE
2.	RCT SUPERVISOR
3.	DOSIMETRY MANAGER

FS-F-1372-1 (REV. 10/2/93)

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ATTACHMENT I

FEMP FIELD ACTIVITY LOG ((FS-F-3682)

FEMP
FIELD ACTIVITY LOG

CONTROL NUMBER:	DATE:	Page of

PROJECT NAME:	PROJECT NUMBER:
FIELD TEAM LEADER:	FIELD TEAM MEMBERS:
FIELD ACTIVITY SUBJECT:	
WEATHER CONDITIONS:	RELATED FIELD FORM CONTROL NUMBERS:
TEAM LEADER SIGNATURE:	DATE: / ALPHA METER S.N.: / BETA/GAMMA METER S.N.:

TIME	DESCRIPTION OF ACTIVITY

WATER QUALITY METER SERIAL NO.:	METER CALIBRATION												
INITIALS/DATE	pH (STD BUFFER)		SP. COND. (µmhos/cm)		D.O. (mg/L)	TURBIDITY (NTU)	TEMP. (°C)	SALINITY (mg/L)	PID SERIAL NO.	PID CONDIT.	PID LIST NO.	PID READING	PID SPAN
TEMP.:	4	7	HIGH	LOW									
Manual Calibration:													
Auto Calibration:													

VISITORS		TIME	
NAME(S)	ORGANIZATION(S)	ARRIVED	LEFT

FS-F-3682 (REV. 9/19/93)

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Title: PROCEDURE FOR AUGER DRILLED BORINGS AND SOLIDS SAMPLING WITH A SPLIT-BARREL OR THIN-WALLED TUBE	PROCEDURE NO: SCDM FO-001	
	Date: 5/20/94	Revision No: 0
COMPLIANCE WITH THIS PROCEDURE IS MANDATORY WHEN EXECUTING ACTIVITIES WITHIN ITS SCOPE	Page 50 of 53	

ATTACHMENT J

FEMP LITHOLOGIC LOG (FS-F-3881)

CONTROL NUMBER

FEMP
LITHOLOGIC LOG

Page of

PROJECT NAME: | PROJECT NUMBER:

BORING NUMBER: | COORDINATES: | RELATED FAL NUMBERS:

SURFACE ELEVATION: | GROUNDWATER LEVEL: | DATE: | TIME: | DATE STARTED:

GEOLOGIST: | GROUNDWATER LEVEL: | DATE: | TIME: | DATE COMPLETED:

WATER USED DURING DRILLING: | DRILLING CONTRACTOR: | DRILLING EQUIPMENT: | DRILLER/HELPER:

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (tsf)	REMARKS

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

* Samples collected per ASTM Standard Penetration test.

FS-F-3881 (8-1-93)

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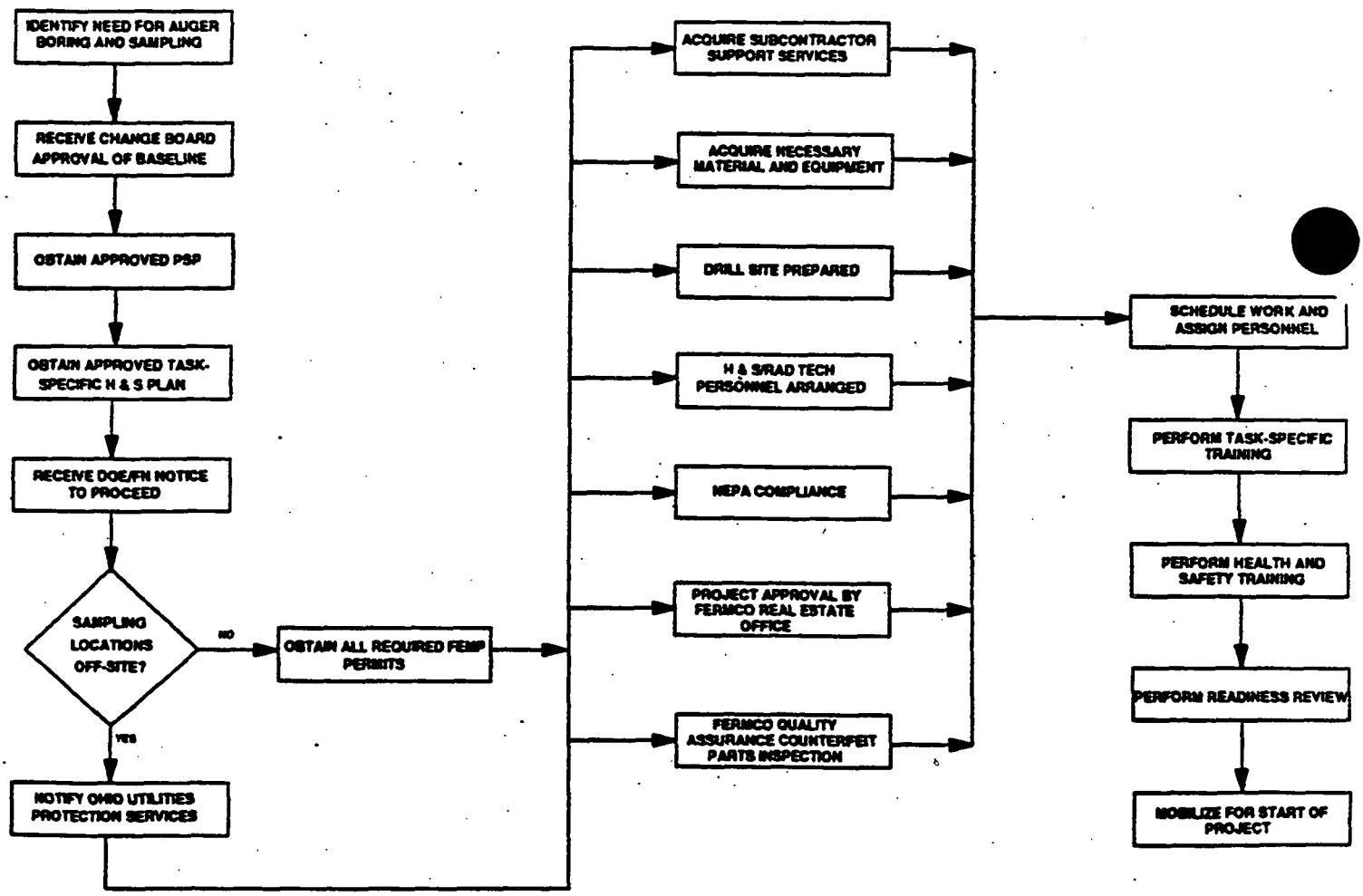
ATTACHMENT K

AUGER BORING PROJECT PREPARATION FLOWCHART



NOTE: Some activities may be arranged concurrently.

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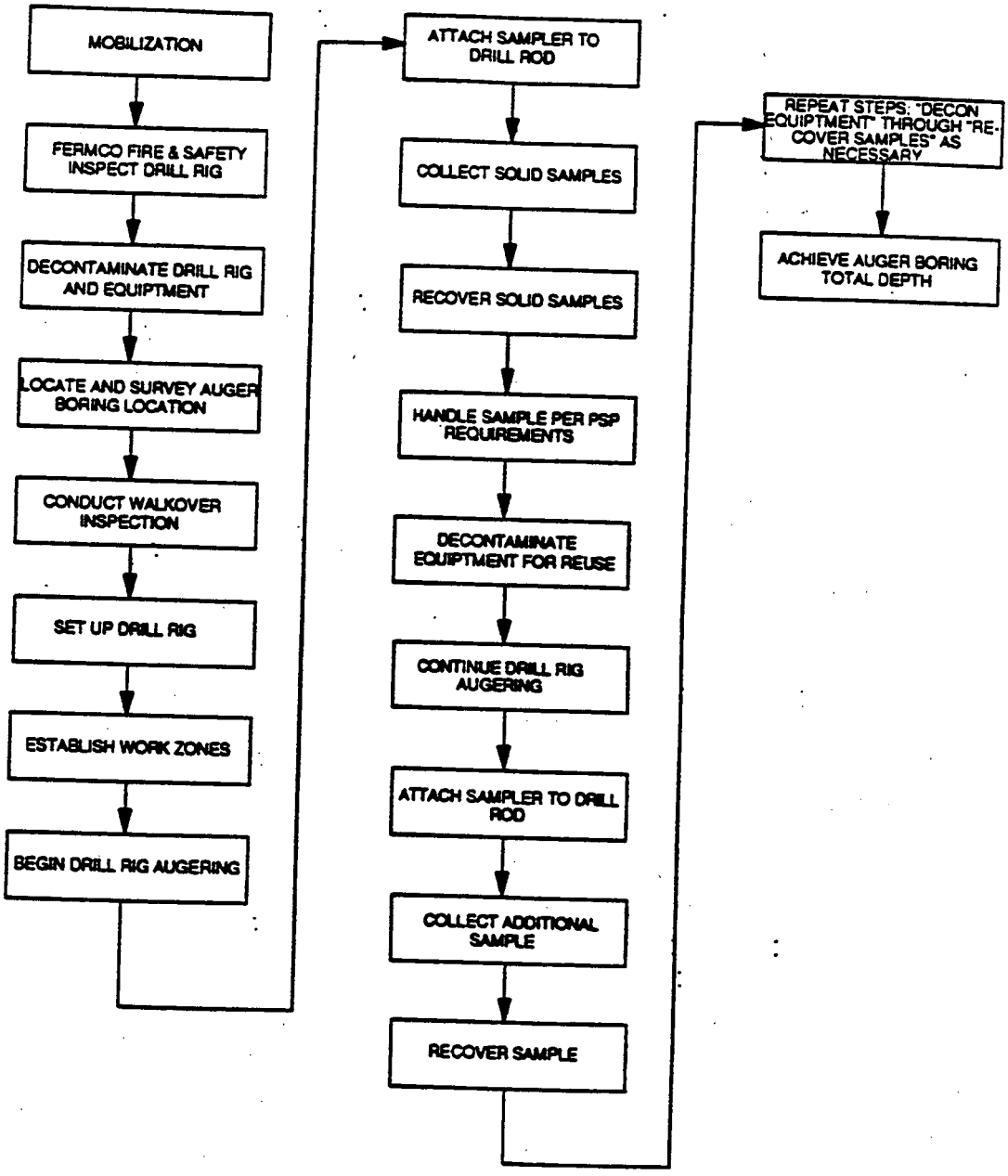
ATTACHMENT L

AUGER BORING PROJECT PERFORMANCE FLOWCHART



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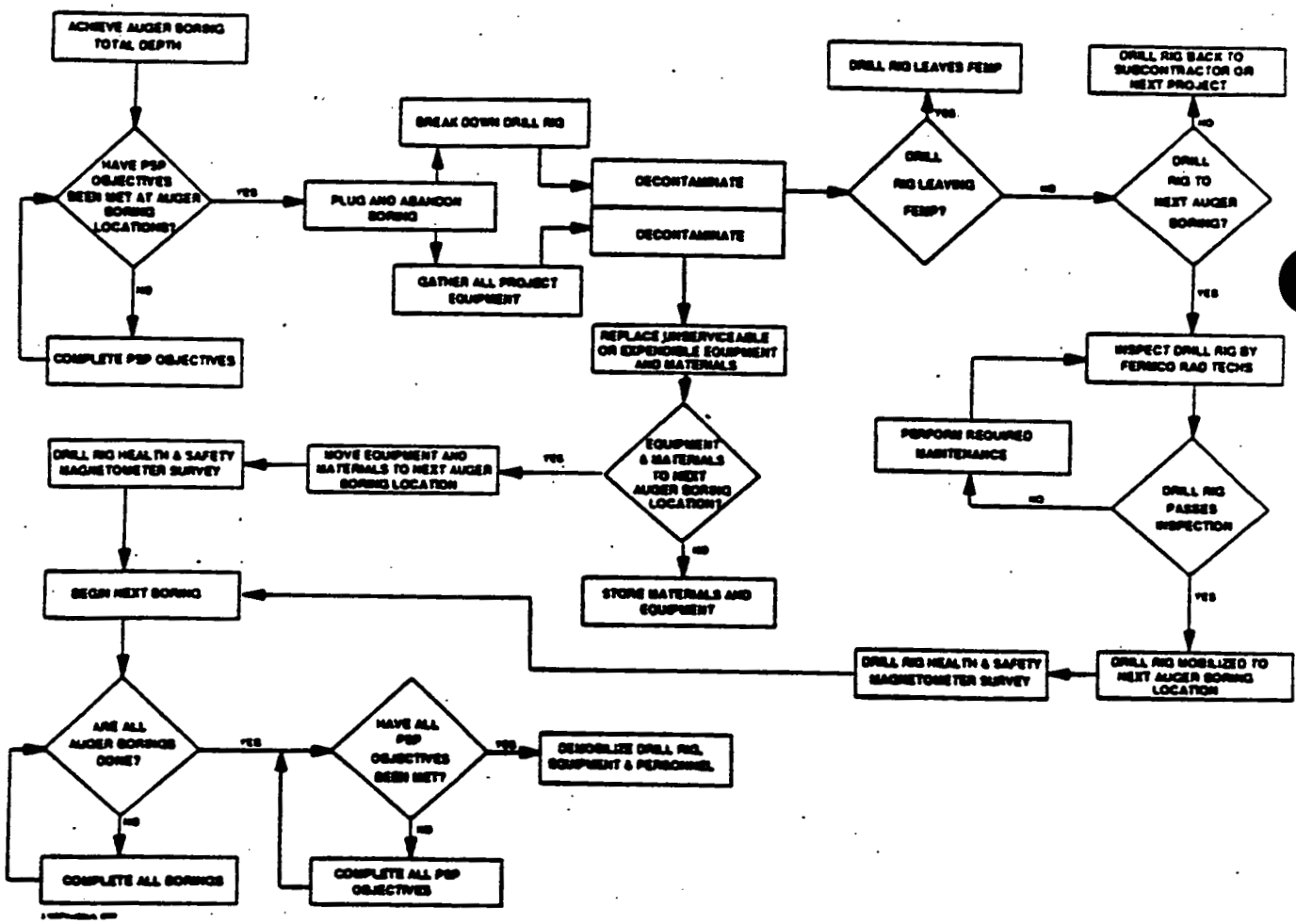
ATTACHMENT M

AUGER BORING PROJECT COMPLETION FLOWCHART



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Fernald Environmental Management Project Fernald Environmental Restoration Management Corp. REMEDIATION SUPPORT OPERATIONS DOCUMENT PROGRAM	Page 1 of 9 Revision No. 1 Revision Date: 05-04-94

REMEDIATION SUPPORT OPERATIONS PROCEDURE	CONTROL AND UTILIZATION OF CONTAMINATED TRASH DUMPSTERS	SOP 20-C-604 Area: As Applicable

(Signature on File) Authorization: M.L. West, Manager, Environmental Waste Management	Supersedes: 20-C-604 Dated: 05-24-88	Issue Date: 10-18-93

1.0 PURPOSE

The purpose of this document is to provide the procedure for moving, filling, securing, and inspecting the dumpsters for contaminated trash containment on the controlled side.

2.0 APPLICABILITY

This procedure is applicable to contaminated trash dumpsters at the FEMP.

3.0 RESPONSIBILITIES

NON-CONTROLLED COPY

3.1 Supervisors shall be responsible for the following:

3.1.1 Ensuring that personnel are qualified per the established training requirements identified by the Department/Section Manager.

3.1.2 Maintaining training records of personnel who are using the dumpsters.

3.1.3 Providing training records to Environmental Waste Management.

3.1.4 Contacting Environmental Safety and Health (ES&H) to determine the appropriate respiratory protection for handling contaminated trash.

3.1.5 Providing Contaminated Trash Handlers with the required respiratory protection.

3.1.6 Reviewing applicable Material Safety Data Sheets with Contaminated Trash Handlers.

3.2 Contaminated Trash Generators shall be responsible for ensuring that prohibited items are not placed into trash receptacles.

3.3 Dumpster Owners shall be responsible for the following:

3.3.1 Ensuring that designated contaminated trash dumpster access doors remain locked when not in use.

R 3.3.2 Ensuring that contaminated trash does not accumulate around the dumpsters unless the dumpster is full.

3.3.3 Maintaining ownership (or delegating ownership) of the key to open the "master" lock on the contaminated trash dumpster.

3.0 RESPONSIBILITIES (cont.)

R 3.3.4 Notifying Waste Generation Control (WGC) when key control has been
R delegated to someone other than the designated key-holder.

3.3.5 Notifying WGC of problems associated with contaminated trash dumpsters.

R 3.3.6 Ensuring that unidentified (un-labelled) bags that have been "dropped"
R at the dumpster are marked with a large red "X" and placed in the
R dumpster for segregation and internal inspection at the contaminated
R trash baler.

R 3.3.7 Arranging for a Motor Vehicle Operator (MVO) to empty/transport full
R dumpsters.

R 3.3.8 Coordinating with Contaminated Trash Handlers to ensure that bags are
R inspected visually (externally) and prohibited items are detected at the
R point of generation.

R 3.3.9 Ensuring that labeled, acceptable contaminated trash is deposited in
R dumpsters or ensuring that only authorized contaminated trash handlers
R deposit trash into dumpsters.

R 3.4 Contaminated Trash Handlers/MVOs shall be responsible for complying with this SOP.

3.5 RSO Operations and Waste Generation Control (WGC) shall be responsible for the following:

3.5.1 Periodically updating the prohibited items list that is posted on the contaminated trash dumpsters.

3.5.2 Initiating the appropriate action to take if prohibited items are found.

3.5.3 Maintaining a list of dumpster owners.

3.5.4 Retaining duplicate keys to the dumpster locks.

3.5.5 Routinely issuing "employee updates" to inform personnel of the requirements for disposing of contaminated trash.

3.5.6 Determining placement of contaminated trash dumpsters to better serve the site needs.

R 3.5.7 Coordinating with Dumpster Owners to ensure that authorized Contaminated
R Trash Handlers deposit waste material in dumpsters.

3.6 Quality Control (QC) shall be responsible for the following:

3.6.1 Performing weekly inspections of the dumpsters.

3.6.2 Notifying dumpster Owners of deviations and forwarding copies of DCARs to QA & WGC.

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3.0 RESPONSIBILITIES (cont.)

3.7 Quality Assurance shall be responsible for the following:

3.7.1 Evaluating the Contaminated Trash Dumpster per the QC Inspection Checklist form and documentation from the package certifiers (pre-baled trash inspection) and baler operators.

3.7.2 Contacting Dumpster Owners and issuing Deviation Reports whenever appropriate.

4.0 DEFINITIONS

4.1 Contaminated Material - A substance containing radioactive constituents that are above the limit for unrestricted release (1,000 dpm/cm^2).

4.2 Contaminated Trash Dumpsters - Gray, secured containers for contaminated trash that are located throughout the controlled area.

4.3 Contaminated Trash Generator - Any person who works in, or will access, the controlled area to perform duties, and subsequently be disposing of trash.

4.4 Contaminated Trash Handler - Any person (porter, laborer, HAZWAT, chemical operator, sub-contractor, MVO, or radiation technician) that will collect contaminated trash for disposal.

4.5 Contaminated Trash - Any waste that is suspected to have contaminated material which would prevent the disposal at a sanitary landfill.

5.0 APPLICABLE DOCUMENTS

5.1 Drivers

5.1.1 PO-D-026, "Site Services Document Program"

5.1.2 RM-0012, "Quality Assurance Program Description"

5.2 References

None

6.0 INDUSTRIAL HEALTH AND SAFETY REQUIREMENTS

6.1 Safety glasses with side shields shall be worn unless other eye protection is specified by ES&H or posted signs.

6.2 Respiratory protection issued by the supervisor shall be worn when required by ES&H.

6.3 Leather-palm gloves shall be worn when handling rough and/or contaminated material.

6.4 Contaminated trash shall not be allowed to accumulate around the dumpsters.

6.0 INDUSTRIAL HEALTH AND SAFETY REQUIREMENTS (cont.)

6.5 Contaminated Trash Handlers/MVOs shall have reviewed and be familiar with MSDSs for hazardous materials/chemicals that may be used or handled.

6.6 Any circumstance which could have resulted in an intake of radioactive materials by inhalation, ingestion, or absorption shall immediately be reported to a Supervisor. The Supervisor shall immediately report the circumstance of possible radioactive materials intake to ES&H Radiological Control Department for evaluation. When the suspect isotope is uranium, the involved personnel shall report to the Urine Sampling Station at the end of their shift to complete an Incident Investigation Report (IIR) (Form No. FS-F-1458), and submit an incident urine sample. The involved personnel shall also report to the Urine Sampling Station at the start of their next shift to submit a follow up urine sample. When the suspect isotope is other than uranium, the involved personnel shall report to the Dosimetry Section of the Radiological Control Department for further determination of actions. Employees are responsible for complying with additional requirements as specified by the Radiological Control Section.

6.7 Any situation which could have resulted in the inhalation, ingestion, or absorption of a hazardous material shall immediately be reported to a Supervisor or to the Assistant Emergency Duty Officer (AEDO), who will immediately report the circumstances to Medical and Industrial Hygiene. The involved personnel shall be directed by the Supervisor or AEDO as to when and where to report for medical evaluation, completion of an Incident Investigation Report (IIR) (Form No. FS-F-1458), and submitting bioassay samples (e.g. blood, urine). Employees are responsible for complying with any additional requirements as specified by ES&H.

7.0 GENERAL

7.1 Warnings, Cautions, and Notes precede the Item or Step to which they apply.

8.0 PROCEDURE

8.1 Bag Inspection

CONTAMINATED TRASH HANDLER

8.1.1 Visually examine the trash for prohibited items or categories of waste (Refer to Table 1) as the clear plastic bags are filled.

8.1.1.1. If inspection of the trash is not possible, perform an external visual inspection through the bag.

8.1.2 Remove prohibited items from the trash.

8.1.3 Contact the supervisor and dumpster owner and request disposition instructions.

8.1.3.1 If the supervisor or dumpster owner are unable to determine disposition contact Waste Generation Control (Telephone No. 738-8444).

8.0 PROCEDURE (cont.)

8.1.4 Dispose of prohibited items in approved manner (Refer to Table 1) as instructed by the supervisor or Waste Generation Control.

8.1.5 Ensure the building, office area, or project from which the trash originated is clearly marked on the accumulation bags with a permanent marker or paint pen.

8.2 Filling Contaminated Trash Dumpsters

CONTAMINATED TRASH HANDLER

8.2.1 Dispose of small or loose items as follows:

8.2.1.1 Inspect small/loose material for prohibited items (Refer to Table 1).

8.2.1.2 Set prohibited items, if any, aside for disposal.

8.2.1.3 Place the trash in a clear plastic bag.

8.2.1.4 Gather or twist the open end of the bag until the opening is closed.

8.2.1.5 Using tape, secure the bag.

8.2.1.6 Ensure that the building, office area, or project from which the trash originated is clearly marked on the accumulation bags with a permanent marker or paint pen.

8.2.1.7 Contact the supervisor or WGC (738-8444) and request instructions for prohibited items that were removed.

8.2.2 Contact the Dumpster Owner (listed on the information sheet posted on the dumpster) to obtain approval for disposal and to obtain the lock key (See Figure 1).

8.2.3 Unlock the dumpster.

CAUTION

Piping and pieces of wood over two feet in length shall not be placed in the dumpster.

8.2.4 Place bulky items (such as oversize pieces of cardboard) directly into the dumpster.

8.2.5 Inspect the bags for damage.

8.2.5.1 Place damaged bags into undamaged bags.

8.2.5.2 Identify the bag with the same markings as the damaged bag.

8.2.6 Check bags for identification marking and "clean" trash bags.

8.2.6.1 Mark bags without identification with a large red "X."

8.0 **PROCEDURE** (cont.)

NOTE 1: Unsecured and/or unidentified bags or damaged bags shall not be placed in the dumpster.

NOTE 2: Green-tinted "clean office trash bags" shall not be placed in the dumpsters. Clean bags are disposed of differently than contaminated trash. Clean office trash in green-tinted bags are accumulated next to the contaminated trash dumpsters. The bags are picked up by transportation twice per week.

8.2.7 Place identified contaminated trash (excluding items in Table 1) in the dumpster.

8.2.8 Lock the dumpster.

8.2.9 Return the lock key to the Dumpster owner.

8.2.10 Notify Dumpster owner when a full dumpster requires emptying.

8.3 Transporting Contaminated Trash Dumpsters

MOTOR VEHICLE OPERATOR (MVO)

8.3.1 Transport the contaminated trash dumpsters according to the established schedule (Refer to Figure 1).

8.3.2 Pick up prohibited items that have been segregated.

8.3.3 Transport prohibited items to the designated locations for disposal.

8.3.4 Contact Dumpster Owner when transport schedule cannot be met.

8.4 Dumpster Inspection

QUALITY CONTROL

8.4.1 Inspect dumpsters (monthly) and document the inspection.

8.4.2 Notify the Dumpster Owner and Waste Generation Control of inspection results.

9.0 **APPLICABLE FORMS**

9.1 NN, "Contaminated Trash Dumpsters"

TABLE 1

NTS Waste Stream -- ONLO-00000007
"Contaminated Trash"

Allowed Items	Restrictions
Certain Batteries	No Lead-Acid (vehicle) or Ni-Cad (rechargeable)
Empty Cans	No Prohibited Item Residue
Metal	Less than 2 ft. in length. Free from grease, oil, residues, lead-based paint
Paper/Cardboard	
Personal Protective Equipment (Anti-C's, Boots, Gloves, Tyvek)	Unless specifically restricted by Work Plan
Plastic	
Rope, Twine, String	
Styrofoam, Rubber	
Wood	Less than 2 ft. in length. Free from creosote, residue, stains, lead-based paint

Dumpster Usage Instructions:

1. All trash MUST be marked with the building or area of origin.
2. All trash MUST be placed inside the dumpster (except green-bagged Office Trash).

Prohibited Items	Examples	Where to Go	Who to Contact
Asbestos Containing Material	Transite, Pipe Insulation, Floor Tile	—	Leigh Fisher, x8638
Batteries	Auto, Ni-Cad Rechargeable	Plant 6	Susan Hoskins, x6826
Compressed Gases and Aerosol Cans (unpunctured)	Spray Paint, Deodorant Cans, Spray Disinfectant Cleaner, WD-40, Propane	Plant 1	Sam Laupola, xo052
Glass	Bottles, Jars, Light bulbs	Plant 1	Sam Laupola, x6052
Lead-bearing Material	Lead metal, Pipe dope, Lead flashing, Oil filters	Satellite Accum. Areas	John Grace, x8924
Liquids	Water, Coffee, Ice, Pop	Sink	—
Mercury-bearing Material	Switches, Vaccuum Pumps	Satellite Accum. Areas	John Grace, x8924
Particulates (unbagged)	Ashes, Dust, Pad Sweepings	—	Chris Gilbert, x6428
Solvents and Soaked Rags	Kerosene, Toluene, Acetone	Satellite Accum. Areas	John Grace, x8924
UNCONTAMINATED TRASH	Office Trash, Paper, Non-radioactive trash	—	Chuck Menche, x6428
Wood	Pallets, 2x4's, Lumber	Plant 1	Lori Hurst, x8448

Any Questions...Call
Waste Generation Control - x8444

Contaminated Trash Dumpsters – Master

No.	Check-Off	New Lock	Pickup Schedule Mon	Tue	Wed	Thu	Fri	Location	Description	Facility/ Dumpster Owner	Phone	Keyholder(s)	Phone
1		X2800	x					Plt 4 E	E Entrance to Plant 4	Brenda Perkins	6001	Brenda Perkins	6001
2		2700		x				Lab S	South of Lab Bldg.	Ken Bad	6570	Ken Bad	6570
3		2969			x			South of Union Trailer	Gravel near Y-64	Jim Hey	6116	Bob Gieding	8409
4		2759				x		Plt 5 NE	NE corner	Ken Peters	6451	Ken Peters	8451
5		2977					x	Plt 6 S	at Bldg 31	Dale Vizedom	6478	Dale Vizedom	6478
6		2878	x					Plt 6 Insp	E side of Plant 6	Ken Peters	6451	Alan Blundell	6611
7		2212		x				Plt 6 N	N side of Plant 6	Ken Peters	6451	Alan Blundell	6611
8		2569	x	x	x	x	x	Lab Pad W	West of Lab Dock	Doug Stamper	6984	Wanda Burk	6556
9		X2227				x		Garage	S side near fence	Steve Schonegg	6622	Tim Feltner	6045
10		X2232					x	Bldg 12 SE	SE end of bldg	Karl Schaefer	6866	Paul Raab	6441
11		X2608	x					Bldg 12 SW	SW end of bldg	Karl Schaefer	6866	Mark Collins	6673
12		X2362		x				Plt 1	Near Plant 1 Pad	Sam Laupola	6052	Sam Laupola	6052
13		2333			x			Decontamination	SE corner	Jerry Knight	6708	Roy Douglas	6770
14		2287				x		Plt 9 W	NW corner	Ken Peters	6451	Bill Gibson	6708
15		2323					x	Bldg 12 N	North side (Electrical Shop)	Bill Libbert	6655	Bill Libbert	6655
16		X2403	x					Plt 1	Near loading dock	Sam Laupola	6052	Sam Laupola	6052
17		2853	x	x	x	x	x	Pilot Plant	Between Lab and Pilot Plant	Brenda Perkins	6001	Brenda Perkins	6001
18		2256			x			Plt 1	Near offices on west side	Sam Laupola	6052	Sam Laupola	6052
19		X2690				x		Lab W	West of Lab Dock	Doug Stamper	6984	Wanda Burk	6556
20		X2368					x	Bldg 3045	NE corner	C.K. Smith	6953	C.K. Smith	6953
21		2728	x					Service Bldg	W side, near Laundry	Joe Legge	6975	Joan West	6476
22		X2445		x				Hot Raffinate Bldg	South side	Brenda Perkins	6001	Brenda Perkins	6001
23		2382			x			Plt 5 W	West side of Plt 5 near annex	Ken Peters	6451	Phil Kraus	6696
24		2708				x		Plt 1	NE of Bldg 71	Sam Laupola	6052	Sam Laupola	6052
25		X2122					x	Plant 2/3 S	South Alley	Brenda Perkins	6001	Brenda Perkins	6001
26		X2464	x					Boiler Plant	Beneath "Electrostatic Precipitator" sign	Bill Naber	6434	Bill Naber	6434
27		2553		x				K-65	East of K-65 silos	Nick Glassey	648-6602	Roy Roseberry	6433
28		2191			x			Lime Bldg	S. of Bulk Lime Handling Building	Ron Young	6437	James Ellis	6398
		Totals	8	7	7	7	7						

CONTAMINATED TRASH DUMPSTERS
Figure 1

RECORD OF ISSUE/REVISIONS

DATE	REV. NO.	DESCRIPTION AND AUTHORITY
05-24-88	0	New procedure issued from CIO C88-014 per Request No. P88-056, initiated by J. E. Harmon.
12-27-90	1	Revised procedure to incorporate CIO C90-024 per Request No. P90-255.
01-28-91	2	Revised to incorporate CIO C91-061 per Request No. P92-015.
12-08-92	3	Revised to incorporate CIO C92-015 (P92-284) and update to current procedure program requirements.
10-18-93	0	Reissued to update to current requirements per Request No. P93-1006, initiated by C. Gilbert. Also CIO C93-717 (P93-1007) was incorporated.
05-04-94	1	Revised to incorporate CIOs C93-757 (per Request P94-0248) and C94-002 (per Request P94-0249).

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3.3.2 Ensuring that contaminated trash does not accumulate around the
R dumpsters unless the dumpster is full.

3.3.3 Maintaining ownership (or delegating ownership) of the key to open the "master" lock on the contaminated trash dumpster.

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To Pat Riley	From T. Hey
Co.	Co.
Dept.	Phone # 6 11 9
Fax #	Fax #

PROJECT SPECIFIC PLAN
FOR OPERABLE UNIT 1
DEWATERING EXCAVATION EVALUATION PROGRAM
GEOTECHNICAL INVESTIGATION
RI/FS WBS NUMBER 10.03.06
REVISION 1, SEPTEMBER 30, 1994

APPROVAL:

_____

William Benson, Director — Date
Operable Unit 1

_____

Fred Ford, Manager — Date
Quality Assurance Department

_____

Linda K. Rogers, Manager — Date
Environmental Program Development

APPENDIX H

ASTM STANDARDS

ASTM STANDARD NUMBER	ASTM STANDARD TITLE
D 422-63	Standard Test Method for Particle-Size Analysis of Soils
D 698-91	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))[1]
D 854-92	Standard Test Method for Specific Gravity of Soils
D 1140-92	Standard Test Method for Amount of Material in Soils Finer Than the No. 200 Sieve
D 1557-91	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))[1]
D 1586-84	Standard Method for Penetration Test and Split-Barrel Sampling of Soils
D 1587-83	Standard Practice for Thin-Walled Tube Sampling of Soils
D 1883-92	Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils
D 2166-91	Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
D 2435-90	Standard Test Method for One-Dimensional Consolidation Properties of Soils
D 2487-93	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
D 2488-90	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
D 3441-86	Standard Test Method for Deep, Quasi-Static, Cone and Friction-Cone Penetration Tests of Soil
D 3740-92	Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
D 4318-84	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
D 4767-88	Standard Test Method for Consolidated-Undrained Triaxial Compression Test on Cohesive Soils
D 5299-92	Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities

THE PREVIOUS TABLE LISTS THE AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS FOLLOWED DURING THE PERFORMANCE OF THE DEEP FIELD AND LABORATORY WORK. THESE STANDARDS HAVE BEEN REFERENCED AS PART OF THIS WORK PLAN.

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APPENDIX I

PROJECT SCHEDULE

RI/FS WBS NUMBER: 10.03.06
PROJECT TITLE: OU1 DEWATERRING EXCAVATION EVALUATION PROGRAM (DEEP)

Activity Number	WBS.Task Number	Description	Early Start	Early Finish	Duration (Days)
1P43203100	10.03.06.1000	Prepare DQO	11JUL94A	21JUL94A	0
1P43203100	10.03.06.1010	Review/Approve DQO	11JUL94A	21JUL94A	0
1P43203100	10.03.06.1020	Prepare PSP	8AUG94	12AUG94	5
1P43203100	10.03.06.1030	Review/Approve PSP	15AUG94	26AUG94	12
1P43203100	10.03.06.1040	Prepare HASP	8AUG94	12AUG94	5
1P43203100	10.03.06.1050	Review/Approve HASP	15AUG94	26AUG94	12
1P43203300	10.03.06.1060	Rec. Notice to Proceed	26AUG94	26AUG94	1
1P43203150	10.03.06.1070	Obtain Permits	29AUG94	2SEP94	5
1P43203400	10.03.06.1080	Conduct Task Briefing	3OCT94	3OCT94	1
1P43203400	10.03.06.1090	Conduct Readiness Review	3OCT94	3OCT94	1
1P43203500	10.03.06.1100	Mobilization	3OCT94	4OCT94	3
1P43203550	10.03.06.1110	Collect Samples	4OCT94	19OCT94	15
1P43203500	10.03.06.1130	Demobilization	19OCT94	21OCT94	3
1P43203150	10.03.06.1140	Validate Field Data	24OCT94	4NOV94	12
1P43203150	10.03.06.1150	Field Data in SED	7NOV94	18NOV94	12
1P43210390	10.03.06.1160	Analyze Samples	5OCT94	20NOV94	45
1P43203150	10.03.06.1190	Lab Data in SED	21NOV94	28NOV94	5
1P43203150	10.03.06.1220	Disp. Wastes	17OCT94	12FEB95	110

ATTACHMENT I

PROJECT SPECIFIC PLAN

FOR OPERABLE UNIT 1

MODULAR PROCESS AREA

GEOTECHNICAL INVESTIGATION

PROJECT SPECIFIC PLAN

FOR

OPERABLE UNIT 1

MODULAR PROCESS AREA

GEOTECHNICAL INVESTIGATION

RI/FS WBS NUMBER 10.03.10

REVISION 1

OCTOBER 19, 1994

Prepared by

Fernald Environmental Restoration Management Corporation

Prepared for

U.S. Department of Energy
Fernald Field Office

Under Contract DE-AC05-92OR21972

PROJECT SPECIFIC PLAN
FOR OPERABLE UNIT 1
MODULAR PROCESS AREA GEOTECHNICAL INVESTIGATION
RI/FS WBS NUMBER 10.03.10
REVISION 1, OCTOBER 19, 1994

APPROVAL:

W. M. Burton for RIF 10/20/94
Robert Fellman, Director — Date
Operable Unit 1

Richard Arko for 10-19-94
Fred Ford, Manager — Date
Quality Assurance

Linda K. Rogers 10-19-94
Linda K. Rogers, Manager — Date
Environmental Program Development

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1.0 INTRODUCTION

This Project Specific Plan (PSP) has been developed to provide geotechnical data for the Modular Process Area (MPA) facility foundations. This PSP outlines the sampling and drilling activities for 7 borings to be completed and sampled and 18 Cone Penetrometer Testing (CPT) locations. The geotechnical borings and CPT locations will provide geotechnical information to select sizes and types of foundations for the MPA facility and design of roads in the area southeast of Waste Pit 6 (see Figure A-1 and A-2, Appendix A).

Select soil samples collected during installation of the seven geotechnical borings will be tested for grain size distribution, Atterberg limits, moisture content, unit weight, specific gravity, unconfined compressive strength test, consolidated undrained triaxial compression test with pore pressure measurements, five point standard and modified proctor test, and California bearing ratio. The CPT shall be used to measure soil characteristics with tip, sleeve, and pore pressure measurements from the cone.

This PSP outlining field activities to be completed for the Modular Process Area Geotechnical Investigation, has been developed under the specifications of the FEMP Sitewide Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Quality Assurance Project Plan (SCQ). The PSP will guide FERMCO and subcontractor personnel in drilling, collection of samples, and the associated laboratory work required to meet the project specific Data Quality Objectives (Appendix B). All field operations and data handling procedures will be consistent with the FEMP SCQ; sections of the SCQ are incorporated into this PSP by reference.

2.0 PROJECT ORGANIZATION

An Environmental Restoration Management Contract (ERMC) has been implemented at the FEMP site to manage the restoration activities, with Fernald Environmental Restoration Management Corporation (FERMCO), a wholly-owned subsidiary of Fluor Daniel, Inc., currently serving as the ERMC. FERMCO, reporting directly to the Department of Energy, Fernald Field Office (DOE-FN), will act as the main contractor for FEMP activities and coordinator of technical support and remediation subcontractors. Primary FERMCO organizational responsibility for implementation of the Operable Unit 1 Modular Process Area Geotechnical Investigation is Operable Unit 1. Additional support will be provided by matrixing Site Characterization Department staff, equipment, and by subcontractor personnel.

Key positions involved in completing the Operable Unit 1 Modular Process Area Geotechnical Investigation specifically are presented as follows:

Operable Unit 1 Director

The Operable Unit 1 Director is responsible for coordinating all Operable Unit 1 activities including project performance, schedule, budget and resources. The Operable Unit 1 Director provides guidance and support to all Operable Unit 1 projects. Additionally, the Director provides project status information to senior management, client, and regulatory officials.

Operable Unit 1 Health and Safety Officer

The Health and Safety Officer is responsible for the comprehensive Operable Unit 1 Health and Safety Program. The Health and Safety Officer reviews and approves the Modular Process Area Geotechnical Investigation Health and Safety Plan, which is specific to the proposed field activities, in accordance with FEMP policy, proper health and safety practices, and the SCQ. The Operable Unit 1 Health and Safety Officer will coordinate with the Field Health and Safety Officer to assess unforeseen circumstances, from a health and safety perspective, and issue addenda to the Health and Safety Plan, as necessary.

Field Health and Safety Officer

The Field Health and Safety Officer ensures that the Project Specific Health and Safety Plan is fully implemented during all field activities. The Field Health and Safety Officer will coordinate with the MPA Project Manager to ensure that field activities are conducted in a manner which is consistent with the Project Health and Safety Plan. The Field Health and Safety Officer can request, verbally or in writing, that individual personnel be relieved of field duties for specific violations to the Project Health and Safety Plan. The Field Health and Safety Officer will coordinate with the Operable Unit 1 Health and Safety Officer to assess unforeseen circumstances, from a health and safety perspective, and implement addenda to the Project Health and Safety Plan issued by the Operable Unit 1 Health and Safety Officer.

Operable Unit 1 Project Manager

The Operable Unit 1 Project Manager is ultimately responsible for fully implementing every aspect of this PSP. The Project Manager can halt field activities at any time for any reason, and is ultimately responsible for the health and safety of field personnel during field activities. Specific responsibilities include:

- overall planning and execution of the MPA in accordance with the SCQ,
- requesting variances to the PSP, in writing, to the Operable Unit 1 Quality Assurance (QA) Officer,
- coordinating with knowledgeable personnel to make informed decisions about all field activities, in particular, placement of discretionary sample locations, and
- signature approval of requested discretionary boring locations and variances to the PSP.

Field Operations Lead

Responsible for ensuring the PSP is implemented correctly and efficiently in the field. Coordinates all drilling and sampling activities in the field, obtains work permits, provides technical oversight of field personnel and subcontractors.

Field Geologist

Responsible for supervising sampling and drilling activities at each boring location. The Field Geologist of each sampling and drilling crew will also be responsible for preparing and maintaining all field data documentation that provides a written record of activities and measurements in the field.

Quality Assurance Officer

Responsible for establishing and preparing Quality Assurance (QA) requirements for the MPA program. The QA Officer will perform or coordinate project audits and surveillance, as required, in cooperation with any FERMCO project quality oriented organization.

Sampling Technicians

Under supervision of the Field Geologist, Sampling Technicians are responsible for the collection of samples in accordance with the approved PSP. These technicians are also responsible for ensuring the proper sample equipment is available and in serviceable condition (See Appendix C), and properly decontaminated between each sampling event/interval. Sampling technicians are responsible for ensuring that sample field screening results are reported to the Field Geologist.

3.0 SAMPLING AND TESTING PROGRAM

Any variance from the required sampling or testing technique, PSP requirements, or standard operating procedures shall be approved prior to implementation by the Operable Unit 1 Project Manager and the EPD Manager as prescribed in Section 15.4 of the SCQ. Changes to the program shall be noted in the project files and on an approved Variance Request Form.

3.1 GEOTECHNICAL BORING INSTALLATION AND SAMPLING

A total of 7 borings (see Table 3-1) will be completed to depths ranging from 30.0 feet. All borings will be installed using a truck-mounted auger drilling rig. Borings will be installed in accordance with FERMCO Site Characterization and Data Management Department Standard Operating Procedure SCDM FO 001, titled "Procedure for Auger Drilled Borings and Solids Sampling with a Split-Barrel or Thin-Walled Tube" (see Appendix D). All soil borings shall be installed using 8-inch outer diameter (4.25 inch inner diameter) hollow stem augers. All sampling will be completed downhole through the hollow stems in advance of the auger tip.

TABLE 3-1
MODULAR PROCESS AREA BORING LOCATION AND DEPTHS

OU1 BORING NUMBER	RI/FS BORING NUMBER	BORING DEPTH (ft.)	NORTHING (ft.)	EASTING (ft.)
G1-601	11506	30.0	481750.0	1347754.0
G1-602	11507	30.0	481644.0	1347860.0
G1-603	*11508	30.0	481839.0	1347842.0
G1-604	11509	30.0	481789.0	1347892.0
G1-605	*11510	30.0	481733.0	1347948.0
G1-606	11511	30.0	481909.0	1347913.0
G1-607	11512	30.0	481803.0	1347018.0

* Complete indicated borings first.

3.1.1 Soil Sampling Procedure

Samples will be collected continuously using split-spoon samplers and thin-walled tube samplers in all borings. Split-spoon samples will be collected during Standard Penetrating Testing (SPT) using standard 2-inch diameter, 2.0 foot long split-spoon samplers driven 1.5 feet with a 140-pound sampling hammer falling 30 inches in accordance with the American Society for Testing and Materials (ASTM) Method D 1586-84 (Appendix E).

Undisturbed samples will be collected using standard 3.0 foot long 3-inch diameter thin-walled sampler. Prior to pushing the thin-wall tube sampler, the auger will be advanced 0.5 feet below the bottom depth of the preceding sample. All thin-walled tube sampling will be pushed 2.5 feet and administered in accordance with ASTM Method D 1587-83 (Appendix E). The thin-walled tube samples will be capped and sealed with wax at both ends of the sampler to prevent damage and disturbance to the sample.

Split-spoon and thin-walled tube sampling will be conducted in advance of the drill bit to total depth of 30 feet. Borings shall be completed a minimum of 5 feet above the base of the till. Three sampling sequences consisting of alternating split spoon and thin-walled tube sampling (see Figure A-3, Appendix A) shall be followed during drilling and sampling activities.

In accordance with ASTM D 2488-90 (Appendix E), the Field Geologist will describe and classify all split-spoon samples for lithologic purposes, the soil or waste material collected in the Shelby tube sampler will also be described, by examining the material at the ends of the sample tubes. Soil samples will be described and classified based on color (Munsell Soil Color Chart), consistency (pocket penetrometer), angularity, grain-size distribution, particle size, estimated water content, field approximation of the Unified Soil Classification System, and depth from land surface.

Immediately following sampling and prior to containerization, each soil sample shall be field screened for radiological activity and the presence of organic vapor constituents. Field screening shall be accomplished by using a pancake Geiger Mueller detector, and photoionization (PID) detector.

Field screening results shall be recorded on the Lithologic Log, Sample Collection Log, chain of custody form, and the sample label. Appendix F contains examples of the field forms to be used during this project. The split-spoon samples shall be placed in a 500 millimeter (ml) clear glass jar. The disturbed geotechnical tests will be completed on split-spoon samples when distinct lithologic changes are encountered.

Split-spoon samples and thin-walled tube samples not being analyzed will be archived. The number of samples and selected laboratory testing will be specified by the Field Geologists and the Operable Unit 1 Project Manager. Table A-1 (Appendix A) summarizes the approximate number of samples and tests to be completed per interval and boring. Selection will be based on the presence of distinct lithologic changes, vertical data coverage, soil characteristics, and sample recovery. If sand and gravel lenses are encountered within the till, then samples shall be collected for grain size testing and Atterburg Limits testing. Disturbed split-spoon samples will be tested for moisture content, Atterberg Limits and grain-size analysis.

Bulk samples shall be collected from drummed soil cuttings from Borings 11506, 11509, and 11511. The cuttings shall consist of soil collected between approximately 5 and 10 feet in depth; i.e., no topsoil will be collected. Bulk soil samples shall be placed in 5-gallon plastic buckets, custody taped, and handled according to Section 3.3.

Appendix F outlines the samples to be collected from each boring, the sample type from each depth interval, and its unique six-digit sample number. The samples collected from these borings will be tested by the onsite University of Cincinnati Geotechnical Laboratory.

Upon completion of sampling and drilling activities, and following the direction of the Operable Unit 1 Project Manager, the borehole will be plugged and abandoned with Volclay grout up to the ground surface in accordance with ASTM D 5299, "Standard Guide for Decommissioning Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities" (Appendix E) and Appendix J of the SCQ. The grout will be tremied into the borehole with a grout pump. A survey stake with the boring identification number will be placed in the top of the Volclay grout at each boring location. During the plug and abandonment process, the Field Geologist will document the plug and abandonment on a Well Completion Log (Appendix F).

3.1.2 Geotechnical Testing

Soil samples will be tested to provide the following geotechnical information:

TABLE 3-2

TABLE OF GEOTECHNICAL TESTS FOR MODULAR PROCESS AREA GEOTECHNICAL INVESTIGATION

GEOTECHNICAL TEST	SAMPLE TYPE	METHOD (Appendix H)
Consolidated-Undrained Triaxial Compression Tests with Pore Pressure Measurements	Undisturbed	ASTM D 4767
One-Dimensional Consolidation Test	Undisturbed	ASTM D 2435
Unconfined Compressive Strength Test	Undisturbed	ASTM D 2166
Grain-Size Analysis	Disturbed	ASTM D 422 / ASTM D 1140
Specific Gravity	Disturbed	ASTM D 854
Atterberg Limits	Disturbed	ASTM D 4318
Moisture Content	Disturbed	ASTM D 2216
Standard Proctor Compaction Test	Disturbed	ASTM D 698
Modified Proctor Compaction Test	Disturbed	ASTM D 1557
California Bearing Ratio Test	Disturbed	ASTM D 1883

At distinct lithologic changes, split-spoon samples shall be tested for grain-size analysis, specific gravity, Atterberg Limits, and moisture content (Table 3-2). A sample volume of 500 ml will be sufficient sample to complete the requested tests. Table A-1 (Appendix A) summarizes the approximate number of samples and tests to be completed.

Selected undisturbed soil samples will be analyzed for Unconfined Compressive Strength Test; Consolidated, Undrained Triaxial Compression Tests with Pore Pressure Measurements; One-Dimensional Consolidation Test; Atterburg Limits; grain-size analysis; and specific gravity. Consolidated, Undrained Triaxial Compression Tests will be tested at confining pressures consistent with existing overburden pressure.

Bulk samples collected from the drummed soil cuttings will be tested for Standard Proctor, Modified Proctor, and/ or California Bearing Ratio. Samples will also be tested for grain-size analysis, Atterburg Limits, natural moisture content, and specific gravity.

Geotechnical testing for physical properties will be conducted under the appropriate ASTM standards and laboratory procedures using qualified geotechnical laboratory technicians and properly calibrated apparatus which meets ASTM D 3740-90, "Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction" (Appendix E).

3.1.3 Archive of Undisturbed and Disturbed Samples

Undisturbed thin-walled tube samples not submitted for testing will be archived for potential testing to be determined by Operable Unit 1. The 500-ml disturbed samples not being tested for the disturbed geotechnical tests outlined in Table 3-2, will be archived for future Operable Unit 1 data needs. Excess soil sample not required for testing will be containerized and archived.

3.2 CONE PENETROMETER TESTING DESCRIPTION

The major component of the Site Characterization and Analysis Penetrometer System (SCAPS) is a 20-ton all-wheel-drive penetrometer truck. The truck contains separate push and data acquisition work spaces within a stainless steel van body. The van is equipped with shock-isolated flooring for the instrumentation along with a hydraulic power unit and controls to operate the push mechanism. A 25-kilowatt generator provides power for the operation of the equipment. Push rods and probes are forced through the chamber suspended beneath the van floor. The chamber is equipped with rubber plates on the top and bottom forming a septum configuration.

The SCAPS is capable of pushing approximately 38,000 pounds. The minimum and maximum borehole depths are 3 feet and 150 feet, respectively. The probe depth is determined by built-in string potentiometer attached to the hydraulic ram used to push the probe rods into the ground. The push rods create a borehole that is slightly less than 2 inches in width. Rods and probes are retracted into the van following decontamination, data retrieval, and sampling. Sampling will be in accordance with American Society of Testing and Materials (ASTM) D 3441 (Appendix E).

Eighteen testing locations located in the southeast of Waste Pit 6 (see Figure A-2, Appendix A) will be tested for geophysical parameters: tip and sleeve stress and electrical resistivity. Testing depths are summarized Table 3-3. Boreholes shall be terminated a minimum 5 feet above the base of the Glacial Overburden. If termination depth cannot be reached, an alternate testing location will be identified by the Operable Unit 1 Project Manager, the Field Geologist and the EFO Manager. Permits will be reviewed to ensure new locations are in compliance.

At each sampling location, geophysical measurements will be collected. A temporary PVC casing may be inserted into each borehole by the SCAPS operator if borehole collapse interferes with proper probe insertion. Plastic sheeting shall be placed under the SCAPS to cover the ground around the borehole during testing and sampling.

Boreholes with be abandoned after completion of sampling and testing using a tremie grouting mechanism on a trailer. Grout will be emplaced to the surface. A minimum 24 hours after abandonment, the boreholes will be observed for grout subsidence. If grout has subsided, additional grout will be placed in the boreholes to the surface.

TABLE 3-3

MODULAR PROCESS AREA GEOTECHNICAL INVESTIGATION CONE PENETROMETER TESTING LOCATIONS AND DEPTHS

BORING NUMBER*	COORDINATES		DEPTH (FEET)
	NORTHING	EASTING	
11513	481742.5	1347761.0	30
11514	481798.0	1347901.0	30
11515	481899.0	1348051.0	20
11516	482044.6	1347963.5	20
11517	481499.0	1347436.0	30
11518	481319.0	1347436.0	30
11519	481499.0	1347746.0	30
11520	481410.0	1347842.0	25
11521	481311.5	1347841.0	25
11522	481578.0	1347905.0	30
11523	481578.0	1348226.0	30
11524	481397.0	1348226.0	30
11525	481314.0	1347638.0	25
11526	481409.0	1347027.0	20
11527	481174.0	1348027.0	20
11528	481206.0	1348226.0	30
11529	481015.0	1348226.0	30
11530	481410.0	1347324.0	30

* Borings to be completed in order presented.

3.3 SAMPLE HANDLING AND SHIPPING

3.3.1 Sample Management

Immediately following collection, each sample shall be surveyed with a Geiger Mueller frisker and an Alpha meter, the readings will be recorded and reported to the Field Geologist. Immediately following containerization, each sample will be labeled and custody taped. A unique six-digit sample number (Appendix G) shall be assigned to each collected sample. Each sample shall be affixed with a label containing, at a minimum, the unique sample number, RI/FS WBS number, location number, sample matrix, depth interval sampled, collection time, samplers' initials, geotechnical parameters, and field screening results. The custody tape shall be initialed and dated by the sampler.

3.3.2 Sample Chain-of-Custody Records and Field Documentation

Sample custody procedures outlined in the SCQ shall be adhered to throughout the sample handling process from field collection to shipment of the samples to the laboratory. A Site-Wide Analysis Request/Custody Record (SWAR/CR) shall be used to document collection data, chain-of-custody, and geotechnical parameters requested for each sample.

In addition to the custody records, a Sample Collection Log shall be completed which summarizes all samples collected from a single borehole. All field work shall be documented in detail on a daily basis using the Field Activity Log (FAL). Descriptions and classifications of all split-spoon and Shelby tube samples will be contained in the Lithologic Log. All field documentation will be completed by the Field Geologist.

3.3.3 Sample Packaging, Storage, and Transport

Sample custody seals will be examined and verified by FERMCO Sample Processing Laboratory (SPL) personnel of the FERMCO Sample Management Organization prior to acceptance of samples. The field screening results will be clearly displayed on the sample label and the SWAR/CR. Sample packaging shall be performed in accordance with the SCQ Section K.10.

Final sample handling, screening, storage, and shipping activities will be completed by the SPL. Samples will be shipped to the designated on-site University of Cincinnati Geotechnical Laboratory for the geotechnical tests required.

3.4 CALIBRATION OF FIELD EQUIPMENT

All equipment used during this investigation shall be operated and calibrated according to the manufacturer's specification. Written logs of equipment calibration are maintained by the FERMCO personnel responsible for performing the instrument calibrations.

3.5 LOCATION SURVEY

Following sampling activities, the coordinates of each sample location will be surveyed to the nearest 0.01 foot relative to the 1927 State Planar Coordinates by a State of Ohio Registered Professional Land Surveyor. Surveyed points will be integrated into the existing FEMP Geographic Information System (GIS) and incorporated into the Sitewide Environmental Database (SED).

3.6 EQUIPMENT DECONTAMINATION

Decontamination is completed to limit the introduction of contaminants from equipment to sampled media, limit cross-contamination between sampling points, and protect worker safety and health. Sampling and drilling equipment will be thoroughly cleaned prior to use and or transport to the field site.

3.6.1 Geotechnical Testing

Drilling equipment will not be decontaminated between locations if perched groundwater is not encountered. Level I decontamination (Section K.11 of the SCQ) of the drilling equipment will be completed if perched water is encountered during drilling or if the auger flights are required to remain in the borehole to prevent collapse of soil during abandonment as specified in Section J.4.2.1.2 of the SCQ. Level II decontamination of sampling equipment will be performed at each boring location.

At completion of the project and final decontamination, the drilling equipment will be frisked using a beta/gamma frisker. If field screening indicates that the decontamination method is not effective, alternative decontamination methods will be employed.

3.6.2 Cone Penetrometer Testing

Sampling equipment shall be thoroughly decontaminated prior to use and/or transport to the field sample site and also prior to being retracted into the SCAPS. Approximately 1.5 feet of exposed rod will be decontaminated while in a vertical position under the SCAPS. Following decontamination, the rods will be thoroughly frisked using a beta/gamma frisker. A damp rag will be used to decontaminate the probe rods. Plastic sheeting will be used to cover the annular space between the soil and probe rods and the ground under the SCAPS. The rods will be retracted into the SCAPS by the operator only after the field screening results indicate background radiation levels or lower. A third, independent individual will relay communications between the operator and the decontamination/sampling technician. If field screening indicates that the decontamination method is not effective, Level I decontamination will be completed.

4.0 INVESTIGATION-DERIVED WASTE

During sampling and drilling activities borehole cuttings will be placed into 55-gallon drums. Drums shall be marked with the boring number, media type (soil, water, or waste), drum number, and the date generated.

Contact waste (such as used PPE, etc.) will be placed in plastic bags or 55 gallon drums, and handled in accordance with Standard Operating Procedure 20-C-604 "Control And Utilization Of Contaminated Trash Dumpsters" (Appendix D). The bag will be placed in the Operable Unit 4 RI/FS dumpster. Prior to placing the bag in the dumpster, a label will be attached, with the name and phone number of the project manager.

5.0 DATA MANAGEMENT PLAN

This data management plan will be implemented so that information collected during the investigation will be properly managed following completion of the field activities. Data and field documentation generated during the investigation shall be validated to ensure compliance with the DQOs outlined in Appendix B of this PSP.

As specified in Section 5.1 of the SCQ, sampling teams shall describe daily activities on the FAL sufficient for the sampling team to reconstruct a particular situation without reliance on memory. The Field Geologist shall complete lithologic logs for each boring as specified in Section J.4.1.2 of the SCQ. Sample collection logs shall be completed according to instructions specified in Appendix B of the SCQ.

5.1 VALIDATION

To assure appropriate documentation was completed during field activities and that documentation was completed correctly, field documentation shall be validated to Analytical Support Level (ASL) A as described in the SCQ, Section D.5 by Environmental Programs Development (EPD) and QA.

5.2 DATA ENTRY

Geotechnical data shall be entered into the FEMP Site-Wide Environmental Database (SED) by Analytical Data Management. Manual, double keyed, data entry shall be performed and the entered data shall be compared to the original data sheets; corrections shall be initialed and dated, and made as necessary. Hard-copy documents are kept in permanent storage in the RI/FS Project Files, filed under the RI/FS WBS number 10.03.10; the electronic database is permanently archived in a neutral ASCII file format.

6.0 HEALTH AND SAFETY PLAN

EFO technicians will conform to all precautionary surveys performed by the employees representing site Safety, Industrial Hygiene, and Health Physics. Concurrence to all applicable safety permits (indicated by signature of the Environmental Field Operations (EFO) technicians assigned to the project) is expected of EFO technicians in the performance of their assigned duties.
The EFO Senior Technician and responsible sampling team lead will ensure that all technicians performing sampling related to any project has read all applicable permits that protect worker safety and health. EFO technicians who do not sign the applicable health and safety permit forms shall not participate in the execution of sampling activities related to the completion of assigned project responsibilities. A copy of all applicable safety permits/surveys issued for worker safety and health shall be posted at the field locations. The Project Specific Health and Safety Plan is contained in Appendix H.

Prior to implementation of field work, a FEMP Penetration Permit will be obtained. The permit process involves comparing proposed locations to the underground utility site database. No intrusive sampling will be conducted without a valid Penetration Permit being obtained prior to performance of the work.

Health and safety coverage of the field program will be provided by a technician monitoring the activities of the field crew. Proper equipment to be used for health and safety monitoring and personnel protection and criteria for the selection of monitoring equipment and protective clothing are outlined in the Project-Specific Health and Safety Plan contained in Appendix G.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

The primary objectives of the Quality Assurance/Quality Control (QA/QC) section of this plan relate to the collection of field information and data sufficient to evaluate size and types of foundations for the MPA facility and designs of roads in the area Specific objectives of this field sampling effort shall be designed, organized, and implemented in a manner which will optimize the collection of information which meets the DQOs (Appendix B) specified in this PSP. To ensure information is gathered in such a manner that DQOs are met, QA/QC measures will be used to determine conformance with overall Operable Unit 1 objectives.

The fundamental mechanisms used to achieve these quality goals can be characterized as prevention, assessment, and correction. These components are further described as follows:

- Prevention of defects in the data quality through planning and design, documented instruction and procedures, and selection and training of skilled, qualified personnel.
- Quality assessment through program or regular audits and surveillance to supplement continual informal review.
- Permanent correction of conditions adverse to quality objectives through a close-looped corrective action system.

All Environmental Field Operations (EFO) sampling programs follow protocol established in the Sitewide CERCLA Quality Assurance Project Plan, Vol I, Section 4, Vol II, Appendix K.

Self-assessment and independent assessments of work processes and operations shall be undertaken to assure quality of performance. Self-assessment shall be performed by the Quality Assurance Officer assigned to the MPA Geotechnical Investigation. Self-assessment activities shall encompass technical and procedure requirements, and may be conducted at any point in the project.

At a minimum, one surveillance shall be conducted, consisting of monitoring/observing on-going project activity and work areas to verify conformance to specified requirements. Surveillance shall be planned and documented in accordance with Section 12.3 of the SCQ.

8.0 PROJECT SCHEDULE

The project schedule for this field activity is summarized in Appendix I.

APPENDIX A

FIGURES AND TABLES

Figure A-1 Boring and Cone Penetrometer Probe Locations

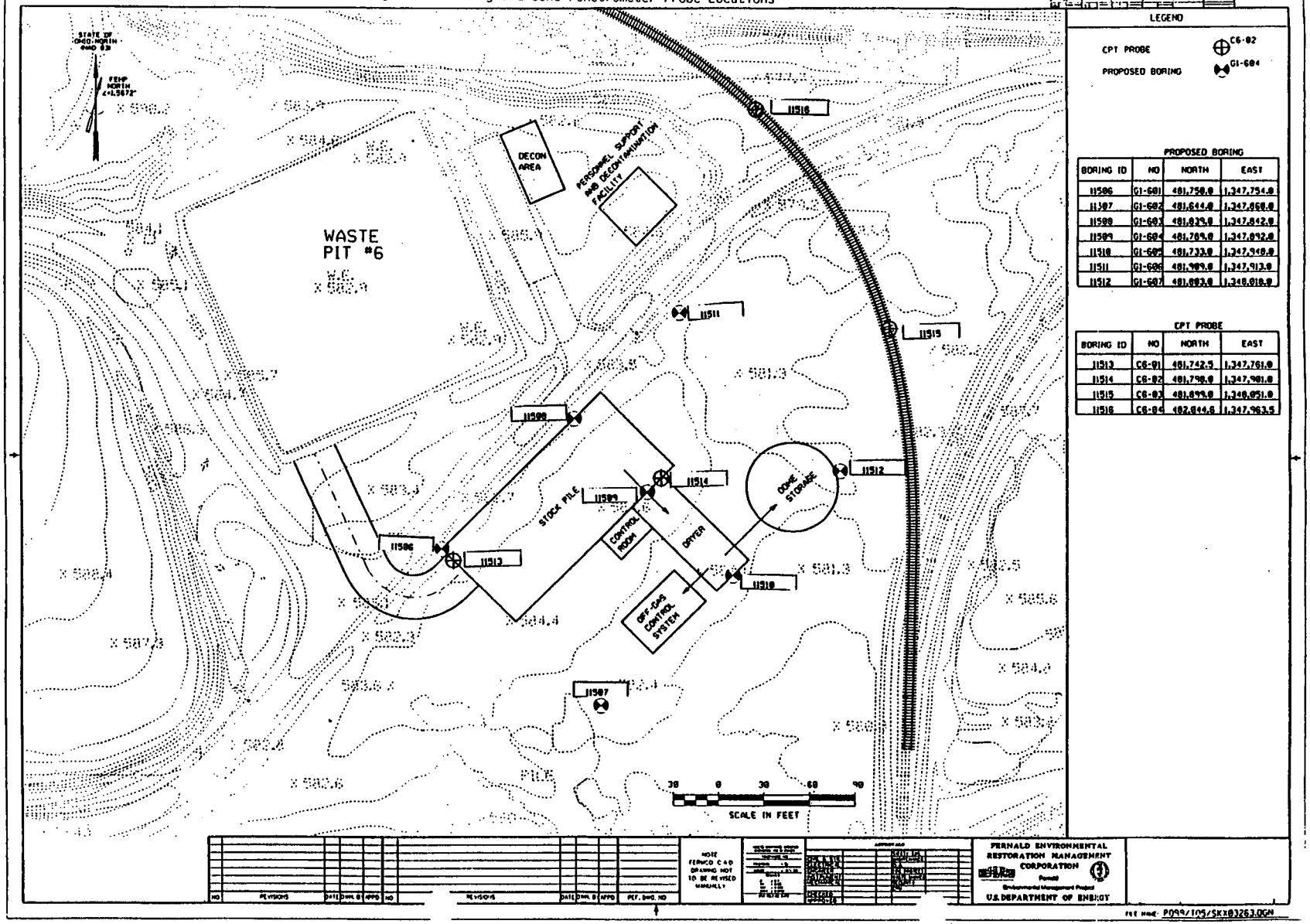
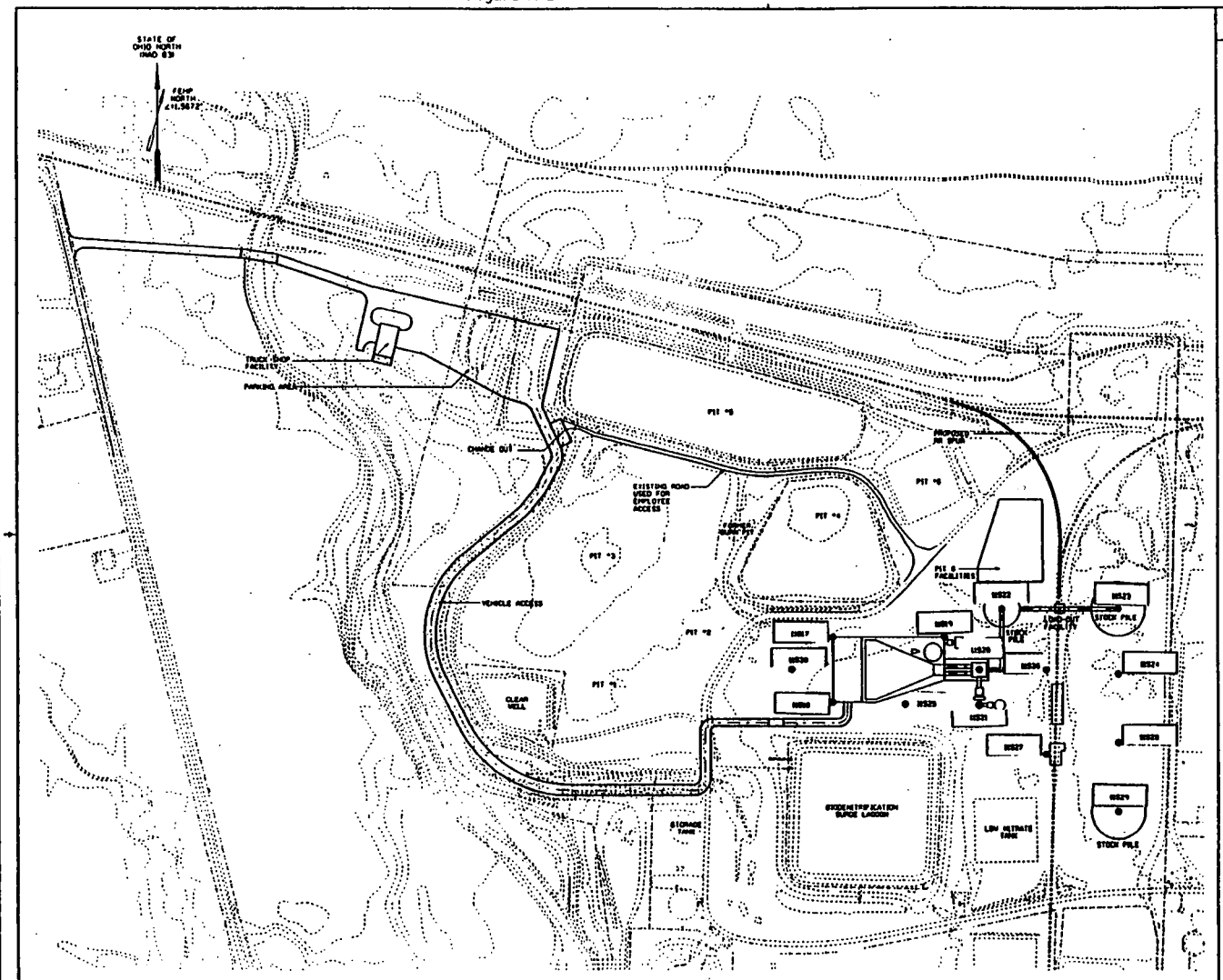


Figure A-2 Cone Penetrometer Probe Locations



LEGEND

CPT PROBE ● CS-05

CPT PROBES

BORING ID	HO	NORTH	EAST
[illegible]	CS-05	[illegible]	[illegible]
[illegible]	CS-06	[illegible]	[illegible]
[illegible]	CS-07	[illegible]	[illegible]
[illegible]	CS-08	[illegible]	[illegible]
[illegible]	CS-09	[illegible]	[illegible]
[illegible]	CS-10	[illegible]	[illegible]
[illegible]	CS-11	[illegible]	[illegible]
[illegible]	CS-12	[illegible]	[illegible]
[illegible]	CS-13	[illegible]	[illegible]
[illegible]	CS-14	[illegible]	[illegible]
[illegible]	CS-15	[illegible]	[illegible]
[illegible]	CS-16	[illegible]	[illegible]
[illegible]	CS-17	[illegible]	[illegible]
[illegible]	CS-18	[illegible]	[illegible]

NOTE: FERNCO CAD DRAWING NOT TO BE REVISED MANUALLY

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

U.S. DEPARTMENT OF ENERGY

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APPENDIX B

DATA QUALITY OBJECTIVE

NOTE 1: This copy of the Data Quality Objectives is an uncontrolled document. Verify current revision is being used prior to implementation.

NOTE 2: The DQO for this project is approved but has not been issued. Upon issuance the DQO will be distributed for incorporation as Appendix B into this plan.

Fernald Environmental Management Project

Data Quality Objectives

Title: Modular Process Areas Geotechnical Testing

Number: GT-005

Revision: 0

Effective Date: 10/14/94

Contact Name: Dan Stropes

Approval: _____ *Date:* 10/19/94
DQO Coordinator

Rev #	0				
Date	10/14/94				

Data Quality Objectives for Modular Process Areas Geotechnical Testing

1. State the Problem or the Situation to be Resolved

The Operable Unit 1 Dewatering Excavation Evaluation Project (DEEP) Treatability Study Work Plan has been amended to include the collection of remedial design information related to proposed waste processing and handling facilities within Operable Unit 1. These facilities, or Modular Process Areas (MPAs), will support the removal of excavated pit wastes, associated wastes processing storage and transportation systems, and other modular facilities ancillary to the drying of pit waste.

This Data Quality Objective (DQO) is necessary to acquire the required MPA facilities' remedial design geotechnical information for the purpose of foundation design. Figures 1 and 2 show the locations of the proposed MPA facilities. Resolution of the lack of remedial design information will consist of performing an intrusive sampling series of Standard Penetration Tests (SPT) and Cone Penetrometer Tests (CPT) in the area of interest. Figures 1 and 2 show the proposed SPT borings and CPT samplings locations.

The Operable Unit 1 MPAs consist of three locations where dryer system storage, handling and shipment components will be located. The work to be performed under this DQO consists of all three MPA components.

MPA waste processing and handling support facilities components include the following:

- Stock pile Storage Pad
- Control Room
- Dryer
- Off-gas Control System
- Wastes Dome Storage Facility
- Load out Hopper
- Load out Facility
- Personnel Support and Decontamination Facility
- Decontamination Area
- Interim Box Storage Pad
- Rail line

Available subsurface data from the vicinity of the proposed MPA facilities does not contain sufficient information for engineering design purposes. No geotechnical investigations within the Operable Unit 1 area which provide the necessary data have been previously conducted, therefore, new data will need to be collected.

To characterize the nature of the surface and subsurface of MPA sites prior to construction of the support facilities' foundations, geotechnical studies of the soil, subsoil, and glacial overburden shall be performed. These studies will determine the physical properties of the geologic materials required for wastes processing support facility foundation design considerations.

The surface of the area of investigation consists of roads, rail lines, ditches and fill areas. Surface elevation ranges from 575 to 585 feet. Much of the naturally occurring near-surface and surface materials have been disturbed by past FEMP activities. These disturbances include both material removal and filling. A natural well-developed soil/subsoil horizon may not be present, or may be buried at SPT and CPT locations.

Geology in the area of investigation consists, from below the surface materials, of glacial overburden which ranges from 30 to greater than 40 feet in thickness. The glacial overburden consists of a variety of glacial-fluvial deposits, including perched water units, sand and gravel lenses, tills, and lacustrine sediments. At the base of the glacial overburden is a gradational contact into the underlying vadose zone of the Great Miami Aquifer fluvial sediments. Lithologic information shows that the general sequence in the vicinity is comprised of clay with interbedded silt, sand, and gravel.

The DEEP Treatability Study is driven by the terms of Section XII.D.1 and D.2 of the Amended Consent Agreement between the Department of Energy (DOE) and the U.S. Environmental Protection Agency (USEPA). The MPA facilities proposed, and the geotechnical information required under this investigation are driven both by the remedial design information necessary in the Operable Unit 1 Remedial Investigation/Feasibility Study, Preferred Remedial Alternative, and the DEEP Treatability Study Work Plan.

2. Identify the Decisions to be Made that Affect the Situation

A. Standard Penetration Test (SPT) Borings

Geotechnical borings for this investigation will provide geotechnical information for the MPA facility foundations' suitability and design. SPT boring, will be performed using, in the following order, a split spoon sampler, a Shelby, Piston, or Dennison sampler, as appropriate, to obtain undisturbed samples. The sampling sequence is described in Figure 3. Boring installation will be performed with an auger drilling rig.

MPA project field staff, consisting of a geologist, sampling technicians, and drillers, will perform the field sample collection activities according to Table 1 of this DQO.

Based upon the laboratory and field results of geotechnical boring SPT testing, decisions about the MPA foundation requirements will be used to size and determine the type of foundation necessary. The type of material encountered will determine foundation types. Clay materials will possibly require drill piers or spread footings; sand materials will possibly require mat or spreading footing foundations.

B. Cone Penetrometer Tests (CPT) Samplings

CPT uses a hydraulic ram to push a steel rod equipped with a cone-shaped tip. Load cells in the probe body measure characteristics of the materials being penetrated by the amount of tip and frictional stress measured. The resultant information is transmitted to integrated on-board computers.

CPT samplings will provide tip, sleeve, and pore pressure measurements for the soil and subsurface materials penetrated. Based upon the laboratory and field results of geotechnical CPT testing, decisions about the MPA foundation requirements will be used to size and determine the type of foundation necessary. The type of material encountered will determine foundation types. Clay materials will possibly require drill piers or spread footings; sand materials will possibly require mat or spreading footing foundations.

CPTs for this investigation will be performed in three areas within Operable Unit 1. These areas include the proposed MPA facilities near Waste Pit 6, and East of Waste Pit 2, and the area in the vicinity of the new rail line. CPT samplings will be performed with a Site Characterization and Analysis Penetrometer System (SCAPS) unit.

CPT samplings will provide design information as follows; 1. the CPT data will be used to correlate all project CPT data to SPT data, 2. the CPT data will provide information to be used as a basis for soil strength for foundation and rail line design.

Based on the field results of CPT samplings, decisions about the strength of the sub-base for the new rail line, MPA facility foundations, and correlation of the CPT data with the SPT data within the MPA will be made.

3. Identify Inputs that Affect the Decision

Inputs which affect the decision include the following:

SPT Borings - Laboratory analysis results of the following soil tests will provide input to the decision making process:

- Grain size distribution
- Atterberg limits
- Moisture contents
- Unconfined compressive strength test
- Consolidated undrained triaxial compression test with pore pressure measurements
- Five point standard and modified proctor test
- California Bearing Ratio

The analysis results of these tests will enable the Operable Unit 1 engineering staff to make sound decisions about the sizes and types of foundations for the MPA facility and the design of transportation systems at waste processing support facility construction sites.

A total of seven SPT borings will be advanced into the subsurface in the MPA locations shown on Figure 1. Seven SPT borings are proposed by Operable Unit 1 engineering as an optimum number of borings for geotechnical characterization purposes. Each boring will be advanced to a depth of 30 feet. The depth of 30 feet has been determined to be an adequate depth to characterize the geotechnical information necessary from the

soil, subsoil, and geologic materials contained within the glacial overburden. A total of 90 samples will be collected for geotechnical analysis.

CPT Samplings - The CPT samplings will provide tip, sleeve, and pore pressure measurements for the soil material in the vicinity of the MPA and rail line locations. This information will be used to correlate the SPT and the CPT information within the MPA facilities. Also, the CPT data will be used to check the strength of the sub-base material below the MPA foundations and the rail line.

A total of 18 CPT samplings will be performed, within the MPA locations and along the rail line, as shown on Figure 1. The 11 CPTs in the MPA locations will be advanced to a depth of 30 feet. To avoid potentially penetrating the base of the glacial overburden, three CPT samplings, as shown on Figure 2, will be advanced to a depth of 25 feet. The remaining four CPTs in the rail line area will be advanced to a depth of 20 feet.

The 18 CPT samplings are proposed by Operable Unit 1 engineering as an optimum number of CPT samplings for geotechnical characterization purposes. The corresponding 11 samplings to a depth of 30 feet, have been determined to be adequate depths to characterize the geotechnical information necessary from the soil, subsoil, and geologic materials contained within the glacial overburden, given the anticipated loads of the facilities. The three CPT samplings to a depth of 25 feet, have been determined to be adequate depths to characterize the geotechnical information necessary from the soil, subsoil, and geologic materials contained within the glacial overburden, given the anticipated loads of the proposed facilities. The corresponding four CPT samplings to a depth of 20 feet, have been determined to be adequate depths to characterize the geotechnical information necessary from the soil, subsoil, and geologic materials contained in the glacial overburden, given the anticipated lighter loads of rail traffic relative to the facilities.

4. Define the Boundaries of the Situation

Boundaries to this project include both horizontal and vertical. The upper boundary of the area of investigation is the material present at the surface within the MPA locations. The lower boundary of the area of investigation is the base of the glacial overburden. SPT and CPT geotechnical sampling results will characterize changes caused by the occurrence and distribution of surface and subsurface materials, naturally occurring (glacial overburden, soil/subsoil profile), and manmade (disturbed or fill areas), which cause horizontal and vertical boundary variations.

The base of the glacial overburden is a boundary which serves as a barrier to possible cross contamination of the GMA from overlying glacial overburden materials. SPT boring and CPT sampling depths were selected to minimize the possibility of breaching the base of the glacial overburden. All intrusive samplings are to be completed at least five (5) feet above the known location of the base of the glacial overburden. Additionally, all SPT and CPT holes will be plugged and abandoned in accordance with SCQ and State of Ohio requirements.

Horizontal boundaries define the specific horizontal dimensions of the area under investigation. However, horizontal boundaries can be identified by correlation of sampling information obtained from the subsurface SPT drilling and CPT samplings program. Examples of horizontal subsurface boundaries include those zones of materials encountered with the same or similar physical characteristics and properties, which would logically justify the grouping of these zones into discrete mappable units. Examples of these discrete zones anticipated to be encountered include:

- Disturbed surface areas
- Fill locations
- Soil horizons
- Subsoil horizons
- Weathered zones
- Glacial till sequences
- Clay zones
- Fluvial (water) sediments
- Lacustrine (lake) sediments
- Perched water bodies
- Sand/gravel lenses

Vertical boundaries define the specific vertical dimensions, or depths, of the SPT borings and CPT samplings, including the subsurface, to their total depths. Subsurface interpretation of the discrete zones anticipated will be enhanced and supported or refuted by the sequence and distribution of vertical information about materials encountered during SPT boring and CPT samplings.

SPT borings and CPT samplings will be performed within the Northeast corner of Operable Unit 1 and the corresponding Northwest corner of Operable Unit 3. All field work will take place within the fenced Waste Pit Area. Dimensions of the area of investigation are defined by a rectangular area approximately 900 feet by 1000 feet.

Temporal boundaries for this project include weather and access. Performance of the SPT and CPT work during inclement weather causes numerous logistical problems related to drilling rig, equipment, and project personnel access. Additionally, the Operable Unit 1 area has surface radiological contamination which could potentially be spread more easily if the field work were performed during rainfall and subsequent uptake of contaminated mud by equipment and personnel in the area. This condition could potentially result in a higher risk of exposure of equipment and personnel, thus leading to unanticipated or irregular decontamination problems.

5. Develop a Logic Statement

The DEEP Treatability Study Geotechnical Investigation, which is designed to provide supporting data to evaluate the effectiveness of the waste pits dewatering process, will be amended to include foundation investigations for the waste processing area components. Analytical results of the geotechnical testing proposed will determine the

suitability of the proposed waste processing modules. This geotechnical investigation information is vital to evaluating the waste processing support location site's engineering suitability and providing related component design information.

All project information obtained during this field and laboratory investigation will be used by Operable Unit 1. However, the results will be available to other data users at the FEMP.

If, during SPT drilling and CPT sampling, an obstruction is encountered which the auger or probe cannot penetrate, then the rig will be relocated a minimum of five (5) feet, and a new location will be established.

If, following geotechnical testing, physical property results show the waste processing support facility location is unsuitable, that location will be further evaluated to determine if an engineered solution can be implemented during construction. If an engineered solution is determined to be impossible, then a new location will be selected and investigated.

If geotechnical analysis results are within acceptable soils strength criteria for the MPA components proposed, Operable Unit 1 engineering staff will develop the necessary component design and foundation information.

6. Establish Constraints on the Uncertainty of the Decision

Individual errors will be controlled by performing a thorough review of the sampling plan with project geologists, sampling technicians, drillers and other assigned project personnel. Technical guidance will be provided by Operable Unit 1 project and health and safety staffs during drilling, sampling and CPT operations.

Collection of undisturbed geotechnical samples is critical to the assessment of suitability of the area to the modular process area components. All samples collected are considered to be necessary for successful interpretation. However, if sampling from a boring is inadequate, then another nearby boring may be drilled, or additional sampling from another boring may be performed. Also, if either SPT or CPT results interpretation are not possible, it is likely that results from other sampling locations will serve as an effective substitute.

To ensure the collection of undisturbed samples, all SPT boring sampling will be performed in accordance with applicable American Society for Testing and Materials (ASTM) standards.

ASTM appropriate and applicable field standards include:

- D 1586-84, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils"
- D 1587-83, "Standard Practice for Thin-Walled Tube Sampling of Soils"

- D 4700-91, "Standard Guide for Soil Sampling from the Vadose Zone"

CPT samplings will be performed in accordance with ASTM standard:

- D 3441-86, "Standard Test Method for Deep, Quasi-Static, Cone and Friction-Cone Penetration Tests of Soil"

Geotechnical testing for material physical properties will be conducted under the appropriate ASTM standards. Laboratory handling, analysis and reporting of sample results will be done in accordance with applicable procedures using qualified geotechnical laboratory technicians, and properly calibrated apparatus which meet ASTM D 3740-80, "Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil Rock as Used in Engineering Design and Construction."

ASTM appropriate and applicable laboratory standards include:

- D 2166-91, "Standard Test Method for Unconfined Compressive Strength of Cohesive Soil"
- D 2435-90, "Standard Test Method for One-Dimensional Consolidation Properties of Soils"
- D 422-63, "Standard Test Method for Particle-Size Analysis of Soils"
- D 4318-84, "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"
- D 2216-92, "Standard Method for the Laboratory Determination of Water Content of Soil, Rock, and Soil-Aggregate"
- D 1883-92, "Standard Test Method for California Bearing Ratio of Laboratory-Compacted Soils"
- D 4767-88, "Standard Test for Consolidated-Undrained Triaxial Compression Test on Cohesive Soils"

To eliminate the creation of contaminant pathways into the subsurface, all SPT and CPT locations will be plugged and abandoned by using Volclay grout.

A project "false positive" is defined as an erroneous geotechnical analysis result which appears to show that the result is within acceptable limits for the MPA components proposed for that location(s) when in reality it is not. Sources of a "false positive" error include the following:

A. Improper field sample collection and handling technique(s).

B. Laboratory handling, analysis, and reporting errors.

C. Interpretation errors in the application of the geotechnical results to the engineering design information required.

D. Drilling pattern too wide to detect subsurface variation critical to foundation design.

Consequences of "false positive" errors would be the creation of improper design and foundation information for the MPA components proposed. Because the error is that the geotechnical result is within acceptable limits, the end result could be the partial or total failure of the MPA component structures and appurtenances. Ultimately the consequences of a 'false positive" would be the repair or relocation of constructed MPA components, leading to excess project cost and delayed project implementation.

A project "false negative" is defined as an erroneous geotechnical analysis result which appears to show that the result is not within acceptable limits for the MPA components proposed for that location(s) when in reality it is within acceptable limits. Sources of a "false negative" include the following:

A. Improper field sample collection and handling technique(s).

B. Laboratory handling, analysis, and reporting errors.

C. Interpretation errors in the application of the geotechnical results to the engineering design information required.

D. Drilling pattern too wide to detect subsurface variation critical to foundation design.

Consequences of "false negative" errors would be the interpretation that the MPA component site locations are inadequate and unsuitable for construction of the components. This error would lead to further MPA component siting searches, additional fieldwork to perform more geotechnical sampling, and additional laboratory analysis effort. Ultimately the consequences of a "false negative" would lead to excessive project costs and delayed project implementation.

7. Optimize a Design for Obtaining Quality Data

Data quality will be optimized by performing field activities in accordance with the Sitewide CERCLA Quality Assurance Plan (SCQ), established FEMP procedures and ASTM standards, the DEEP Treatability Study Work Plan, and the Modular Process Areas Geotechnical Sampling Project Specific Plan.

Data quality will be optimized by performing geotechnical laboratory work in accordance with ASTM standards, the DEEP Treatability Study Work Plan, and the Modular Process Areas Geotechnical Sampling Project Specific Plan. Additionally, FERMCO Quality Assurance staff assigned to Operable Unit 1 have performed a pre-work audit of the geotechnical laboratory subcontractor's quality assurance program and have found their program to be satisfactory.

Geotechnical analyses will be performed at the FEMP onsite laboratory by subcontract personnel. This will allow for ready access to subcontract staff for periodic surveillance, and will allow the subcontractor to, in turn, interact with the Operable Unit 1 and Quality Assurance staff involved in the MPA project.

Analytical Support Level (ASL) A is proposed for the geotechnical analyses necessary for the MPA project. This ASL is consistent with other geotechnical work of a similar nature which has been performed in the past on other similar projects at the FEMP.

There are no known USEPA standards or guidance for the performance of geotechnical sampling, location and numbers of geotechnical samples to be taken, or laboratory analysis and quality assurance/quality control. Thus, the need for geotechnical investigations, sampling, and laboratory analyses, which precedes the USEPA as an agency, are normally performed in accordance with ASTM standards. Laboratories performing geotechnical analyses normally are expected to be in conformance with:

- ASTM D 3740-90, "Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction."

The laboratory services subcontractor to be used for this investigation has been determined by the FERMCO Quality Assurance group to be in compliance with this ASTM standard.

To avoid the remobilization of a drilling services contractor, selected archive samples will be taken to ensure the availability of materials for analysis if required by the geotechnical laboratory.

If, during the construction phase of the MPA facilities investigation, materials which exceed inorganic, organic, or radiological contaminant action levels, as directed by FERMCO Environmental Safety and Health staff, that material will be removed prior to construction of the facility foundations.

All fieldwork will be performed in accordance with a Project Specific Plan. The plan provides detailed information relative to the SPT and CPT fieldwork, including: health and safety, drilling, field screening, sampling, sample handling, decontamination, and reporting of analysis results and other information obtained during the investigation.

The SCQ does not provide guidance for or address geotechnical sampling. Additionally, the SCQ does not require the collection of quality control samples for geotechnical analyses. However, the Data Quality Objectives process, as described in the SCQ, is addressed by the preparation and approval of this document.

1.A. Task/Description: CRU #: 1_____

Dewatering Excavation Evaluation Program (DEEP) Treatability Study, Geotechnical Investigation, Modular Process Areas Geotechnical Sampling - Standard Penetration Test (SPT) Borings and Cone Penetrometer Tests (CPT). A total of seven SPT borings and 18 CPT samplings will be performed.

1.B. Project Phase: (Put an X in the appropriate selection.)

RI ☐ FS ☐ RD ☐ RA ☐ R_vA ☐ OTHER ☒ Specify: Treatability Study

1.C. DQO No.: GT-005 DQO Reference No.: _____

---

2. Media Characterization: (Put an X in the appropriate selection.)

Air ☐ Biological ☐ Groundwater ☐ Sediment ☒ Soil ☒

Waste ☐ Wastewater ☐ Surface water ☐ Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Put an X in the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization
A ☐ B ☐ C ☐ D ☐ E ☐

Risk Assessment
A ☐ B ☐ C ☐ D ☐ E ☐

Evaluation of Alternatives
A ☒ B ☐ C ☐ D ☐ E ☐

Engineering Design
A ☒ B ☐ C ☐ D ☐ E ☐

Monitoring during remediation activities
A ☐ B ☐ C ☐ D ☐ E ☐

Other (Explain) _____
A ☐ B ☐ C ☐ D ☐ E ☐

4.A. Drivers: The DEEP Treatability Study is driven by the terms of Section XII.D.1 and D.2 of the Amended Consent Agreement between the Department of Energy and the U.S. Environmental Protection Agency.

4.B. Objective: The DEEP Treatability Study Work Plan has been amended to provide additional geotechnical information for the purposes of determining and designing foundations for the waste processing support facilities to be constructed within the Operable Unit 1 Modular Process Areas. This will be achieved by sampling proposed waste processing support facilities' construction sites to determine the suitability of the sites for the facilities to be constructed.

5. Site Information (Description):

All required SPT and CPT sampling will be conducted within the Northeast area of Operable Unit 1, and a part of the Northwest area of Operable Unit 3. SPT borings and CPT samplings will be placed in apparently undisturbed areas Southeast of Waste Pit 6, in the vicinity of the generally North-South trending existing rail line, and North of the Biodenitrification Surge Lagoon.

All seven SPT borings will be advanced to a depth of 30 feet.

Of the 18 CPT samplings, 11 will be advanced to a depth of 30 feet, 3 will be advanced to a depth of 25 feet, and the remaining 4 will be advanced to a depth of 20 feet.

DQO Number: GT-005

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and SCQ Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the SCQ Section.)

1. pH	☐	2. Uranium	☐	3. BTX	☐
Temperature	☐	Full Radiologic	☐	TPH	☐
Specific Conductance	☐	Metals	☐	Oil/Grease	☐
Dissolved Oxygen	☐	Cyanide	☐		
		Silica	☐		
4. Cations	☐	5. VOA	☐	6. Other (specify)	
Anions	☐	ABN	☐	Geotechnical	
TOC	☐	Pesticides	☐		
TCLP	☐	PCB	☐		
CEC	☐				
COD	☐				

6.B. Equipment Selection and SCQ Reference:

Equipment Selection — Refer to SCQ Section

ASL A ASTM Standards listed in PSP SCQ Section: N/A

ASL B _____ SCQ Section: _____

ASL C _____ SCQ Section: _____

ASL D _____ SCQ Section: _____

ASL E _____ SCQ Section: _____

7.A. Sampling Methods: (Put an X in the appropriate selection.)

Biased	☐	Composite	☐	Environmental	☐	Grab	X	Grid	☐
Intrusive	X	Non-Intrusive	☐	Phased	☐	Source	☐		

Other (specify): _____

DQO Number: GT-005

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples:

7.C. Sample Collection Reference: (Please provide a specific reference to the SCQ Section and subsection guiding sampling collection procedures.)

Sample Collection Reference: Section 2 of the DEEP Treatability Study Work Plan and Section 5 of the Modular Process Areas Geotechnical Sampling Work Plan identifies the ASTM standards to be used.

---

8. Quality Control Samples: (Place an "X" in the appropriate selection box.)

8.A. Field Quality Control Samples:

Trip Blanks	☐	Container Blanks	☐
Field Blanks	☐	Duplicate Samples	☐
Equipment Rinsate Samples	☐	Split Samples	☐
Preservative Blanks	☐	Performance Evaluation Samples	☐

Other (specify) N/A

8.B. Laboratory Quality Control Samples:

Method Blank	☐	Matrix Duplicate/Replicate	☐
Matrix Spike	☐	Surrogate Spikes	☐

Other (specify) N/A

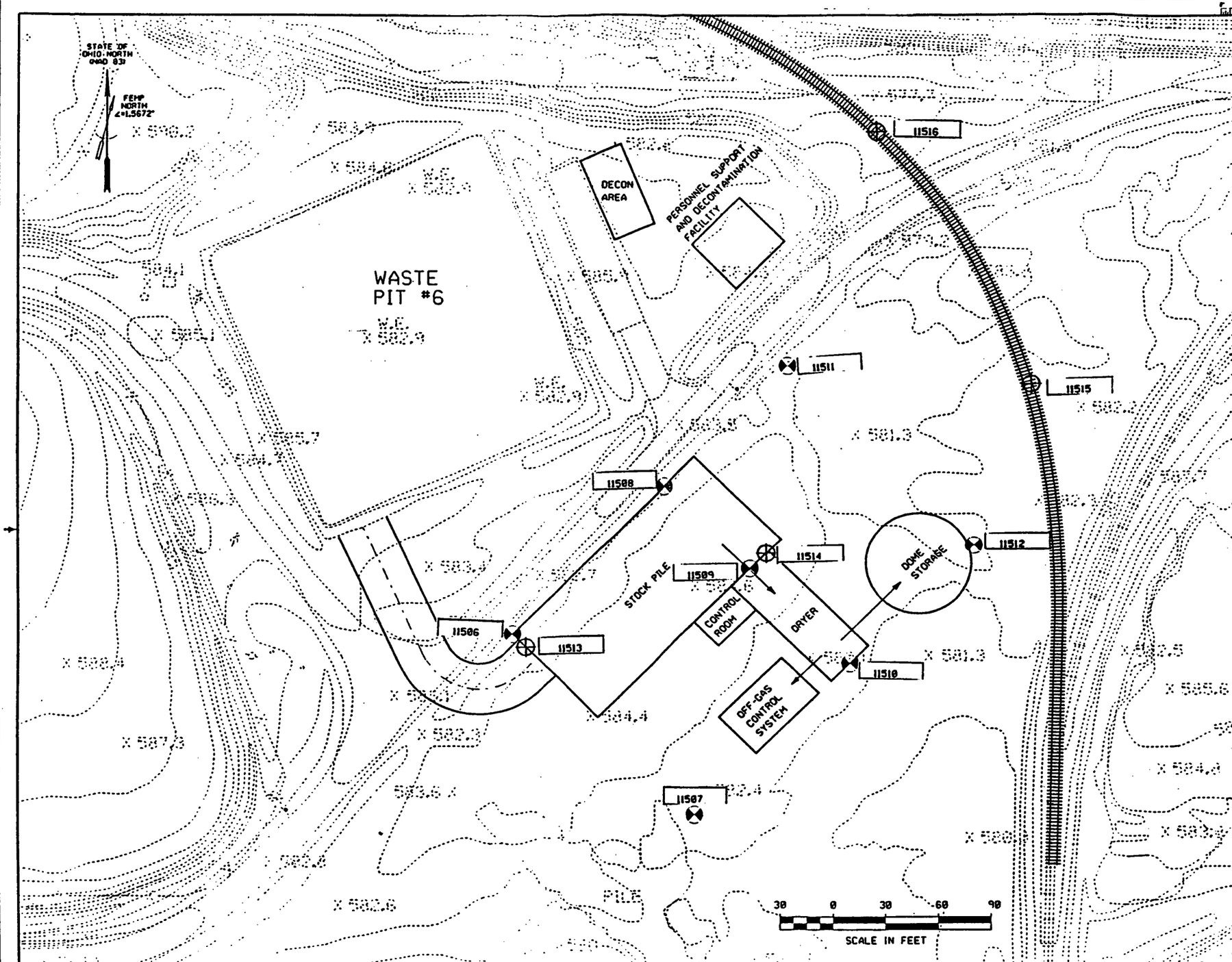
9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

FIGURE 1

MAP SHOWING SEQUENCE AND IDENTIFICATION NUMBER

OF STANDARD PENETRATION TEST AND CONE PENETROMETER TEST

LOCATIONS



LEGEND

CPT PROBE — C6-02

PROPOSED BORING — G1-604

PROPOSED BORING

BORING ID	NO	NORTH	EAST
11506	G1-601	481,750.0	1,347,754.0
11507	G1-602	481,644.0	1,347,860.0
11508	G1-603	481,839.0	1,347,842.0
11509	G1-604	481,789.0	1,347,892.0
11510	G1-605	481,733.0	1,347,948.0
11511	G1-606	481,909.0	1,347,913.0
11512	G1-607	481,803.0	1,348,018.0

CPT PROBE

BORING ID	NO	NORTH	EAST
11513	C6-01	481,742.5	1,347,761.0
11514	C6-02	481,798.0	1,347,901.0
11515	C6-03	481,899.0	1,348,051.0
11516	C6-04	482,044.6	1,347,963.5

NO	REVISIONS	DATE	DWN. BY	APPD	NO	REVISIONS	DATE	DWN. BY	APPD	REF. DWG NO

NOTE
FERMCO CAD DRAWING NOT TO BE REVISED MANUALLY

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FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald
Environmental Management Project
U.S. DEPARTMENT OF ENERGY

Figure 1: Sequence and Identification Number of SPT and CPT Locations

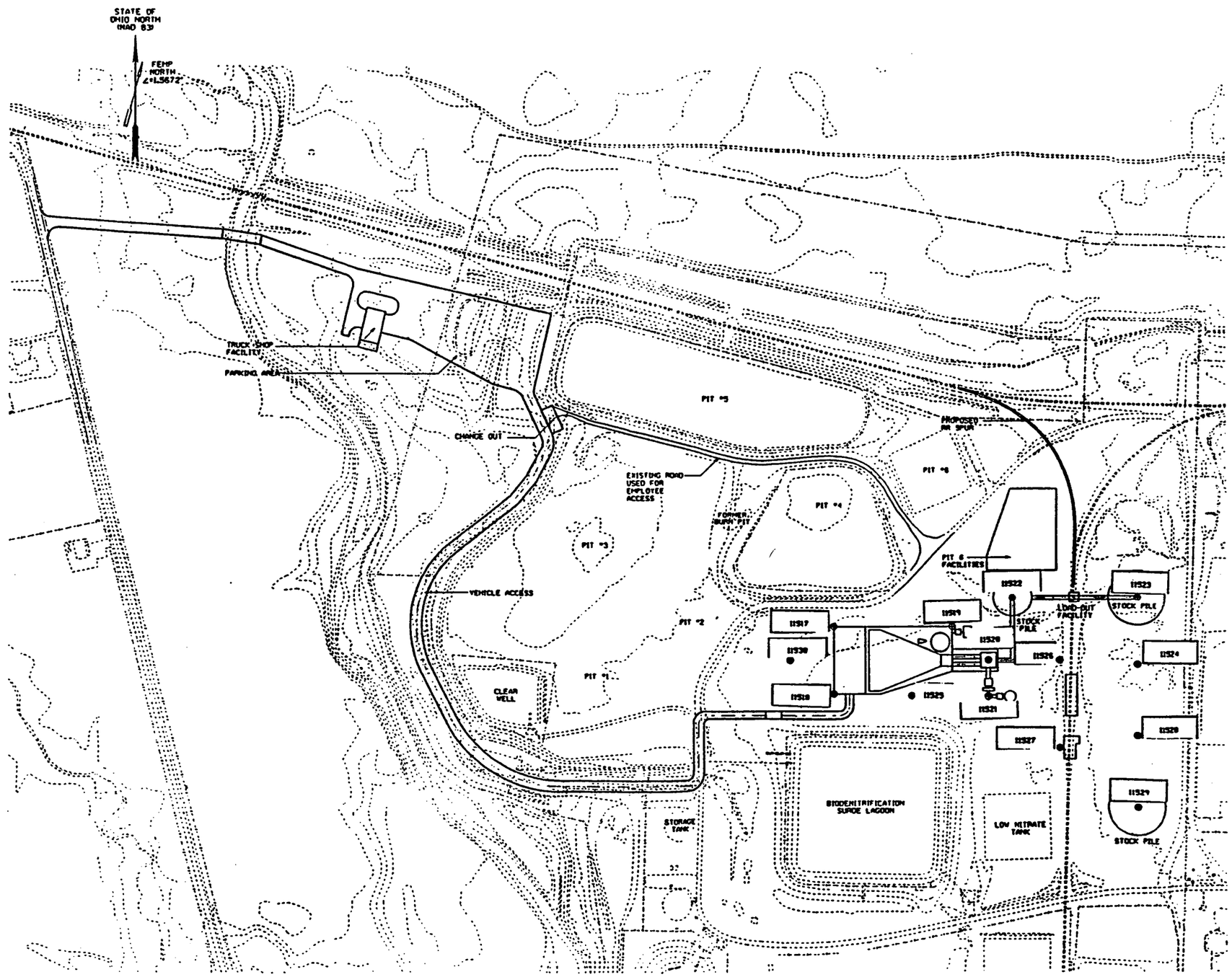
FILE NAME: P099/T05/SKX03263.DGN

FIGURE 2

MAP SHOWING SEQUENCE AND IDENTIFICATION NUMBER

OF CONE PENETROMETER LOCATIONS

000484A



LEGEND

CPT PROBE ● CS-05

CPT PROBES

BORING ID	NO	NORTH	EAST
11517	CS-05	481,499.0	1,347,436.0
11518	CS-06	481,319.0	1,347,436.0
11519	CS-07	481,499.0	1,347,746.0
11520	CS-08	481,410.0	1,347,842.0
11521	CS-09	481,311.5	1,347,841.0
11522	CS-10	481,578.0	1,347,905.0
11523	CS-11	481,578.0	1,348,226.0
11524	CS-12	481,297.0	1,348,226.0
11525	CS-13	481,314.0	1,347,638.0
11526	CS-14	481,489.0	1,348,027.0
11527	CS-15	481,174.0	1,348,027.0
11528	CS-16	481,206.0	1,348,226.0
11529	CS-17	481,015.0	1,348,226.0
11530	CS-18	481,418.0	1,347,324.0

0 50 100 250 500
SCALE IN FEET

NO.	REVISIONS	DATE	DWN. BY	APPD.	NO	REVISIONS	DATE	DWN. BY	APPD	REF. DWG NO.

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

APPROVALS

CIVIL & STR		SAFETY ENG.	
ELECTRICAL		MAINTENANCE	
ENGINEER		Q.A.	
INSTRUMENT		ERE PROJECT	
MECHANICAL		WASTE MANAG.	
		SECURITY	
		CRU	
CHECKED			
APPROVED			

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

Figure 2: Sequence and Identification Number of Cone Penetrometer Locations

FILE NAME: /PD99/1095/SK18395.DGN

FIGURE 3

SAMPLING TYPE AND SAMPLING INTERVALS

OF

STANDARD PENETRATION TEST BORINGS

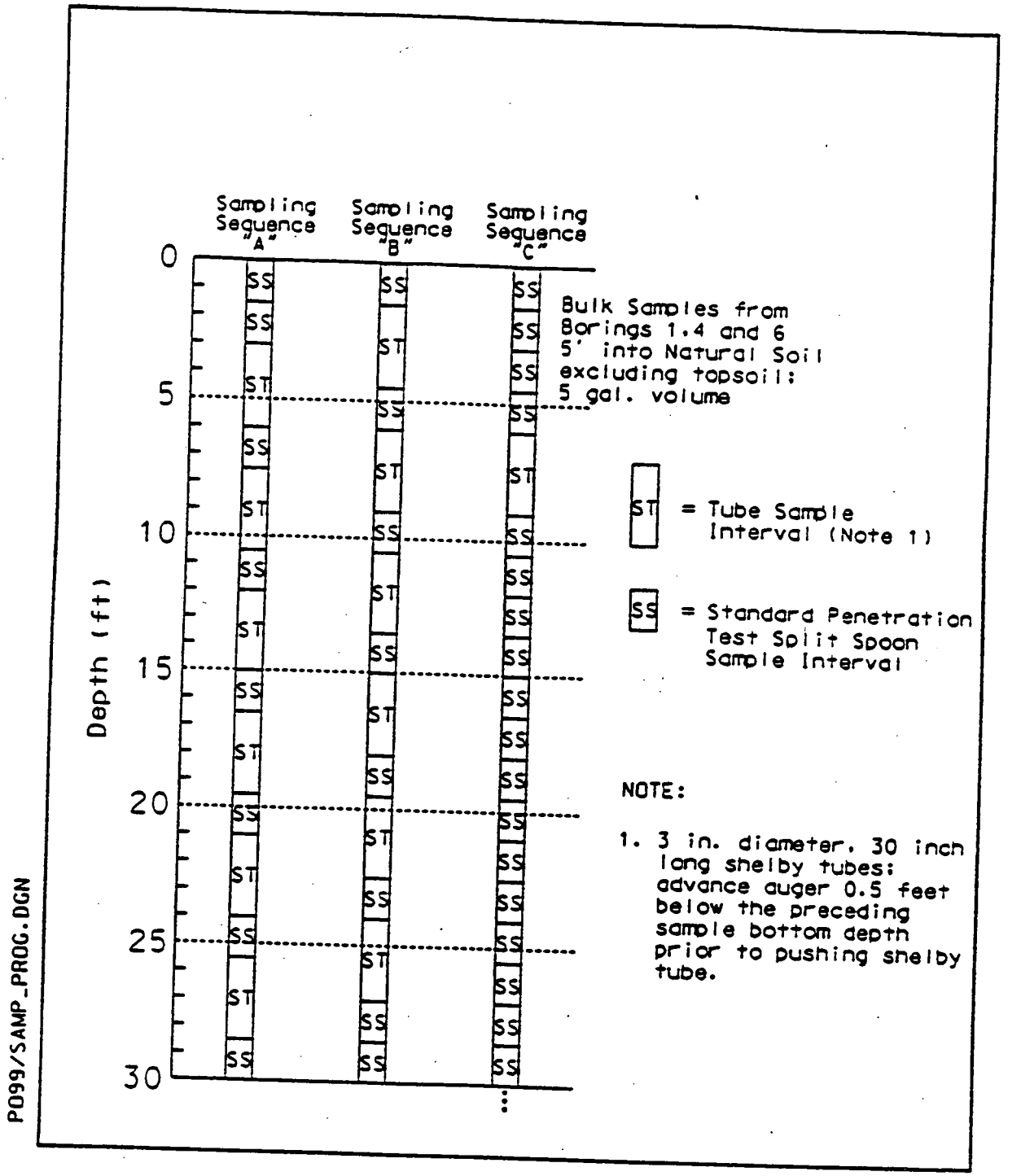


FIGURE 3 SAMPLE TYPE AND SAMPLING INTERVALS

TABLE 1

ESTIMATED DRILLING, SAMPLING AND GEOTECHNICAL TESTING REQUIREMENTS FOR PROPOSED OU1 WASTE DRYING AND PACKAGING FACILITY

Table 1 - Estimated Drilling, Sampling and Geotechnical Testing Requirements for Proposed OU1 Waste Drying and Packaging Facility

Boring No.	Purpose	Boring Depth (ft)	Sample Sequence (See Fig. 3)	Approximate Depth Interval (ft)	BULK Samples	Natural MC	AL	GS	UCS	TX-CUpp	Consol.	Std. Proc.	Mod. Proc.	CBR
1	Foundation Analysis and Design, Road Design	30	A	0 - 10	1	1	1	1	1			1		1
				10 - 20		1	1	1						
				20 - 30		1	1	1			1			
2	Foundation Analysis and Design	30	B	0 - 10		1	1	1			1			
				10 - 20		1	1	1						
				20 - 30		1	1	1	1					
3	Foundation Analysis and Design,	30	B	0 - 10		1	1	1	1					
				10 - 20		1	1	1		1	1			
				20 - 30		1	1	1			1			
4	Foundation Analysis and Design,	30	C	0 - 10	1	1	1	1	1		1		1	
				10 - 20		1	1	1						
				20 - 30		1	1	1						
5	Foundation Analysis and Design	30	A	0 - 10		1	1	1			1			
				10 - 20		1	1	1		1	1			
				20 - 30		1	1	1	1					
6	Foundation Analysis and Design, Road Design	30	A	0 - 10	1	1	1	1			1	1		1
				10 - 20		1	1	1						
				20 - 30		1	1	1	1					
7	Foundation Analysis and Design	30	B	0 - 10		1	1	1	1					
				10 - 20		1	1	1						
				20 - 30		1	1	1			1			
TOTAL:		230			3	21	21	21	7	2	9	2	1	2

Explanation for Table 1:

BULK Samples = Number of Bulk samples (5 gal. drum, typical) of auger cuttings
MC = Moisture Content Test (ASTM D 2216)
AL = Atterberg Limits Test (ASTM D 4318)
GS = Grain Size Analyses (ASTM D 422 and ASTM D 1140). Note: These analyses shall include Specific Gravity Tests (ASTM D 854) for each different type of soil material encountered
UCS = Unconfined Compressive Strength Tests (ASTM D 2166)
TX-CUpp = Consolidated, Undrained Triaxial Compression Test with Pore Pressure Measurements (ASTM D 4767)
Consol. = One-Dimensional Consolidation Test (ASTM D 2435)
Std. Proc. = Standard Proctor Compaction Test (ASTM D 698). Note: The compaction curve should consist of 5 points. Standard Proctor tests will be conducted on bulk (drum) samples of auger cuttings.
Mod. Proc. = Modified Proctor Compaction Test (ASTM D 1557). Note: The compaction curve should consist of 5 points. Modified Proctor tests will be conducted on bulk (drum) samples of auger cuttings.
CBR = California Bearing Ratio Test (ASTM D 1883). Note: CBR tests will be conducted on bulk (drum) samples of auger cuttings.

Notes for Table 1:

1. The number of tests to be performed and the depth interval for the test within the boring are estimates only. The actual samples selected for laboratory will be specified by the Field Geotechnical Engineer based on conditions encountered in the field. For example, if a low-strength, compressible natural strata is encountered during field penetration testing, the Field Geotechnical Engineer will specify laboratory tests (i.e, strength and consolidation) for samples of the material.
2. See FERMCO Figure entitled "Civil - Proposed Boring Locations Waste Pit #6 Area" for boring locations. Figure 1 shows the proposed sampling sequence. Laboratory tests should be assigned to specific samples by the field Geotechnical Engineer to provide areal and elevational distribution of samples to be tested for the site. Adequate coverage of strata encountered should also be considered.
3. For Boring No. 4, collect bulk (drum) sample of auger cuttings. Perform UCS (ASTM D 2166) and Consolidation (ASTM D 2435) tests on remolded (95% Modified Proctor, at or near optimum moisture content) test specimens of the bulk sample from the boring.
4. Depth is approximate. Boring No. 4 will be advanced approximately 5 feet into the sands and gravels of the Great Miami Aquifer Formation.
5. Standard Penetration Test (SPT) (ASTM D 1586) will be performed in conjunction with sampling with 18-in. sample intervals. The samples will be visually classified (ASTM D 2488) by the field Geologist.
6. Thin-walled sampling will be conducted per ASTM D 1587 with 3-in. diameter, 30 inch long Shelby tubes. Advance auger 0.5 ft below the preceding sample bottom depth prior to pushing Shelby tube
7. Where lenses of sand or gravel are encountered within the till, the split spoon sampler should be used to obtain samples for grain size distribution and Atterberg Limits tests. SPT Blowcounts will be logged per ASTM D 1586. These data provide information regarding liquefaction potential of the material.
8. The laboratory tests listed in this table will be performed primarily on sample material obtained from Shelby tube samples. It is desirable to perform Atterberg Limits tests in conjunction with Grain Size Analysis Tests to allow for classification of soils for engineering purposes (ASTM D 2487). Grain size analysis and Atterberg limits tests should be performed on the samples undergoing physical properties testing (UCS tests, Consolidation tests, Proctor tests and CBR tests)
9. The TX-CUpp tests will consist of individual tests on three specimens from a Shelby Tube Sample conducted at three different confining pressures. The confining pressures will be specified by communication with the Geotechnical Testing Laboratory. The confining pressures should consider the existing overburden pressure at the sample's depth.

APPENDIX C

EQUIPMENT LIST

APPENDIX C
EQUIPMENT LIST

Required Documents

General Work Permit
Penetration Permit
Health and Safety Plan
Radiological Worker Permits
Training Certification Card
Radiological Survey
Equipment Inspection for Rig
Project-Specific Plan

Transportation

2 DOE vehicles

Blank Forms

Tailgate Safety Meeting
FAL
Lithologic Log
Sample Collection Log
SWAR/CR
Material Evaluation Forms

Storage

Metal Clipboard Box
File Box

Meters and Detectors

Pancake Geiger Mueller Detector (Frisker)
Photoionization Detector (PID)

Emergency Equipment and Supplies

Cellular Phone
Radio
Emergency Eyewash Station
5-10 Extra Gallons of De-Ionized Water for Emergency Decontamination
First Aid Kit

Geological Supplies

Munsell Color Chart
Pocket Penetrometer

Investigation-Derived Waste Supplies

Plastic Trash Bags
55-Gallon Steel
Drums Stencils
White & Black Spray Paint
drum stencil
oak pallets

Sampling Supplies

2-inch split-spoon traps
5-gallon buckets
500 ml clear glass jars
Sample Labels
Custody Tape
Permanent Markers
Pens

Miscellaneous Tools

Scissors
Screwdriver
Hammer
Box Knife

Exclusion Zone Supplies

Caution Tape
Wooden Stakes
Danger/Caution Signs/Flags/Stanchions

Decontamination Supplies

Alconox
Large elbow-length Nitrile Gloves
Brushes
Stainless Steel Water Sprayer
De-Ionized Water
Chemical wipes
Large tubs for cleaning sampling equipment

Tape and Plastic

Silver Duct Tape
Yellow Radiological Tape
Wide Clear Tape
Roll of Clear Plastic Sheeting
Custody Tape

Personal Protective Equipment (PPE)

Steel-Toed Boots
Hard Hat
Safety Glasses
Dosimeter
Latex Gloves
Cotton Glove Liners
Leather Work Gloves

APPENDIX D

STANDARD OPERATING PROCEDURES

Note: These copies of Standard Operating Procedures are uncontrolled documents. Please verify that current copies are being used.

FERMCO	SITE CHARACTERIZATION AND DATA MANAGEMENT (SCDM) DEPARTMENT PROCEDURES	PROC. NO: SCDM FO-001
		EFFECTIVE DATE: 5/20/94
		REV. NO: 0
		PAGE 1 OF 53

PROCEDURE APPROVAL

PROCEDURE TITLE: PROCEDURE FOR AUGER DRILLED BORINGS AND SOLIDS SAMPLING WITH A SPLIT-BARREL OR THIN-WALLED TUBE

PROCEDURE NUMBER: SCDM FO-001

UNCONTROLLED

PREPARED BY: Dan Stropes — SUBJECT EXPERT(S)/TECHNICAL WRITER(S) — 5/20/94 DATE

APPROVAL: DEPARTMENT MANAGER — 5/20/94 DATE

APPROVAL: DIVISION MANAGER — 5/20/94 DATE

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REVISION SUMMARY

Revision	Date	Description of Revision
Draft	4/20/94	New procedure for Auger Drilled Borings and Solids Sampling with a Split-Barrel or Thin-Walled Tube
0	5/20/94	Changed from a Division procedure to Department procedure

Title: PROCEDURE FOR AUGER DRILLED BORINGS AND SOLIDS SAMPLING WITH A SPLIT-BARREL OR THIN-WALLED TUBE	PROCEDURE NO: SCDM FO-001	
	Date: 5/20/94	Revision No: 0
COMPLIANCE WITH THIS PROCEDURE IS MANDATORY WHEN EXECUTING ACTIVITIES WITHIN ITS SCOPE	Page 3 of 53	

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1.0 PURPOSE

This procedure establishes methods for the drilling of borings and the recovery and sampling of solid soil, subsoil, and waste materials utilizing the hollow-stem auger drilling technique by employee and subcontractor personnel of the Fernald Environmental Restoration Management Corporation (FERMCO), Environmental Division, Site Characterization and Data Management (SCDM) Department, at the Fernald Environmental Management Project (FEMP). It provides accurate specifications to confirm that all aspects of the auger drilled borings, solid soil/waste material recovery and sampling are satisfactory, documented, and verifiable.

2.0 SCOPE

This procedure provides guidance to all FERMCO SCDM employees and subcontractor personnel during the performance of Comprehensive Environmental Response Compensation and Liability Act (CERCLA)/ Resource Conservation and Recovery Act (RCRA) site characterization field work. Such site characterization field work consists of utilizing the hollow-stem auger drilling technique for borings, recovery, and sampling of solid soil/waste material from within glacial overburden sediments and waste collection areas contained within glacial overburden sediments at and in the vicinity of the FEMP.

3.0 DEFINITIONS

Auger Drilling Technique - Drilling method characterized by the use of a drill rig, and a series of hollow stem auger flights, which allow the penetration of geologic/waste materials for the investigation of the nature of the subsurface, the presence of perched water, and of unconsolidated strata.

Data Quality Objectives - Qualitative and quantitative statements which specify the quality of the data required to support decisions during remedial response activities.

Drilling Personnel - FERMCO subcontractor personnel who are employed by an FEMP drilling services subcontractor and who are directly assigned to the daily operation of a drill rig.

Geologist-In-Charge - A person who is qualified, by a combination of education and experience in the science of geology, to directly manage an FEMP field operations project.

Glacial Overburden - Unconsolidated geologic strata consisting of materials derived from, deposited by, or created from the actions of glacial processes. Such materials consist of soils, subsoils, loess, lacustrine, sand, gravel, and glacial erratic commingled geologic strata. These materials are usually encountered at the land surface and, if present, are located physically and stratigraphically above pre-existing sediments of the Great Miami Aquifer. At the FEMP, glacial overburden sediment corresponds in elevation to the Type 1 soil boring zone.

3.0 DEFINITIONS (CONT.)

N-Value - The blowcount representation of the penetration resistance of the soil. The N-value, reported in blows per foot, equals the sum of the number of blows required to drive the sampler over the depth interval of 6 to 18 inches.

Notice-To-Proceed - Formal notification, in writing, from a designated responsible DOE-FN/FERMCO employee assigned to the auger drilled boring project, allowing and authorizing commencement of a field project.

Project-Specific Plan (PSP) - Scoping documents required for any media sampling program or project. Project-specific plans for FEMP sampling and analysis activities include elements defined in Section 6 of the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ). Project-specific plans may include but are not limited to, work plans, field sampling plans, Health and Safety Plans, and standard operating procedures.

Sampler Head - Device which serves to couple a thin-walled tube to insertion equipment and, together with the thin-walled tube, comprises the thin-walled tube sampler.

Sampling Technicians - A person who is qualified, by a combination of education and experience in the area of environmental science, to perform daily routine duties of field projects at the FEMP which require the sampling of various environmental media and necessary documentation associated with the sampling.

SCQ - The Sitewide CERCLA Quality Assurance Project Plan which establishes minimum standards of performance for ongoing and future environmental sampling and analysis projects at the FEMP.

Split-Barrel Sampler - A hollow tubular sampling device driven by a 140 pound weight to retrieve representative samples from unconsolidated strata or solid waste materials. An analogous term for split-barrel also often used is split-spoon.

Standard Penetration Test (SPT) - Procedure for driving a split-barrel sampler to obtain a representative soil sample and a measure of the resistance of the soil to penetration of the sampler.

Thin-Walled Tube Sampler - Device used in conjunction with a drilling rig to obtain a representative core sample of unconsolidated strata, or solid waste material. Thin-Walled tubes shall be of a diameter range of 2 to 5 inches, a length of 36 to 54 inches, and a wall thickness range of 0.049 to 0.120 inches. An analogous term for thin-walled also often used is Shelby tube.

Waste Collection Areas - Areas where waste materials (by products) of FEMP production activities have been accumulated/deposited/stored, some in below grade "pits", some in above grade "pits".

4.0 PREREQUISITE ACTIONS

4.1 Background

The FEMP periodically has a need to bore into the soil and subsoil to determine the presence of contaminants, geology, and soil material type(s) within the Type 1, or glacial overburden, soil boring zone at and in the vicinity of the facility. In order to adequately provide auger drill rig Type 1 soil borings which meet quality assurance and quality control criteria, detailed procedures are necessary. A PSP provides information about the need for, number of, and location of auger drilled borings. This standard operating procedure provides the level of detail necessary to ensure that the borings, and concurrent split-barrel, or thin-walled tube environmental media sampling, are performed in a consistent manner which achieves project data quality objectives, as specified in the PSP.

4.2 Planning and Coordination

The following planning and coordination functions are necessary actions prior to performing auger drilled borings and solids sampling with a split-barrel or thin-walled tube at the FEMP. Responsible personnel and organizations who shall expedite planning and coordination functions have been identified. Also, applicable planning and coordination functions have been identified.

4.2.1 Responsibilities of Division Manager

[1] Designate a Department Manager to direct the drilling of auger borings, and sampling, in accordance with the PSP and this procedure.

[2] Authorize the use of this procedure and signify concurrence by signing the appropriate approval block on the procedure.

[3] Delegate to managers the responsibility for the proper drilling of auger borings, and sampling, as specified by the PSP and this procedure.

4.2.2 Responsibilities of Department Manager

[1] Assign the organization and completion of this drilling to the appropriate FEMP Field Project Manager.

[2] Ensure in coordination with the FEMP Field Project Manager, that the auger drilled borings, and sampling, contained in the PSP are safe, realistic, concise, and achievable.

[3] Develop sufficient project justification and resource cost and scheduling information and present to the Change Control Board for approval if considered new scope.

4.0 PREREQUISITE ACTIONS (CONT.)

4.2.3 Responsibilities of FEMP Field Project Manager

[1] Assign a Geologist-in-Charge to directly manage the field operation of auger drilled borings and sampling.

[2] Ensure, in coordination with the Department Manager, that the proposed steps for conducting the auger drilled borings, and sampling contained in the PSP are safe, realistic, concise, and achievable.

[3] Perform periodic on-site field inspections to ascertain that the auger drilled borings and sampling are being performed in accordance with the requirements of this procedure.

[4] Ensure that the subcontractor(s) have necessary resources, personnel, materials, and training necessary for the satisfactory completion of the project.

[5] Conduct a Readiness Review to verify that all personnel involved in any auger drilled borings and solids sampling demonstrate the training, experience and knowledge of health and safety issues, applicable procedures, and task-specific duties necessary to successfully accomplish their respective project task.

4.2.4 Responsibilities of Geologist-in-Charge

[1] Acquire a proficient working knowledge of the auger drilled boring and sampling requirements of the PSP and this procedure.

[2] Directly manage the active field operations associated with auger drilled borings and sampling.

[3] Perform detailed assessments of auger drilled borings and sampling to ensure compliance with the requirements of this procedure.

[4] Document on the appropriate boring forms the drilling history and construction details.

[5] Determine, in consultation with site Quality Assurance staff, the FEMP Field Project Manager, and drilling personnel, the need for modification or changing some aspect of the auger boring project.

[6] Ensure that all project performance requirement documents such as PSP, Health and Safety Plan, procedures, and permits are valid and current.

4.0 PREREQUISITE ACTIONS (CONT.)

4.2.5 Responsibilities of Sampling Technicians

[1] Familiarize themselves with the PSP thin-walled tube and split-barrel sampling requirements.

[2] Ensure that all equipment, materials, and documentation requirements of the PSP sampling events are available, decontaminated, and in serviceable condition.

[3] Follow the PSP sampling requirements, as directed by the Geologist-in-Charge, and the PSP.

[4] Perform all assigned duties in accordance with project and FEMP requirements.

4.2.6 Responsibilities of Drilling Personnel

[1] Adhere to the auger drilled boring and sampling requirements of this procedure and the PSP.

[2] Perform the field work necessary to accomplish the drilling and sampling of the borings, as directed by the Geologist-in-Charge.

[3] Possess, through a combination of experience and training, the skills necessary to adequately perform the field work associated with auger drilled borings.

[4] Notify the Geologist-in-Charge immediately if, in the drilling personnel's opinion, any aspect of the auger drilled boring and sampling field work is unsafe, suspect, or in error.

4.3 Performance Documents

This subsection describes the applicable documents which are required before commencement of the auger drilled boring field activities.

4.3.1 Project-Specific Plan

The PSP describes project data quality objectives. The successful adherence to and completion of the project data quality objectives ensures that the project field activities will achieve all objectives specified in the approved PSP. The FEMP Field Project Manager shall:

[1] Obtain an approved PSP which describes the auger drilled boring field activities to be performed.

[2] Ensure that the PSP is the current revision.

4.0 PREREQUISITE ACTIONS (CONT.)

[3] Contact the appropriate FEMP CRU, Division or Department PSP authors about any issues/problems/contingencies discovered during the preparation for field activities.

[4] Determine that any PSP discrepancies have been satisfactorily resolved prior to the performance of any potentially affected activity.

[5] Ensure that all necessary subcontractor, equipment, and material procurements have been performed.

4.3.2 Required PSP Information

In order to correctly install borings and perform split-barrel or thin-walled tube sampling, the FEMP Field Project Manager shall also ensure that the PSP contains the following information.

- Anticipated depth of each boring.
- Anticipated depth of each interval (depth) to be sampled, if more than one sample from the same boring is necessary.
- Specific geological information regarding the nature and types of strata to be encountered.
- Volume of sample required for laboratory analysis purposes.
- Type of sample (split-barrel, thin-walled tube) required.
- Location(s) identified by the State Planar Coordinates System.

In the absence of the above specified information, the PSP author shall perform an analysis of available information from nearby or similar locations and convey this information to the FEMP Field Project Manager.

4.3.3 Standard Operating Procedures

Standard Operating Procedures (SOPs) exist, in part, to provide standard, approved methodology for performing field work required by a PSP. However, a PSP usually contains some field activities which are not described in SOPs. In order to ensure that the PSP field activities do not result in a nonconformance with other existing SOPs, the FEMP Field Project Manager shall:

4.0 PREREQUISITE ACTIONS (CONT.)

[1] Identify from the PSP and other Environmental Division and FEMP sources, all Department, Division or site SOPs applicable to the performance of the auger drilled boring activities.

[2] Notify the appropriate FEMP CRU, Division or Department PSP authors about any existing approved SOP which, if the auger drilled boring activities proposed in the PSP are followed, may result in a nonconformance with the existing SOP.

4.3.4 Health And Safety Plan

Prior to the performance of any auger drilled boring field activities, a Project/Task-specific Health and Safety Plan is necessary. The FEMP Field Project Manager shall:

[1] Obtain a Project/Task-specific Health and Safety Plan, in accordance with the requirements of SCDM procedure **SCDM HS-001, "SOP for Acquisition of a Project/Task-specific Health and Safety Plan."**

[2] Ensure all field personnel assigned to the project have received training specific to the Health and Safety Plan.

[3] Document, in writing, that all assigned field personnel have participated in training unique to the Project/Task-specific Health and Safety Plan.

[4] Ensure that the Project/Task-specific Health and Safety Plan is immediately available for review by field staff/site visitors at the project location.

[5] Interface with the project health and safety technician about any project health and safety issue which is identified.

4.0 PREREQUISITE ACTIONS (CONT.)

WARNING:

NO AUGER DRILLED BORING FIELD PROJECT SHALL BEGIN WITHOUT A PROJECT/TASK-SPECIFIC HEALTH AND SAFETY PLAN WHICH HAS BEEN APPROVED BY THE RESPONSIBLE FERMCO ENVIRONMENTAL SAFETY AND HEALTH PERSON.

WARNING:

NO AUGER DRILLED BORING FIELD PROJECT SHALL BEGIN WITHOUT A TRAINING SESSION SPECIFIC TO THE PROJECT/TASK-SPECIFIC HEALTH AND SAFETY PLAN. THE TRAINING SESSION SHALL INCLUDE ALL PERSONNEL WHO MAY BE INVOLVED WITH THE AUGER DRILLED BORING PROJECT.

4.3.5 Training

Prior to commencement of any monitoring well installation field activities the FEMP Field Project Manager shall:

[1] Verify that all field personnel meet all site-specific training requirements and remain current throughout the duration of the project.

4.0 PREREQUISITE ACTIONS (CONT.)

[2] Verify through a Readiness Review, that all personnel involved in any auger drilled boring field project demonstrate project-specific training, knowledge, and experience necessary to successfully accomplish their respective project tasks.

WARNING:

NO AUGER DRILLED BORING FIELD ACTIVITIES SHALL BEGIN WITHOUT A TRAINING SESSION SPECIFIC TO THE PROJECT-SPECIFIC PLAN. THE TRAINING SESSION MUST INCLUDE ALL PERSONNEL WHO MAY BE INVOLVED WITH THE AUGER DRILLED BORING PROJECT.

4.4 Required Approvals And Notifications

Prior to the performance of any auger drilled boring field activities, a determination of all necessary approvals/permits/notifications shall be made and applicable approvals/permits/notifications shall be expedited.

4.4.1 DOE-FN Requirements

No field work, including mobilization procurement activities preparatory to the auger drilled boring field work, shall begin until receipt of PSP approval from DOE-FN and written Notice-to-Proceed has been obtained.

4.4.2 Regulatory Agency Requirements

As directed by DOE-FN, the PSP author, FEMP CRU, Division, or Department requesting the field work may be required to obtain prior approval for the project from state, or federal regulatory agency.

4.4.3 On-Site Requirements

Prior to the implementation of auger drilled boring field activities at the FEMP, the Department Manager shall:

[1] Arrange, through the appropriate FERMCO procurement departments, any necessary project subcontractor support.

4.0 PREREQUISITE ACTIONS (CONT.)

[2] Ensure that the necessary procurement subcontractor support duration, or period of performance, is sufficient for the expected time required to perform the auger drilled boring field activities.

Prior to implementation of auger drilled boring field activities, the FEMP Project manager shall:

[1] Obtain the following FEMP Permits (Attachments A through H), if necessary, for the PSP field activities:

- FERMCO Work Permit (FS-F-2939)
- FERMCO Asbestos Work Permit (FS-F-2940)
- FERMCO Confined Space Evaluation/Permit and Chemical Hazardous Materials Work Permit (FS-F-2745)
- FEMP Construction Excavation/Penetration Permit (FS-F-2711)
- FEMP Facility Outage Permit (FS-F-2757)
- FERMCO Open Flame and Welding Hazardous Work Permit (FS-F-352)
- FEMP Radiological Work Permit (FS-F-1372).

WARNING:

IF OVERHEAD POWER OR TELEPHONE LINES ARE LOCATED WITHIN 20 FEET OF THE AUGER DRILLED BORING LOCATION, FIELD ACTIVITIES SHALL NOT BEGIN UNTIL THE FEMP FIELD PROJECT MANAGER, IN CONSULTATION WITH THE GEOLOGIST-IN-CHARGE, DRILLING PERSONNEL, AND THE HEALTH AND SAFETY TECHNICIAN, HAS DETERMINED THAT ADEQUATE CLEARANCE EXISTS BETWEEN THE POWER OR TELEPHONE LINES AND THE DRILL RIG TO ENSURE THAT NO ELECTRICAL SHOCK HAZARD EXISTS.

4.0 PREREQUISITE ACTIONS (CONT.)

[2] Make prior arrangements regarding the handling, storage, and disposal of all project related wastes, as addressed in the PSP, before initiation of the auger drilled boring field activities.

NOTE *The FERMCO Waste Characterization Section, Environmental Protection Department, Environmental Safety & Health Division, should be contacted prior to the beginning of auger drilled boring field activities to arrange the handling, storage, and disposal of project related wastes.*

NOTE *The National Environmental Policy Act (NEPA) Compliance Section, Environmental Planning Department, Regulatory and Technical Programs Division, must be contacted to determine the applicability of NEPA to ground disturbing activities associated with auger drilled boring field activities. Contact must be initiated prior to beginning auger drilled boring field activities.*

NOTE *Private landowner access must be arranged through the Real Estate Management Section, Property Management Department, Acquisitions and Finance Division. The Real Estate Office should be contacted as early as possible in the planning process. Proper access must be processed and approved prior to beginning field activities.*

[3] Ensure that all auger drilled boring locations have been properly located, surveyed, and recorded prior to auger drilled boring.

[4] Visit all auger drilled boring sites with a FEMP health and safety technician to determine if any unforeseen health and safety concerns, issues or contingencies may exist which need to be addressed prior to commencement of auger drilled boring activities.

4.4.4 Off-Site Requirements

The performance of off-site auger drilled boring field activities are governed, at a minimum, by the same restrictions as on-site auger drilled boring activities, except that the FEMP permit requirements specified in Subsection 4.4.3, may not be required. In addition, when off-site auger drilled boring field activities are to be performed, the Department Manager shall evaluate the need for the following:

[1] Ensure that appropriate private landowner approval, in writing, has been obtained. Approval shall be obtained from the landowner where auger drilled boring field activities are to be performed, and also from any adjacent landowner whose property may be impacted by access or other activities ancillary to field activities.

NOTE *The Real Estate Office should be contacted as early as possible before any access to licensed pasture land on-site.*

4.0 PREREQUISITE ACTIONS (CONT.)

NOTE *The NEPA Compliance Section, Environmental Planning Department, Regulatory and Technical Programs Division must be contacted to determine the applicability of NEPA to ground disturbing activities associated with auger drilled boring field activities. Contact must be initiated prior to beginning field activities.*

[2] Ensure that private landowner approval will remain current through the duration of the field activities.

[3] Obtain through FERMCO procurement or project subcontractors, all equipment, parts, and other items necessary for the completion of field activities.

The FEMP Field Project Manager shall:

[1] Schedule through the appropriate FERMCO Environmental Safety and Health Division/Department, all required field site health and safety technician and radiological technician support.

[2] Obtain any necessary security personnel, barricades or signs to ensure adequate after hours site security.

[3] Inform the Ohio Utilities Protection Service (1-800-362-2764), Butler Rural Electric Cooperative (513-867-4400), and Southwest Regional Water District (513-863-0828) of all proposed auger drilled boring location(s) a minimum of 48 hours prior to beginning the field activities.

WARNING:

DO NOT BEGIN OFF-SITE AUGER DRILLED BORING FIELD ACTIVITIES UNTIL APPROVALS FROM THE OHIO UTILITIES PROTECTION SERVICE, BUTLER RURAL ELECTRIC COOPERATIVE, AND SOUTHWEST REGIONAL WATER DISTRICT HAVE BEEN OBTAINED.

[4] Ensure that adequate clearance from overhead or nearby obstacles or hazards exists for all equipment to be used during the performance of the auger drilled boring field activities.

4.0 PREREQUISITE ACTIONS (CONT.)

WARNING:

IF OVERHEAD POWER OR TELEPHONE LINES ARE LOCATED WITHIN 20 FEET OF THE AUGER DRILLED BORING LOCATION, FIELD ACTIVITIES SHALL NOT BEGIN UNTIL THE FEMP FIELD PROJECT MANAGER, IN CONSULTATION WITH THE GEOLOGIST-IN-CHARGE, DRILLING PERSONNEL, AND THE HEALTH AND SAFETY TECHNICIAN, HAS DETERMINED THAT ADEQUATE CLEARANCE EXISTS BETWEEN THE POWER OR TELEPHONE LINES AND THE DRILLING RIG TO ENSURE THAT NO ELECTRICAL SHOCK HAZARD EXISTS.

[5] Ensure that all auger drilled boring locations have been properly located, surveyed, and recorded prior to auger drilled borings.

[6] Visit all auger drilled boring sites with a FEMP health and safety technician to determine if any unforeseen health and safety concerns, issues or contingencies may exist which need to be addressed prior to commencement of auger drilled boring activities.

4.5 Drilling Site Preparation

Factors such as drilling site condition, accessibility, vegetation, presence of overhead and buried utilities, surface and subsurface contamination, and topography shall be evaluated by FERMCO staff and the drilling subcontractor during preparation of the work site. If necessary to facilitate auger drilled boring, the FEMP Field Project Manager may need to:

[1] Improve site access by arranging the construction of access roads.

[2] Improve site access by grading or filling areas of topographic highs or lows.

[3] Remove or relocate any structure or feature which could obstruct the field activities.

[4] Identify any buried or overhead utilities which could potentially impact the field activities.

[5] Request moving a borehole location if any unsafe or unsatisfactory condition cannot be eliminated.

NOTE *Vehicles requiring access to the drilling site shall use existing access roads.*

4.0 PREREQUISITE ACTIONS (CONT.)

4.5.1 Drill Site Selection Criteria

Drill site selection criteria shall be determined from the PSP, evaluation of project data quality objectives, and a walk-through inspection of the drilling site prior to the mobilization of the drilling rig to the site.

4.5.2 Drill Site Relocation Criteria

During the performance of project field work, it may be necessary to relocate the drilling site. The site relocation may be identified either prior to mobilization of the drilling rig to the site, or after the drilling rig has been mobilized to the site and drilling or field activities have begun.

Following determination that drill site relocation is necessary, the Geologist-in-Charge shall notify the FEMP Field Project Manager. The FEMP Field Project Manager shall cease all field activities and immediately notify the Department Manager and the responsible FEMP CRU, Division or Department PSP authors who originally requested the field work.

Actual drilling rig demobilization, relocation and remobilization shall be initiated by the FEMP Field Project Manager only upon receipt of a variance from the responsible FEMP CRU, Division or Department PSP author originally requesting the field work.

Direction to relocate a drilling site shall be in the form of a Variance Request and shall be considered a PSP amendment. A Variance Request can be obtained from the Quality Assurance department. The Variance Request initiated by the responsible FEMP CRU, Division or Department PSP author, shall be signed by that responsible person and the designated representative of FERMCO Quality Assurance.

In lieu of receipt of an approved Variance Request, the FEMP Field Project Manager may expedite, through verbal authorization, drilling site relocation in order to efficiently utilize project resources. Written approval must be obtained within five working days of receipt of verbal approval.

4.6 Required Equipment

All equipment and materials used in the installation of auger drilled borings shall be decontaminated in accordance with the PSP and inspected by the FEMP Field Project Manager prior to utilization.

4.6.1 Drilling Equipment

The following drilling equipment may be required to conduct auger drilled boring field activities:

- Truck, platform, or trailer mounted mechanical or hydraulic drill rig
- Hollow stem auger sections

4.0 PREREQUISITE ACTIONS (CONT.)

- Pilot bit
- Auger teeth
- Auger connector
- Center plug
- Center rod
- Drive cap
- Rod to cap adapter
- Split-barrel sampler (type and size specified in the PSP)
- Thin-Walled tube sampler (type and size specified in the PSP)
- Weighted hammer
- Drive weight assembly
- Anvil.

NOTE *NEPA requirements specify that drilling equipment and associated vehicles/equipment be no greater than 10 tons in weight.*

NOTE *Except under emergency conditions, ground disturbing activities shall take place only in dry weather.*

4.6.2 Sampling Equipment

[1] Soil, waste or geologic material encountered within the glacial overburden, during auger drilled boring, shall be continuously sampled and field screened.

[2] Instrumentation used for field screening for radiological activity and the presence of volatile organic constituents shall include:

- Photoionization detector (PID) - exact model and screening methodology to be described in the PSP.

4.0 PREREQUISITE ACTIONS (CONT.)

- Radiation meter - exact model and screening methodology to be described in the PSP.

[3] For soil/waste material sampling, a split-barrel sampler or thin-walled tube sampler shall be used. The PSP shall identify the type of sampler to be used.

4.6.3 Auger Drilled Boring Sample Equipment and Material

The following equipment may be required for auger drilled boring sample collection, depending upon project-specific requirements specified in the PSP:

- Disposable latex gloves
- Herculite plastic
- Non-reactive work surface
- Hammer
- Custody tape
- Sample containers (size and type per PSP)
- Sample labels
- Synthetic ice and ice chest
- Large and small plastic bags
- Lint-free wipes
- Large stainless steel spoon, knife, trowel, and scoop
- Large stainless steel bowl
- Metric scale
- Indelible ink pen
- Geologic characterization tools (Munsell chart, penetrometer, etc.)
- Plastic glove bag with High Efficiency Particulate Air (HEPA) vacuum.

4.0 PREREQUISITE ACTIONS (CONT.)

The following decontamination materials may be necessary to adequately decontaminate sampling equipment:

- Tubs made of nonreactive material
- Cleaning brushes of various sizes
- Sprayers
- Large and small plastic bags
- Duct tape
- Decontamination agents (Deionized water, methanol, HCL, etc.).

4.6.4 Health And Safety Equipment

[1] The level of personal protection is dependant on the location where drilling activities are to be performed and the nature of the materials that may be encountered in the activity, including solid, liquid and vapor components.

[2] The Project/Task-specific Health and Safety Plan identifies all health and safety and industrial hygiene equipment required at each boring location.

[3] Provide, at a minimum, the following health and safety equipment for personnel assigned to the drilling rig:

- Hard hat
- Standard issue work coveralls
- Steel-toed boots
- Safety glasses or goggles
- Gloves
- Portable eye wash station
- Ropes/cones/stanchions for delineating exclusion and controlled access perimeters

4.0 PREREQUISITE ACTIONS (CONT.)

NOTE *Additional safety equipment may be required depending on the location and condition of the drilling site.*

[4] Additional field screening instrumentation, identified in Section 5.4 of this procedure, shall also be used to provide real time monitoring for sample field screening, Action Levels for employee exposure, radiological and organic vapor parameter health and safety purposes.

[5] Ensure that health and safety Action Levels for radiological and organic vapor parameters shall be identified in the Task/Project-specific Health and Safety Plan.

5.0 PROCEDURE

5.1 Mobilization

Attachment K of this procedure, titled "Auger Boring Project Preparation Flowchart," shows the logical and sequential steps necessary prior to the mobilization of personnel, equipment, and materials for auger drilled boring.

WARNING:

INSPECTION BY FERMCO QUALITY ASSURANCE OF THE DRILLING RIG FOR COUNTERFEIT PARTS MUST BE PERFORMED PRIOR TO DRILL RIG UTILIZATION.

Drilling Personnel

[1] Verify, through the Department Manager, that written Notice-to-Proceed for the auger drilled boring field activities has been obtained.

[2] Confirm, through the Department Manager, that Change Control Board approval of the auger drilled boring field activities project baseline and funding has been obtained.

[3] Inspect the drilling rig and all associated components for serviceability.

5.0 PROCEDURE (CONT.)

[4] Inventory all drilling rig components anticipated to be used during the soil boring.

[5] If the drilling rig is being initially brought onto the FEMP, or is being brought back onto the FEMP after removal from the FEMP, deliver the drilling rig to the FERMCO Fire and Safety staff for inspection.

[6] Following inspection, decontaminate the drill rig in accordance with the PSP decontamination criteria.

Attachment L of this procedure, titled "Auger Boring Project Performance Flowchart," shows the logical and sequential steps necessary during the performance of auger drilled boring. Specific sections and subsections of this procedure provide more detailed information relative to performance.

5.2 Drill Site Establishment

Drilling Personnel

[1] Mobilize the drill rig to the drill site location identified in the PSP.

[2] Set up the drill rig in accordance with the drill rig manufacturer's or drilling subcontractor's specifications.

WARNING:

FAILURE TO FOLLOW THE DRILL RIG MANUFACTURER'S OR DRILLING SUBCONTRACTOR'S SPECIFICATIONS WHEN SETTING UP THE DRILL RIG COULD RESULT IN THE CREATION OF AN UNSAFE OR UNSATISFACTORY DRILLING CONDITION.

5.0 PROCEDURE (CONT.)

[3] Establish the site access control zones, in accordance with the Project/Task-specific Health and Safety Plan and the drill rig manufacturer's or drilling subcontractor's specifications.

WARNING:

FAILURE TO PROPERLY ESTABLISH SITE ACCESS CONTROL ZONES COULD RESULT IN UNAUTHORIZED ENTRY INTO THE EXCLUSION ZONE INCREASING POTENTIAL FOR PERSONNEL EXPOSURE OR INJURY.

5.3 Drilling

Drilling operations shall be conducted so a minimum of contaminants are introduced into the environment or spread between target monitoring zones. Surface casing may be set when a potentially contaminated zone is drilled prior to reaching the target monitoring zone. When drilling through areas where near surface contamination is indicated through past use or during screening of samples while drilling, surface casings shall be grouted in place and made a part of the permanent installation. In outlying areas not suspected of being contaminated, large diameter temporary casings may be advanced as necessary for borehole control.

Drilling Personnel

[1] Assemble the hollow-stem auger column, consisting of:

- Pilot or cutter bit
- Auger teeth
- Auger head
- Auger connector
- Hollow-stem auger sections
- Center rod

5.0 PROCEDURE (CONT.)

- Auger connector
- Drive cap
- Rod to cap adapter
- Center plug (not used if sampling).

[2] Connect the assembled auger column to the drill spindle.

> **CAUTION:**
>
> **THE USE OF LUBRICANTS FOR AUGER DRILLING RIG MOVING PARTS WHICH WILL BE LOWERED DOWN THE BOREHOLE OR USED IN CLOSE PROXIMITY TO THE OPEN BOREHOLE IS PROHIBITED. POTABLE WATER IS THE ONLY ALLOWABLE LUBRICANT.**

[3] Initiate rotation of the auger column by engaging the drill rig power source to the drill spindle.

> **CAUTION:**
>
> **FOR SPLIT-BARREL AND THIN-WALLED TUBE SAMPLING, BOTTOM DISCHARGE DRILL BITS SHALL NOT BE USED DURING AUGER BORING.**

[4] Adjust the rate of auger column advancement in accordance with the drill rig manufacturer's or subcontractor's specifications.

[5] Remove accumulated solid material as it is carried to the surface in the vicinity of the auger flights.

5.0 PROCEDURE (CONT.)

[6] Place accumulated solid material into the approved waste container designated for that purpose.

NOTE *Sample and screen the solid material in accordance with PSP requirements during auger drilling.*

NOTE *It may be necessary to grout surface casing to avoid cross contamination, if required by the PSP, or determined by the Geologist-in-Charge.*

[7] Add more auger flights, as the borehole is advanced, in accordance with the drill rig manufacturer's or drilling subcontractor's specifications.

[8] Remove, disassemble, and decontaminate the auger column and components following reaching total depth of the borehole.

Geologist-in-Charge

[1] Record the lithology, depth, and other pertinent characteristics of the borehole during auger boring advancement.

5.4 Sampling, Field Screening

The PSP determines the frequency and interval of subsurface soil/waste material field screening and sampling. Unless otherwise specified in the PSP, split-barrel sampling and field screening shall be performed continuously through the thickness of the glacial overburden. Field screening parameters of concern, Action Levels, and types of instrumentation to be used are also contained in the PSP.

5.4.1 Radiological Activity Determination

Sampling Technician(s)

[1] Calibrate the instrument(s) in accordance with the applicable FEMP procedure, PSP or the instrument manufacturer's specifications.

[2] Perform a 5 minute background count and calculate the time required to obtain the desired minimum detectable activity.

[3] Count the sample for the predetermined count time and record the net counts or count rate on the appropriate form.

[4] If required by the PSP, split the sample lengthwise and screen the sample for the presence of radiological activity.

5.0 PROCEDURE (CONT.)

[5] Select samples for radiological analysis based on results of field screening at frequency specified in the PSP.

[6] Select samples for laboratory analysis that exhibit the highest relative PID readings for a given location and horizon, as specified in the PSP.

5.4.2 Organic Vapor Determination

Sampling Technician(s)

[1] Calibrate the PID in accordance with the applicable FEMP procedure, PSP or the instrument manufacturer's specifications.

[2] Perform a background organic vapor determination, ensuring that no other organic vapor source is present to affect the background readings of the PID.

[3] Recover the split-barrel sampler, open it and screen the sample for the presence of organic vapors, in accordance with the PSP requirements.

[4] If required by the PSP, split the sample lengthwise and screen the sample for the presence of organic vapors.

[5] Record the organic vapor screening results and the background organic vapor results on the appropriate field form.

[6] Select and sample for laboratory analysis that interval which displays the highest relative readings for a given location and horizon, as specified in the PSP.

5.5 Sampling, Split-Barrel

As specified in the PSP, subsurface soil/waste material and glacial overburden sampling may be required. All split-barrel sampling, and associated equipment and handling shall be accomplished in accordance with ASTM-D-1586-84, and PSP requirements. Dimensions of the split-barrel sampler to be used during the performance of auger drilled boring shall be specified in the PSP.

A split-barrel sampler consists of a tube shaped sampler body, of variable length and diameter, which is capable of being split open lengthwise into two separate equal volume components. The top of the split-barrel sampler consists of a top assembly, which is threaded, and can be screw-attached to the sampler body and a drive shoe, which is threaded and can be screw-attached to the base or bottom of the sampler body.

5.0 PROCEDURE (CONT.)

5.5.1 Split-Barrel Attachment

Drilling Personnel

[1] Obtain a clean or decontaminated split-barrel sampler which is equipped with a threaded coupling to fit a standard drill rod.

NOTE *Excessive cuttings must be removed from the borehole prior to split-barrel sampling.*

NOTE *Use a split-barrel sampler with an interior liner installed prior to sampling, if required by the PSP.*

NOTE *Ensure, if a liner is used, that the liner has been properly decontaminated in accordance with the decontamination criteria specified in the PSP.*

[2] Attach the split-barrel sampler to the bottom of the drill (sampling) rod string which extends from the top of the auger or borehole to the bottom of the borehole.

[3] Attach the weighted hammer to the top of the drill rod string.

5.5.2 Sample Collection

Drilling Personnel

[1] Slowly lower the attached split-barrel sampler to the bottom of the boring, ensuring that the base of the split-barrel sampler does not drop onto the soil/waste material to be sampled.

[2] Position the hammer above and attach the anvil to the top of the sampling rods. This may be done before the sampling rods and sampler are lowered into the borehole.

[3] Rest the dead weight of the sampler, rods, anvil, and drive weight on the bottom of the boring and apply a seating blow.

NOTE *If excessive cuttings are encountered at the bottom of the boring, remove the sampler and sampling rods from the boring and remove the cuttings.*

[4] Mark the drill rods in 3 successive 6 inch increments so that the advance of the sampler under the impact of the hammer can be easily observed for each 6 inch increment.

5.0 PROCEDURE (CONT.)

[5] Push or drive the sampler into the undisturbed subsurface soil material at the bottom of the boring, by alternately raising and lowering the hammer on an attached rope, which passes around a rotating cathead, and allow the hammer to free-fall 30 inches, ± 1 inch, by suddenly releasing the tension of the rope.

NOTE *The cathead shall be essentially free of rust, oil or grease and have a diameter in the range of 6 to 10 inches.*

NOTE *The cathead should be operated at a minimum speed of rotation of 100 revolutions per minute, or the approximate speed of rotation shall be reported on the boring log.*

NOTE *No more than 2¼ rope turns on the cathead may be used during the performance of the penetration test.*

NOTE *For a hammer blow, a 30 inch lift and drop shall be employed by drilling personnel. The operation of pulling and throwing the rope shall be performed rhythmically without holding the rope at the top of the stroke.*

NOTE *If the auger drill rig is not equipped with a cathead lift assembly, a trip, automatic or semi-automatic hammer drop system which lifts the hammer and allows it to drop 30 inches, ± 1 inch may be used.*

[6] Count the number of blows applied in each 6 inch increment until one of the following occurs:

[a] A total of 50 blows have been applied during any one of the 3 to 6 inch increments described in Step 4 of this Subsection.

[b] A total of 100 blows have been applied.

[c] There is no observed advance of the sampler during the application of 10 successive blows of the hammer.

[d] The sampler is advanced the complete 18 inches without the limiting blow counts occurring as described in the previous three bullets of this subsection.

NOTE *If the material to be sampled contains significant amounts of liquid, the split-barrel sampler may not be able to recover a complete sample.*

5.0 PROCEDURE (CONT.)

NOTE *If the material to be sampled contains significant amounts of detritus, boulders, cobbles or slabs of consolidated rock, the split-barrel sampler may not be able to recover a complete sample.*

CAUTION:

PERIODICALLY THE ATTACHED ROPE SHALL BE INSPECTED TO ENSURE THAT IT IS IN SERVICEABLE CONDITION.

[7] While driving the sampler, the Geologist-in-Charge shall record the number of blows required to advance the sampler the distance of each 6 inch increment.

NOTE *The first 6 inch increment is considered to be a seating drive. The sum of the number of blows required for the second and third 6 inches of penetration is termed the "standard penetration resistance" or the "N-value."*

NOTE *If the split-barrel sampler is driven less that 18 inches, the number of blows per each complete 6 inch increment and per each partial increment shall be recorded on the boring log. For partial increments, the depth of penetration shall be reported to the nearest 1 inch, in addition to the number of blows.*

NOTE *If the sampler advances below the bottom of the boring under the static weight of the drill rods or the weight of the drill rods plus the static weight of the hammer, this information should be noted on the boring log.*

5.0 PROCEDURE (CONT.)

5.5.3 Sample Recovery

Drilling Personnel

[1] Raise the sampler out of the boring by reversing direction of the rope on the cathead and alternate applying and releasing pressure.

[2] Remove the sampler from the bottom of the drill rod string.

[3] Detach the top assembly and drive shoe from the split-barrel sampler.

Sampling Technician(s)

[1] Open the sampling body by removing one half of the split-barrel.

[2] Perform radiological and organic vapor screening in accordance with the PSP and Subsections 5.4.1 and 5.4.2 of this procedure.

[3] Remove and containerize the interval of sampled subsurface soil/waste material, in accordance with the PSP requirements for sampling.

NOTE *If the sampling results in a partial recovery, the depth of sample collection will be the upper portion of the interval through which the sampling device was driven.*

5.6 Sampling, Thin-Walled Tube

As specified in the PSP, subsurface soil/waste material and glacial overburden sampling using a thin-walled tube may be required, particularly when geotechnical laboratory analysis is required. All thin-walled tube sampling, and associated equipment and handling shall be accomplished in accordance with ASTM-D-1587-83, and PSP requirements.

A thin-walled tube is a one piece hollow tube of variable diameter and length. Thin-walled tube sampling is typically performed if it is necessary to obtain an undisturbed representative sample of the soil material or undisturbed strata, prior to auger drilling being performed through the sampling interval.

5.6.1 Thin-Walled Tube Attachment

For thin-walled tube sampling, the drilled open borehole diameter and the inside diameter of driven casing or hollow stem auger shall not exceed 3½ times the outside diameter of the thin-walled tube.

5.0 PROCEDURE (CONT.)

Drilling Personnel

[1] Obtain a clean or decontaminated tube sampler, and couple the tube to the drill rod with a sampler head.

CAUTION:

IT IS RECOMMENDED THAT TUBES HAVE A PROTECTIVE COATING, OR THE TUBES BE COMPOSED OF AN ALLOY WHICH WILL PROTECT THE TUBE WALL FROM THE EFFECTS OF CORROSION. PROTECTIVE COATING OR ALLOY TYPE IS DEPENDANT ON THE NATURE OF THE MATERIAL TO BE SAMPLED. PROTECTIVE COATING OR ALLOY TYPE SHALL BE SPECIFIED IN THE PSP.

CAUTION:

IF THIN-WALLED TUBE COATING IS USED, CARE SHOULD BE TAKEN TO AVOID THE POSSIBILITY OF CROSS CONTAMINATION OF SOLID MATERIALS LABORATORY ANALYSIS.

5.0 PROCEDURE (CONT.)

CAUTION:

THE SAMPLER HEAD SHALL CONTAIN A SUITABLE CHECK VALVE AND A VENTING AREA TO THE OUTSIDE EQUAL TO OR GREATER THAN THE AREA THROUGH THE CHECK VALVE. ATTACHMENT OF THE SAMPLER HEAD TO THE TUBE SHALL BE CONCENTRIC AND COAXIAL TO ASSURE UNIFORM APPLICATION OF FORCE TO THE TUBE BY THE SAMPLER INSERTION EQUIPMENT.

[2] Ensure proper attachment of the tube and sampler head to the drill rod.

5.6.2 Sample Collection

Drilling Personnel

[1] Lower the attached tube sampler to the bottom of the boring so that the tube base rests on the bottom of the borehole.

[2] Push or press the tube sampler, without impact or rotation, into the undisturbed soil/waste material, or unconsolidated strata, at the bottom of the boring by applying a continuous and rapid motion (usually accomplished by the application of hydraulic pressure) to a depth which is specified in either the PSP or by the Geologist-in-Charge.

NOTE *If the material to be sampled contains significant amounts of liquid, the tube sampler may not be able to recover a complete sample.*

NOTE *If the material to be sampled contains significant amounts of detritus, boulders, cobbles or slabs of consolidated rock, the thin-walled tube sampler may not be able to recover a complete sample.*

NOTE *Care should be taken to ensure that no void spaces exist within the tube after the sample has been collected.*

[3] Determine the length of advance by the resistance and condition of the formation.

NOTE *Length of advance shall never exceed 5 to 10 diameters of the tube in sands and 10 to 15 diameters of the tube in clays.*

5.0 PROCEDURE (CONT.)

NOTE *If the formation is too hard for push type insertion, the tuber may be driven, or ASTM D 3550 may be used. Other methods, as directed by the Geologist-in-Charge, or FEMP Field Project Manager may be used.*

NOTE *If driving methods are used, the data regarding weight and fall of the hammer and penetration achieved must be documented. Driven tubes shall be prominently labeled "Driven Sample."*

5.6.3 Sample Recovery

Sampling Technician(s)

[1] Raise the tube sampler out of the boring.

NOTE *The tube may be rotated to shear the base of the sample after pressing is complete.*

> **CAUTION:**
>
> **THE TUBE SHALL BE REMOVED AS CAREFULLY AS POSSIBLE FROM THE BOREHOLE IN ORDER TO MINIMIZE DISTURBANCE OF THE SAMPLE.**

[2] Remove the tube sampler and sampler head from the drill rod.

[3] Measure and record the length of the sample in the tube.

[4] Remove the disturbed soil/waste material or undisturbed strata, which may have accumulated in the top of the tube sampler.

[5] Measure and record the length of the sample in the tube.

[6] Seal the top of the tube, as specified in the PSP, or by following Steps 10 and 11 of this Subsection.

[7] Remove at least 1 inch of soil/waste material, or unconsolidated strata, from the base of the tube sampler.

5.0 PROCEDURE (CONT.)

NOTE *As specified in the PSP, the sample of soil/waste material or unconsolidated strata, may be used for a soil/waste description.*

NOTE *As specified in the PSP, or by the Geologist-in-Charge, after measurement, the tube may be sealed without removal of the soil/waste from the ends of the tube.*

[8] Measure and record the length of the sample in the tube.

[9] Seal the base of the tube, as specified in the PSP, or by following Steps 10 and 11 of this Subsection.

[10] Place an impervious disk into both the top and base of the thin-walled tube sample.

[11] Cap the tube ends and tape and seal the cap with wax.

[12] Containerize the tube sampler for shipment to the analytical laboratory in accordance with PSP requirements.

NOTE *To ensure that thin-walled tube contents remain undisturbed, it is important to store and transport the device in an upright position (i.e., in the same orientation in which it was removed from the borehole).*

5.7 Total Depth Determination

All soil/waste material, or unconsolidated strata, sampling shall cease when the Geologist-in-Charge has determined that all applicable PSP data quality objectives at the auger drilled boring location have been met.

CAUTION:

NO AUGER DRILLED FIELD INSTALLATION SHALL BE ADVANCED THROUGH THE GLACIAL OVERBURDEN AND INTO THE GREAT MIAMI AQUIFER. FAILURE TO MAINTAIN AUGER DRILLED BORINGS WITHIN THE GLACIAL OVERBURDEN COULD RESULT IN CROSS CONTAMINATION FROM GLACIAL OVERBURDEN SEDIMENTS, OR WASTE MATERIALS, INTO THE UNDERLYING GREAT MIAMI AQUIFER.

5.0 PROCEDURE (CONT.)

5.8 Monitoring Well Installation

As specified by the PSP or Geologist-in-Charge, an auger drilled boring may be converted into a Type 1 monitoring well. This shall be accomplished in accordance with SCDM procedure **SCDM FO 002, "SOP for Type 1 Monitoring Well Installations."**

5.9 Soil Boring Plugging and Abandonment

Soil boring plugging and abandonment field activities shall be performed in accordance with SCDM procedure **SCDM FO-006, "SOP for Subsurface Opening Plugging and Abandonment."**

5.10 Demobilization

Attachment M of this procedure, titled "Auger Boring Project Completion Flowchart," shows the logical and sequential steps necessary to the demobilization of personnel, equipment and materials for auger drilled borings.

[1] Drill rig demobilization at the FEMP shall be performed under the following circumstances:

- The drill rig is moving to a new auger drilled boring location
- The drill rig is being moved off-site and will no longer be used at the FEMP.

The following demobilization actions will be taken only after the FEMP Field Project Manager and the Geologist-in-Charge have verified that all PSP data quality objectives for the borehole have been successfully completed.

Drilling Personnel

[1] Break down the drill rig in accordance with the drill rig manufacturer's or drilling subcontractor's specifications.

[2] Decontaminate the drill rig in accordance with the PSP decontamination criteria established.

[3] Transport the drill rig to the designated location in order for FERMCO Health and Safety staff to perform an inspection of the drill rig to ensure that it has been adequately decontaminated.

[4] Relocate the drill rig to the next auger drilled boring location, or;

[5] Remove the drill rig from the FEMP if the drill rig will no longer to be used at the FEMP.

6.0 RECORDS

[1] Original hard copy and electronic disc copy of this procedure transmitted to and maintained by Department Procedure Controller.

7.0 REFERENCES

7.1 Drivers

- U.S. Department of Energy (DOE), DOE Order 5480.19, "Conduct of Operations Requirements for DOE Facilities."
- FEMP Site Procedure No. 3.4.7, Revision No. 0, "Private Property Access Permits for Construction and NEPA Compliance Reviews," FERMCO Construction Division.
- FEMP Quality Assurance Program Description, RM-0012, Revision 2, April 30, 1993.
- FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ) (FD-1000), Revision 0.1, April 1993.

7.2 References

- American Society for Testing and Materials (ASTM) Designation: D 1586-84, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils," October 1992.
- American Society for Testing and Materials (ASTM) Designation: D 1587-83, "Standard Practice for Thin-Walled Tube Sampling of Soils," October 1983.
- U.S. Department of Energy, DOE Standard DOE-STD-1029-92, "Writer's Guide for Technical Procedures," December 1992.
- U.S. Environmental Protection Agency, EPA/600/4-89/034, "Handbook of Suggested Practices for the Design and Installation of Ground Water Monitoring Wells," February 1990.

ATTACHMENT A

FERMCO WORK PERMIT (FS-S-2939)

FERMCO
WORK PERMIT

SECTION A - BACKGROUND INFORMATION (Completed by Supervisor-in-Charge)

SECTION B - TYPES OF PERMITS REQUIRED (Completed by Supervisor in Charge)

- ☐ OUTAGE
- ☐ ASBESTOS (posted)
- ☐ CONFINED SPACE (posted)
- ☐ HAZARDOUS WORK (posted)
- ☐ PENETRATION
- ☐ CHEM/HAZ MATERIAL (posted)
- ☐ OPEN FLAME/WELDING (posted)
- ☐ RADIATION (posted)

SECTION C - GENERAL PRECAUTIONS (Completed by Supervisor-in-Charge)

	REQ'D.	DONE
PRELIMINARY		
1. Check for Utilities	☐	☐
2. Health & Safety Plan	☐	☐
3. Work Plan	☐	☐
4. Working surface safe for load (especially roof work)	☐	☐
5.	☐	☐
ENERGY CONTROL (Lock & Tag)		
6. Electrical	☐	☐
7. Chemical	☐	☐
8. Mechanical	☐	☐
9. Other (Steam, etc.)	☐	☐
10. Specific Equipment Plan Required	☐	☐
11.	☐	☐
ACCIDENT PREVENTION		
12. Fire Extinguisher	☐	☐
13. Safety Shower Operable & Less Than 100 ft. Away	☐	☐
14. Eye Wash Operable & Less than 100 ft. Away	☐	☐
15. Spill Protection	☐	☐
16. Communications	☐	☐
17. Magnetic Survey for Buried Utilities/Objects	☐	☐
18.	☐	☐
19.	☐	☐
AREA ISOLATION		
20. Area Barricades	☐	☐
21. Signs (PPE)	☐	☐
22. Signs (Warning)	☐	☐
23.	☐	☐
24.	☐	☐
OTHER CONTROLS		
25. Exhaust Ventilation	☐	☐
26. Supplied Air Ventilation	☐	☐
27. GFCI	☐	☐
28. Screen/Shield	☐	☐
29. Non-Sparking Tools	☐	☐
30. Intrinsically Safe Equipment	☐	☐
31.	☐	☐

SECTION E (CONTINUED)

	REQ'D.	DONE
LADDERS/FALL PROTECTION		
32. Ladder	☐	☐
33. Scaffolds/Rollings	☐	☐
34. High Lift Platform	☐	☐
35. Safety Net	☐	☐
36. Safety Harness	☐	☐
37. Safety Line	☐	☐
38. Tripod/Retrieval System	☐	☐
39.		
40.		

SECTION F1 - TASK/AREA/LOCATION (If PPE requirements differ on these)

1.
2.
3.
4.

SECTION G2 - PPE REQUIRED (Completed by OS&H)

HEAD PROTECTION ☐ None	___ Hard Hat ___ Goggles	___ Face Shield ___ Welding Goggles	___ Chemex
GLOVES ☐ None	___ Cotton ___ Nitrile ___ Wool Liner	___ Leather Palm ___ Viton ___ Other	___ Rubber ___ Neoprene
PROTECTIVE CLOTHING ☐ None	___ Level A ___ Level B ___ Level C ___ Level D	___ Poser ___ Tyvek ___ Saranex ___ Other	___ Acid Splash Suit ___ Fire Retardant ___ Shoe Covers
RESPIRATOR ☐ None	___ Full Face ___ Half Mask ___ PAPR	___ Belt-Mount Half Mask ___ Air Line w/Escape ___ Air Line w/Dual Pump	___ Hooded Air Line ___ SCBA
CARTRIDGE ☐ None	___ HEPA ___ HF Canister ___ Ammonia	___ Organic/HEPA Comb ___ Organic Vapor	___ Acid Gas ___ Mercury
OTHER ☐ None	___ Ear Plugs ___ Ear Muffs	___ Cool Vest	___ Steel-Toe Boots

SUPERVISOR-IN-CHARGE SIGNATURE | BADGE NUMBER | DATE
CREW SIGNATURE | BADGE NUMBER | DATE

WORK TASK REVIEWED, APPROVAL TO PERFORM WORK
FACILITY OWNER'S SIGNATURE | BADGE NUMBER | DATE

IN CASE OF EMERGENCY: CALL "CONTROL" BY RADIO, PHONE 6511, OR USE NEAREST FIRE ALARM BOX.

PERMIT TERMINATION (WORK COMPLETED/JOB CONDITIONS HAVE CHANGED)
SUPERVISOR-IN-CHARGE SIGNATURE | DATE

NO.	DISTRIBUTION OF COPIES
1	Post at Job (OS&H Copy)
2	Supervisor in Charge
3	OS&H Free Copy

FS-S-2939 (REV 4/17/93)

Return Copy 1 to OS&H (MS 631)

G:\WPSC94-136

Title: PROCEDURE FOR AUGER DRILLED BORINGS AND SOLIDS SAMPLING WITH A SPLIT-BARREL OR THIN-WALLED TUBE	PROCEDURE NO: SCDM FO-001	
	Date: 5/20/94	Revision No: 0
COMPLIANCE WITH THIS PROCEDURE IS MANDATORY WHEN EXECUTING ACTIVITIES WITHIN ITS SCOPE	Page 40 of 53	

ATTACHMENT B

FERMCO ASBESTOS WORK PERMIT (FS-F-2940)

FERMCO ASBESTOS WORK PERMIT

This permit is only valid when it is attached to the FERMCO Work Permit Form which has Section A through D completed.

FERMCO WORK PERMIT NUMBER:

SECTION A - BACKGROUND AND REGULATORY INFORMATION *(To be completed by supervisor-in-charge)*

1. Exact location:
2. Exact description of work to be conducted:
3. Amount of asbestos to be removed (in linear or square feet):
4. Regulatory approval received to begin work: ☐ YES ☐ DNA ☐ Immaterial
   * If yes, regulatory approval for this job starts _____ (Date) and ends _____ (Date).
5. Does job description meet requirements for small-scale, short-duration work? ☐ YES ☐ NO

Section B contains items which shall be complied with on this job as indicated.

SECTION B - PRE-JOB REQUIREMENTS SPECIFIED BY: _____ (FERMCO Rep. Initials) _____ (DATE) _____ (Time)

PREPARATION OF WORK SITE *(All Asbestos Jobs)*

	REQ'D	DNA
1. Work area barricaded and/or roped off		
2. Asbestos warning signs posted at work area		
3. Preconditioning of work area required		
4. All small items removed from decontamination work area		
5. Large equipment sealed and covered with plastic		
6. Floor and ledges covered with plastic		
7. Area ventilation systems locked and tagged out		
8. Shower established adjacent to work area		
9. Waste water filtered (5 micron filter) **		
10. Personnel air sampling required during work		
11. Hazardous handling equipment shall be replaced or asbestos work to prevent unauthorized access to work area		
12. Contact IH Technician to inspect work area preparation before asbestos removal begins		

WORK PRACTICES

	REQ'D	DNA
1. Personnel air sampling required (samples collected for entire shift when possible)		
2. No smoking, eating or drinking permitted in work area		
3. HEPA-filtered vacuum required for cleanup		
4. HEPA vacuum required at point of generating		
5. Glove bag removal of pipe insulation required		
6. Trapped panels shall be removed whole		
7. Asbestos material shall not be allowed to drop		
8. Trapped panels shall be wet down/encapsulate before removal		
9. Amended water shall be used to wet down material		
10. Asbestos material thoroughly wet down before removal		
11. Removed material promptly bagged (not allowed to dry out)		
12. Surfaces shall be cleaned with a sponge to encapsulate any remaining fibers		
13. Work area cleaned after completion of work each day		
14. Tools and equipment shall be cleaned of all removal dust before removal from work area.		
15. Personnel to decontaminate at each departure from work area		
16. Bag contaminated clothing and waste promptly		
17. Bagged waste material shall be placed in containers and labeled as asbestos waste (exterior of containers shall be clean and asbestos-free)		
18. Shower before lunch and at end of shift		

PREPARATION OF WORK SITE *(For Total Enclosure Jobs Only)*

	REQ'D	DNA
1. Floor and wall penetrations sealed and sealed		
2. Negative air enclosure set-up around work area		
3. Negative air machine operating satisfactorily		
4. Negative pressure achieved at 0.02 inches or greater		

SECTION C - FINAL INSPECTION REQUIREMENTS

	REQ'D	DNA
1. Visual inspection of work area for residual dust required after completion of job (signed by IH Technician)		
2. General area air samples required after completion of job (signed by IH Technician)		
3. Obtain IH Technician approval before removal of barriers & warning signs		

SECTION D - SIGNATURES *(Employees assigned to job)*
I have read and understand all requirements of this permit.

EMPLOYEE(S) SIGNATURE(S)	BADGE NO.	DATE	EMPLOYEE(S) SIGNATURE(S)	BADGE NO.	DATE
1.			4.		
2.			5.		
3.			6.		

APPROVAL TO BEGIN WORK			APPROVAL TO REMOVE BARRIERS AND WARNING SIGNS		
IH TECHNICIAN SIGNATURE	DATE	TIME	IH TECHNICIAN SIGNATURE	DATE	TIME

NO.	DISTRIBUTION OF COPIES
1	POST AT JOB
2	SUPERVISOR IN CHARGE
3	INDUSTRIAL HYGIENE/INDUSTRIAL SAFETY
4	EMPLOYEE REPRESENTATIVE

WORK AUTHORIZATION REVIEWED AND FOUND ACCEPTABLE FOR USE		
SUPERVISOR/COMPETENT PERSON** SIGNATURE	DATE	TIME

* *This Asbestos Work Permit expires when removal of barriers and warning signs is approved, preparation of additional work area is revised, employees assigned to the job are changed, or job conditions require changes in permit requirements. In no case shall the permit be valid beyond the date in Section A.4. above.*

** *For a job which requires the removal of asbestos-containing materials, the signature in this box indicates the supervisor has been trained or an asbestos qualified "Competent Person" per OSHA and as an "On-Site Representative" per NESHAP.*

ATTACHMENT C

FERMCO CONFINED SPACE AND CHEMICAL HAZARDOUS MATERIALS WORK PERMIT (FS-F-2745)

FERMCO
CONFINED SPACE AND
CHEMICAL HAZARDOUS MATERIALS WORK PERMIT

SECTION A - BACKGROUND INFORMATION

SECTION B - CONFINED SPACE PERMIT

CONTACT INDUSTRIAL HYGIENE IF THERE IS ANY CHANGE IN WORK ACTIVITY

CONFINED SPACE ENTRY PERMIT (Valid for NOT MORE THAN 12 HOURS)

ATMOSPHERIC TEST RESULTS

Gas	Initial Concentration	Final Concentration	Peak Concentration	TWA
Oxygen %				
L.E.L. %				
CO				
H_2S				
NO_2				
SO_2				
TOX				

Entry/Exit Points Evaluated ☐ YES ☐ NO

Physical Hazards Evaluated ☐ YES ☐ NO

Monitoring Required ☐ Combustible ☐ Portable ☐ None

Standby to Worker Communication ☐ Voice ☐ Sight ☐ Radio ☐ Other

Standby to EXIT Communication ☐ Radio ☐ Phone ☐ Fire Alarm

PRECAUTIONS	REV'D.	DONE	DNA
Mechanical Ventilation	☐	☐	☐
Additional Lighting	☐	☐	☐
Explosion-Proof Lights	☐	☐	☐
Safety Line & Harness	☐	☐	☐
Rescue Equipment	☐	☐	☐
Standby Rescue Procedure	☐	☐	☐

PERMIT VOID IF CONDITIONS CHANGE FROM ORIGINAL ISSUANCE CONDITIONS

CALL US TO PICK UP EQUIPMENT AND CLOSE PERMIT WHEN FINISHED

SECTION C - CHEMICAL/HAZARDOUS MATERIAL PERMIT

1. TYPE OF HAZARD ☐ Chemical ☐ Biological ☐ Physical
2. PHYSICAL STATE ☐ Solid/Dust ☐ Liquid/Mist ☐ Gas/Vapor
3. TYPE OF OPERATION ☐ Sampling ☐ Clean Up ☐ Repair ☐ Inspection ☐ Other
4. MSDS REVIEWED ☐ Yes ☐ No ☐ DNA ☐ Not Available
5. POTENTIAL HAZARDS ☐ Skin ☐ Inhalation/Ingestion ☐ Eye ☐ Oxygen Deficiency ☐ Explosive (contact FS # 7298)
6. MONITORING REQUIRED ☐ O_2 ☐ CA ☐ Pyrometer ☐ Chemicals ☐ None ☐ Other
7. WORKER-TO-RESCUE COMMUNICATION ☐ Radio ☐ Phone (911) ☐ Pull Rope
8. HYGIENE REQUIREMENTS ☐ Wash Hands at Breaks ☐ Shower at Lunch/End of Shift ☐ Other

PERMIT VOID IF CONDITIONS CHANGE FROM SIGNIFICANTLY DURING THE JOB

SECTION D - SIGNATURES

I HAVE READ AND UNDERSTAND ALL REQUIREMENTS OF THIS PERMIT.

(REQUIRED SIGNATURES)	(PRINT NAME)	DATE
1.		
2.		
3.		
4.		
5.		
6.		

WORK AUTHORIZATION REVIEWED AND FOUND ACCEPTABLE FOR USE

DIST.	DISTRIBUTION OF COPIES
1	Post at Job
2	Supervisor in Charge
3	Industrial Hygiene/Industrial Safety
4	Employee Representative

IN CASE OF EMERGENCY CALL "CONTROL" BY RADIO PHONE 6511, OR USE NEAREST FIRE ALARM BOX.

G:\WPSC\94-168

Title: PROCEDURE FOR AUGER DRILLED BORINGS AND SOLIDS SAMPLING WITH A SPLIT-BARREL OR THIN-WALLED TUBE	PROCEDURE NO: SCDM FO-001	
	Date: 5/20/94	Revision No: 0
COMPLIANCE WITH THIS PROCEDURE IS MANDATORY WHEN EXECUTING ACTIVITIES WITHIN ITS SCOPE	Page 42 of 53	

ATTACHMENT D

FERMCO CONFINED SPACE EVALUATION/PERMIT AND CHEMICAL HAZARDOUS MATERIALS WORK PERMIT (FS-F-2745)

FERMCO
CONFINED SPACE EVALUATION/PERMIT AND
CHEMICAL HAZARDOUS MATERIALS WORK PERMIT

WORK PERMIT NUMBER

SECTION A - BACKGROUND INFORMATION (This permit is only valid when attached to a FERMCO WORK PERMIT)

TODAY'S DATE | TIME | ESTIMATED COMPLETION DATE

BUILDING/PLANT | LEVEL | COORDINATES | PLANT JOB NUMBER

SECTION B - CONFINED SPACE EVALUATION

HAZARDS OF SPACE
- ☐ HAZARDOUS ATMOSPHERE
- ☐ MECHANICAL/MOVING PARTS
- ☐ SPACE CONFIGURATION/ENTRAPMENT
- ☐ ELECTRICAL
- ☐ ENGULFMENT
- ☐ OTHER: _____

ATMOSPHERIC TEST RESULTS

GAS	ACCEPTABLE ENTRY CONDITIONS	INITIAL CONCENTRATION	FINAL CONCENTRATION	TIME
Oxygen %	19.5 to 23.5			
L.E.L. %	<10%			
CO (ppm)	<25			
H_2S (ppm)	<10			
ALT	<5			

INSTRUMENT ID NUMBER | FIELD CALIBRATION DATE

SPACE HAS BEEN EVALUATED AND
☐ IS ☐ IS NOT A PERMIT-REQUIRED CONFINED SPACE FOR THIS WORK.

IH SIGNATURE | BADGE NO.:

Contact Industrial Hygiene if there is any change in work activity.

CONFINED SPACE ENTRY PERMIT

Entry/Exit Points Evaluated ☐ Yes

Monitoring Required ☐ Continuous ☐ Periodic

Standby to Worker Communication ☐ Voice ☐ Sight ☐ Radio ☐ Other: _____

Standby to ERT Communication ☐ Radio ☐ Phone ☐ Fire Alarm

PRECAUTIONS	REQ'D.	DNA
Mechanical Ventilation	☐	☐
Additional Lighting	☐	☐
Explosion-Proof Lights	☐	☐
Safety Line & Harness	☐	☐
Rescue Equipment	☐	☐

SPECIAL INSTRUCTIONS

IH SIGNATURE | BADGE NUMBER

PERMIT ISSUE DATE | TIME

PERMIT EXPIRATION DATE | TIME

Permit void if conditions change from original issuance conditions.
Call IH to pick up equipment and close permit when finished

PERMIT TERMINATION (Work Completed / Job Conditions Have Changed)

IH SIGNATURE | DATE

DISTRIBUTION OF COPIES
1. Page at Job
2. Supervisor in Charge
3. Industrial Hygiene/Industrial Safety
4. Employee Representative

FS-F-2745 (REV 3/1/93)

SECTION C - CHEMICAL/HAZARDOUS MATERIAL PERMIT

NAME OF MATERIAL | HAZARDOUS COMPONENT:
NAME OF MATERIAL | HAZARDOUS COMPONENT:
NAME OF MATERIAL | HAZARDOUS COMPONENT:

1. TYPE OF HAZARD ☐ Chemical ☐ Biological ☐ Physical
2. PHYSICAL STATE ☐ Solid/Dust ☐ Liquid/Mist ☐ Gas/Vapor
3. TYPE OF OPERATION ☐ Sampling ☐ Clean Up ☐ Repair ☐ Inspection ☐ Other _____
4. MSDS REVIEWED ☐ Yes ☐ DNA ☐ Not Available (Hazards Reviewed)
5. POTENTIAL HAZARDS ☐ Skin ☐ Inhalation/Ingestion ☐ Eye ☐ Oxygen Deficiency ☐ Explosive Hazard: FS if >5%
6. MONITORING REQUIRED ☐ BZ ☐ GA ☐ Perimeter ☐ Clearance ☐ None ☐ Other _____
7. WORKER-TO-RESCUE COMMUNICATION ☐ Radio ☐ Phone (5511) ☐ Pull Box
8. HYGIENE REQUIREMENTS ☐ Wash Hands at Breaks ☐ Shower at Lunch/End of Shift ☐ Other _____

SPECIAL INSTRUCTIONS

IH SIGNATURE | BADGE NUMBER

PERMIT ISSUE DATE | TIME | PERMIT EXPIRATION DATE | TIME

Permit Void If Conditions Change Significantly During The Job!

SECTION D - SIGNATURES (Employees assigned to job)

I have read and understand all requirements of this permit.

EMPLOYEE(S) SIGNATURE(S)	BADGE NO.	DATE
1.		
2.		
3.		
4.		
5.		
6.		

WORK AUTHORIZATION REVIEWED AND FOUND ACCEPTABLE FOR USE

SUPERVISOR IN CHARGE | DATE | TIME

IN CASE OF EMERGENCY CALL "CONTROL" BY RADIO PHONE 5511, OR USE NEAREST FIRE ALARM BOX.

G:\WPSC\94-168

ATTACHMENT E

CONSTRUCTION EXCAVATION/PENETRATION PERMIT (FS-F-2711)

FEMP

CONSTRUCTION EXCAVATION/PENETRATION PERMIT

ISSUED TO:	DATE ISSUED:
PERMCO PERMIT NUMBER:	SUBCONTRACTOR S.S. NUMBER:
PERMCO PROJECT TITLE/NUMBER:	
PLANT: / LOCATION:	
SCOPE OF WORK:	

This permit is issued on the basis of available information and may not be a complete description of all obstructions. Stop work immediately and contact the FERMCO Project Engineer if obstructions other than those defined are encountered.

The following utilities are known to exist in the EXCAVATION/PENETRATION area and a sketch or drawing defining the same utilities is attached for verification to this permit.

_____

_____

_____

Drawings: _____

Special Hazards and/or Precautions: _____

Disposal of Excavated Material: ☐ Yes ☐ No

If NO is checked, excavated dirt may be used for backfill provided it meets engineering specifications for backfill. Construction rubble from EXCAVATION/PENETRATION must be disposed of as described below:

MATERIAL TYPE	DISPOSAL AREA	MATERIAL TYPE	DISPOSAL AREA

NOTE: Contractors shall notify appropriate utilities for work outside the plant boundaries in accordance with Ohio Underground Utility Damage Act. All drilling and cutting tools shall be grounded in accordance with OSHA regulations.

The following approvals are required as determined and checked by the FERMCO Project Engineer.

	CIVIL ENGINEER:		ELECTRICAL ENGINEER:
	UTILITIES ENGINEER:		OTHER:

The following approvals are required on all CONSTRUCTION EXCAVATION/PENETRATION PERMITS:

FERMCO PROJECT ENGINEER:	PHONE NUMBER:
OPERATIONAL SUPERVISOR:	PHONE NUMBER:
WASTE MANAGEMENT OPERATIONS:	PHONE NUMBER:
OPERATIONAL SAFETY:	PHONE NUMBER:
HEALTH PHYSICS:	PHONE NUMBER:
ENVIRONMENTAL COMPLIANCE:	PHONE NUMBER:

FS-F-2711 (REV. 9/93)

G:\WPSC\94-168

Title: PROCEDURE FOR AUGER DRILLED BORINGS AND SOLIDS SAMPLING WITH A SPLIT-BARREL OR THIN-WALLED TUBE	PROCEDURE NO: SCDM FO-001	
	Date: 5/20/94	Revision No: 0
COMPLIANCE WITH THIS PROCEDURE IS MANDATORY WHEN EXECUTING ACTIVITIES WITHIN ITS SCOPE	Page 44 of 53	

ATTACHMENT F

FACILITY OUTAGE PERMIT (FS-F-2757)
Page 1 of 2

FEMP
CONS · CS · T/A
FACILITY OUTAGE PERMIT

PERMIT NO.:

Page 1 of 2

1. REQUESTED OUTAGE PERIOD:

		PIC:	OUTAGE TYPE:		PROCESS
BEGIN:	TIME:	DATE:	ORGANIZATION:	ELECTRICAL	EXCAVATION
				UTILITIES	GAS
END:	TIME:	DATE:	PHONE:	FIRE PROTECTION	PPE
				EVACUATION ALARM	HVAC
				OTHER:	
DATE SUBMITTED FOR PREPLANNING:			CONSTRUCTION CONTRACTOR:		

2. LOCATION OF OUTAGE/EXCAVATION (BLDG, ROOM, PARS, NUMBERS, ETC., AND ATTACH OR REFERENCE DRAWINGS):

3. DETAILED DESCRIPTION OF WORK TO BE DONE:

TELEPHONE SURVEY REQUIRED? ☐ YES ☐ NO

4. DETAILED DESCRIPTION OF EQUIPMENT, SYSTEMS OR ROADS TO BE TAKEN OUT OF SERVICE OR SHUTDOWN:

TAGOUTS REQUIRED? ☐ YES ☐ NO

5. BACKUP OR EMERGENCY SYSTEMS REQUIRED/CHECKS NECESSARY TO ENSURE COMPLETE PLANT RECOVERY:

6.	PIC:	DATE:	PHONE:
	CMCC:	DATE:	PHONE:

FS-F-2757 (REV. 10/19/93)

G:\MPBC\94-168

ATTACHMENT F (CONT.)

FACILITY OUTAGE PERMIT (FS-F-2757)
Page 2 of 2

FEMP
CONS - CE - T/A
FACILITY OUTAGE PERMIT - CONTINUED

Page 2 of 2

7. PERMIT APPROVALS:	PRELIMINARY APPROVAL		FINAL APPROVAL		EXTENSION APPROVAL	
POSITION/ORGANIZATION	SIGNATURE	TIME/DATE	INITIALS	TIME/DATE	INITIALS	TIME/DATE
Facility Owner						
Utility Engineer						
As Required: CM/CE						
ESH (Safety)						
EDG						
Others						
QA						
Security						
Maintenance						
Nuclear Safety						
Radiological						
Fire Protection						

8. RESTRICTIONS OR SPECIAL INSTRUCTIONS:

9.	PERMIT APPROVED	BEGIN:	TIME:	DATE:	PIC:
		END:	TIME:	DATE:	
10.	EXTENSION APPROVED	BEGIN:	TIME:	DATE:	PIC:
		END:	TIME:	DATE:	
11.	FACILITY OWNER APPROVAL TO START WORK:				DATE/TIME:
12.	WORK COMPLETED:		TIME:	DATE:	PIC:
	FACILITY OWNER NOTIFIED:		TIME:	DATE:	
13.	PERMIT CLOSED AND APPROVERS NOTIFIED:		TIME:	DATE:	PIC:

FS-F-2757 (REV. 10/18/93)

Title: PROCEDURE FOR AUGER DRILLED BORINGS AND SOLIDS SAMPLING WITH A SPLIT-BARREL OR THIN-WALLED TUBE	PROCEDURE NO: SCDM FO-001	
	Date: 5/20/94	Revision No: 0
COMPLIANCE WITH THIS PROCEDURE IS MANDATORY WHEN EXECUTING ACTIVITIES WITHIN ITS SCOPE	Page 46 of 53	

ATTACHMENT G

FERMCO OPEN FLAME AND WELDING HAZARDOUS WORK PERMIT (FS-F-352)

FERMCO
OPEN FLAME AND WELDING HAZARDOUS WORK PERMIT

WORK PERMIT NUMBER:

SECTION A - BACKGROUND INFORMATION *(This permit is only valid when attached to a FERMCO WORK PERMIT)*

TODAY'S DATE	TIME	ESTIMATED COMPLETION DATE

BUILDING/ PLANT	LEVEL	COORDINATES	PLANT JOB NUMBER

SECTION B - OPEN FLAME/WELDING PERMIT

PRECAUTIONS*	YES	DNA
1. Combustibles, magnesium, and uranium removed, covered or shielded.	☐	☐
2. Flammable liquids removed or isolated.	☐	☐
3. Wall and floor openings covered or protected.	☐	☐
4. Flame retardant tarp suspended underneath work.	☐	☐
5. Combustible gas check.	☐	☐
6. Combustibles removed from opposite sides. (Work on walls or ceilings)	☐	☐
7. Fire watch will remain posted during breaks and for 30 minutes after work is completed.	☐	☐
8. Fire watch has an extinguisher and knows how to activate the nearest alarm.	☐	☐
9. Fire & Safety inspector shall be present during the burning operation.	☐	☐
10. Fire & Safety inspector shall be present to monitor when the system is initially opened.	☐	☐
11. Combustible Gas Test Results		%LEL
12. Equipment/Area checked.	☐	☐
13. Special Instructions/Precautions	☐	☐
14. MSDS Reviewed.	☐	☐
15. FERMCO WORK PERMIT "C" Items: ___ ___ ___ ___ ___ ___ Checked.	☐	☐
16. Applicable PPE in use.	☐	☐

("Fire Watch has received training") NAME:	BADGE NUMBER:
FF/W SIGNATURE (REQUIRED) ☐ YES ☐ NO:	BADGE NUMBER:
OS&H SIGNATURE:	BADGE NUMBER:
PERMIT ISSUE DATE:	TIME:
PERMIT EXPIRATION DATE:	TIME:

NO.	DISTRIBUTION OF COPIES
1	Post at Job (OS&H Copy)
2	Supervisor In Charge
3	OS&H Field Copy

IN CASE OF EMERGENCY CALL "CONTROL" BY RADIO, PHONE 6511, OR USE NEAREST FIRE ALARM BOX.

FS-F-352 (REV 6/8/93)

SECTION C - HAZARDOUS WORK PERMIT

EXCAVATIONS (Personnel in Hole)	YES	NO	DNA
1. Shored or Sloped to 34 degrees	☐	☐	☐
2. Maximum vertical step 24 inches	☐	☐	☐
3. Ladder(s) in place	☐		☐
4.	☐	☐	☐
5. Atmospheric Tests Required	☐		☐
"COMPETENT PERSON" AUTHORIZING EXCAVATION WORK:			
ELEVATED WORK *(greater than 6 feet)*			
1. Railings, toeboards	☐	☐	☐
2. Solid footing under scaffold	☐		☐
3. Ladders tied off	☐	☐	☐
4.	☐	☐	☐
CRANE WORK			
1. Pad Rate O.K.	☐	☐	☐
2. Electric lines deenergized	☐	☐	☐
3.	☐	☐	☐
1. FERMCO WORK PERMIT "C" Items: ___ ___ ___ ___ ___ ___ Checked.	☐		☐
2. Applicable PPE in use.	☐		☐
3. Special Instructions/Precautions	☐		☐

OS&H SIGNATURE:	BADGE NUMBER:
PERMIT ISSUE DATE:	TIME:
PERMIT EXPIRATION DATE:	TIME:

SECTION D - SIGNATURES *(Employees assigned to job)*

I HAVE READ AND UNDERSTAND ALL REQUIREMENTS OF THIS PERMIT.

EMPLOYEE(S) SIGNATURE(S)	BADGE NUMBER	DATE
1.		
2.		
3.		
4.		
5.		
6.		

WORK AUTHORIZATION REVIEWED AND FOUND ACCEPTABLE FOR USE

SUPERVISOR IN CHARGE	DATE	TIME

RETURN EXPIRED COPY #1 TO OS&H (MS 31)

ATTACHMENT H

FEMP RADIOLOGICAL WORK PERMIT (FS-F-1372)
Page 1 of 2

FEMP
RADIOLOGICAL WORK PERMIT
This permit is only valid when attached to a FERMCO WORK PERMIT.

(1) WORK PERMIT NUMBER: | PAGE: 1 OF

PART I - RADIOLOGICAL CONTROL REQUIREMENTS

(2) TODAY'S DATE:	(3) TIME:	(4) ESTIMATED COMPLETION DATE:	
(5) BUILDING/PLANT:	(6) LEVEL:	(7) COORDINATOR:	(8) PLANT JOB NUMBER:
(9) SUPERVISOR IN CHARGE:		(10) PHONE EXT./RADIO:	(11) ESTIMATED JOB MAN-HOURS:

(12) STAY TIME: HOURS/WEEK	(13) STAY TIME BASIS (Determined by Radiological Engineering):		
	SKIN	LIMITING DOSE RATE	mrem/hr
	WHOLE BODY	IF AIRBORNE	%DAC
	EXTREMITY	SURVEY I.D. NUMBER	
	AIRBORNE		

NOTICE *Post most recent survey data at the work site.* *NOTICE*

(14) COVERAGE REQUIREMENTS	(15) AIR MONITORING REQUIREMENTS	(16) CONTAMINATION CONTROL
INTERMITTENT COVERAGE	CONTINUOUS AIR MONITOR (Type:)	HEPA VENTILATION: #
CONTINUOUS COVERAGE	BREATHING ZONE AIR SAMPLER (PAS)	HEPA VACUUM: #
NOTIFY RC EACH SHIFT WHEN RWP IS USED	GENERAL AREA AIR SAMPLING	AREA ISOLATION
OTHER:	OTHER:	CONTAINMENT DEVICE
OTHER:	OTHER:	OTHER:

(17) COMPLETE AN ALARA ASSESSMENT AS PER SP-A-35-007, ALARA REVIEW AND EVALUATION.
Is an ALARA Review Required? ☐ YES ☐ NO (IF YES, THEN attach form)

(18) PRE-JOB BRIEF REQUIRED? ☐ YES ☐ NO

(19) DOSIMETRY		(20) REQUIRED TRAINING	
Special Bioassay *(See Comments)*	Job Specific TLD	Rad Worker I	Respirator Training
Direct Reading Dosimeter	Extremity Dosimetry	Rad Worker II	Other: *(Specify Below)*

(21) COMMENTS:

(22) WORK PERMIT PPE REQUIREMENTS ATTACHED:
☐ YES ☐ NO

APPROVALS *Signee verifies FERMCO Work Permit, PPE Requirements, Health & Safety Plan, or other additional documentation have been reviewed and approved of the requirements of the RWP.*

(23) RCT SUPERVISOR:	DATE:	(24) RADIOLOGICAL ENGINEERING:	DATE:
(25) RADIOLOGICAL COMPLIANCE:	DATE:	(26) REQUESTOR (CONCURRENCE):	DATE:

(27) RCT SIGNATURE:	RCT OFFICE LOCATION:	DATE ISSUED:	TIME ISSUED:
RCT PRINTED NAME:	RCT PHONE:		

PART II - BRIEFING GUIDANCE SHEET *(APPLICABLE ONLY IF BRIEFING IS REQUIRED)*

SCOPE OF WORK TO BE PERFORMED	RADIOLOGICAL CONTROL HOLD POINTS
RADIOLOGICAL CONDITIONS OF THE WORKPLACE	COMMUNICATION AND COORDINATION WITH OTHER GROUPS
PROCEDURAL AND RWP REQUIREMENTS	PROVISIONS FOR HOUSEKEEPING AND FINAL CLEANUP
SPECIAL AND RADIOLOGICAL CONTROL REQUIREMENTS	EMERGENCY RESPONSE PROVISIONS
RADIOLOGICALLY LIMITING CONDITIONS (Radiation and/or contamination levels that may void the RWP)	PROVISIONS FOR HOUSEKEEPING AND FINAL CLEANUP
COMMUNICATIONS AND COORDINATION WITH OTHER GROUPS	EMERGENCY RESPONSE PROVISIONS

NO.	DISTRIBUTION OF
1.	JOB SITE
2.	RCT SUPERVISOR
3.	DOSIMETRY MANAGER

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FS-F-1372 REV. 10/7/93

☐ RWP CONTINUED ON NEXT PAGE

ATTACHMENT H (CONT.)

FEMP RADIOLOGICAL WORK PERMIT (FS-F-1372)
Page 2 of 2

FEMP
RADIOLOGICAL WORK PERMIT
This permit is only valid when attached to a FERMCO WORK PERMIT.

(1) WORK PERMIT NUMBER:

PAGE:

PART III - WORKER VERIFICATION
Signature verifies worker has read, understood, and will comply with the requirements of this RWP.

NAME			BADGE NUMBER	BRIEFED PER PART II?	RESPIRATOR FIT TEST CURRENT?	RADIATION WORKER TRAINING
PRINTED	SIGNATURE	DATE				
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II
				☐ YES ☐ NO	☐ YES ☐ NO	☐ I ☐ II

NO.	DISTRIBUTION OF
1.	JOB SITE
2.	RCT SUPERVISOR
3.	DOSIMETRY MANAGER

FS-F-1372-1 (REV. 10/7/93)

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ATTACHMENT I

FEMP FIELD ACTIVITY LOG ((FS-F-3682)

FEMP
FIELD ACTIVITY LOG

CONTROL NUMBER:	DATE:	Page of

PROJECT NAME:	PROJECT NUMBER:
FIELD TEAM LEADER:	FIELD TEAM MEMBERS:
FIELD ACTIVITY SUBJECT:	
WEATHER CONDITIONS:	RELATED FIELD FORM CONTROL NUMBERS:
TEAM LEADER SIGNATURE:	DATE: / ALPHA METER S.N.: / BETA/GAMMA METER S.N.:

TIME	DESCRIPTION OF ACTIVITY

WATER QUALITY METER SERIAL NO.:	METER CALIBRATION												
INITIALS/DATE	pH (STD UNITS)		SP. COND. (µmhos/cm)		D.O. (mg/L)	TURBIDITY (NTU)	TEMP. (°C)	SALINITY (mg/L)	PID SERIAL NO.	PID SERIAL	PID LIT NO.	PID READING	PID SPAN
TEMP.:	4	7	HIGH	LOW									
Manual Calibration:													
Auto Calibration:													

VISITORS		TIME	
NAME(S)	ORGANIZATION(S)	ARRIVED	LEFT

FS-F-3682 (REV. 9/16/93)

Title: PROCEDURE FOR AUGER DRILLED BORINGS AND SOLIDS SAMPLING WITH A SPLIT-BARREL OR THIN-WALLED TUBE	PROCEDURE NO: SCDM FO-001	
	Date: 5/20/94	Revision No: 0
COMPLIANCE WITH THIS PROCEDURE IS MANDATORY WHEN EXECUTING ACTIVITIES WITHIN ITS SCOPE	Page 50 of 53	

ATTACHMENT J

FEMP LITHOLOGIC LOG (FS-F-3881)

CONTROL NUMBER

FEMP
LITHOLOGIC LOG

Page of

PROJECT NAME | PROJECT NUMBER

BORING NUMBER | COORDINATES | RELATED FAL NUMBERS

SURFACE ELEVATION | GROUNDWATER LEVEL | DATE | TIME | DATE STARTED

GEOLOGIST | GROUNDWATER LEVEL | DATE | TIME | DATE COMPLETED

WATER USED DURING DRILLING | DRILLING CONTRACTOR | DRILLING EQUIPMENT | DRILLER/HELPER

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inches)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MOISTURE CONDITIONS (TBD)	REMARKS

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES

* Samples collected per ASTM Standard Penetration test.

FS-F-3881 8-1-93

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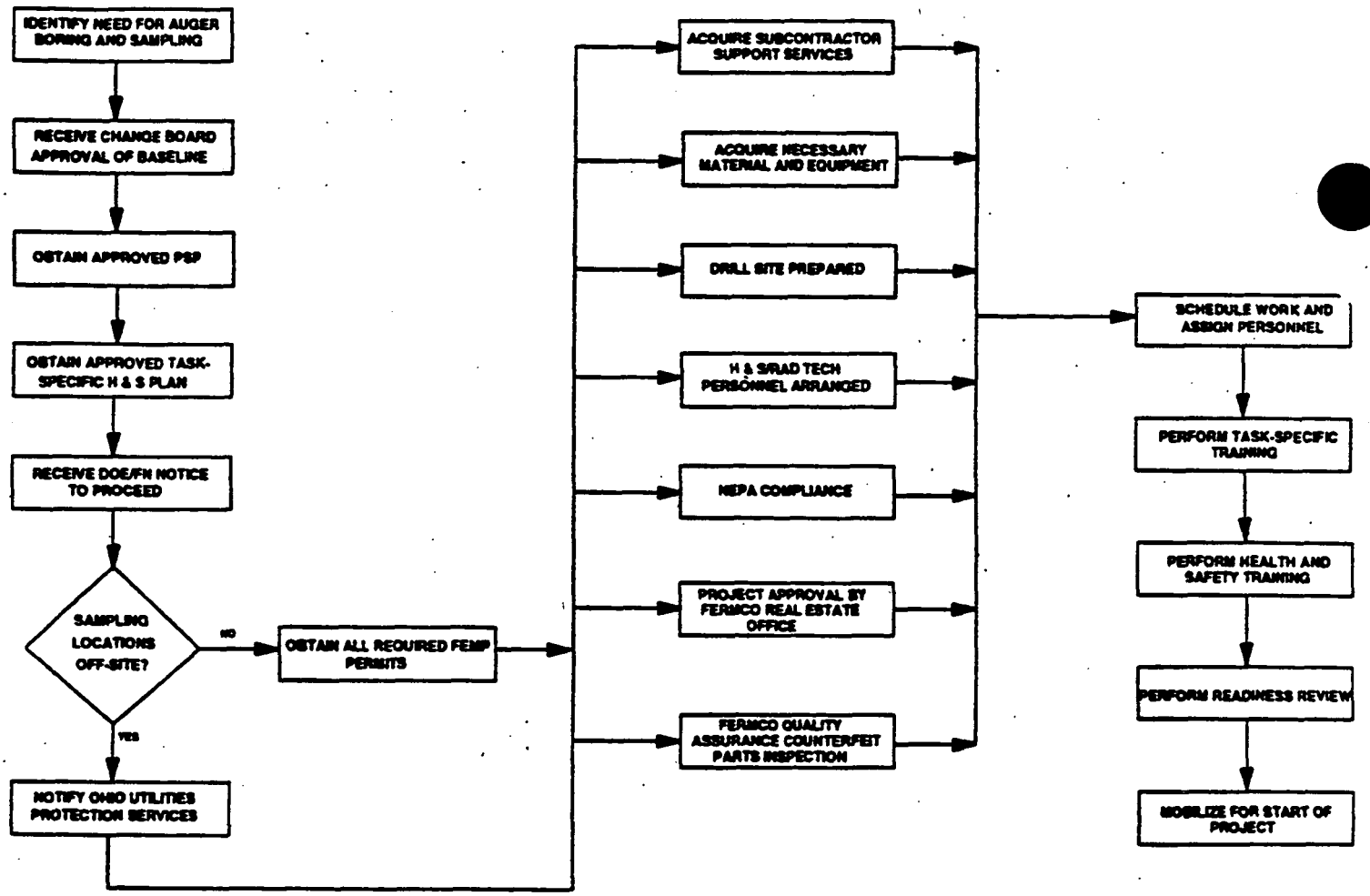
ATTACHMENT K

AUGER BORING PROJECT PREPARATION FLOWCHART



NOTE: Some activities may be arranged concurrently.

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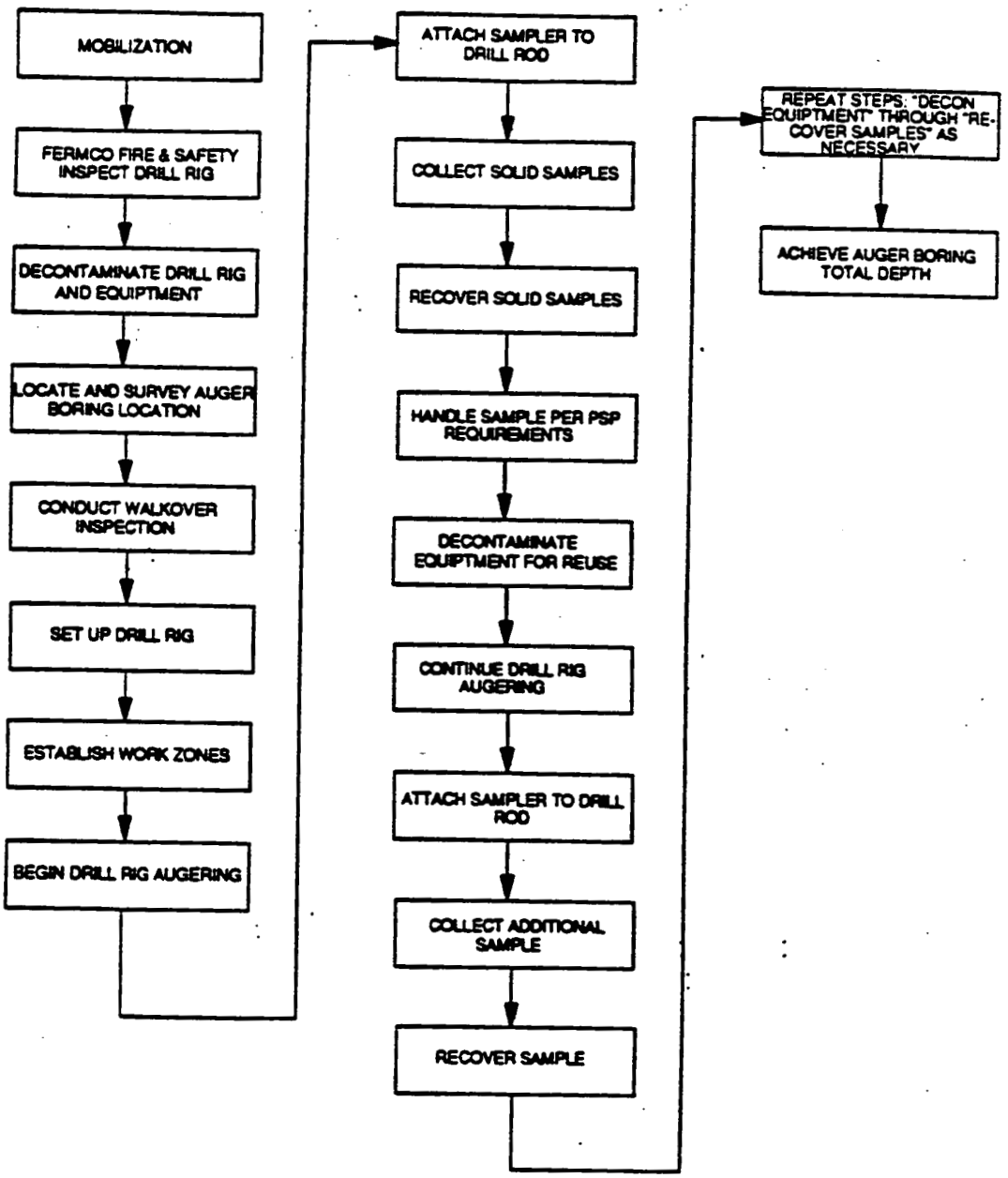
Title: PROCEDURE FOR AUGER DRILLED BORINGS AND SOLIDS SAMPLING WITH A SPLIT-BARREL OR THIN-WALLED TUBE	PROCEDURE NO: SCDM FO-001	
	Date: 5/20/94	Revision No: 0
COMPLIANCE WITH THIS PROCEDURE IS MANDATORY WHEN EXECUTING ACTIVITIES WITHIN ITS SCOPE	Page 52 of 53	

ATTACHMENT L

AUGER BORING PROJECT PERFORMANCE FLOWCHART



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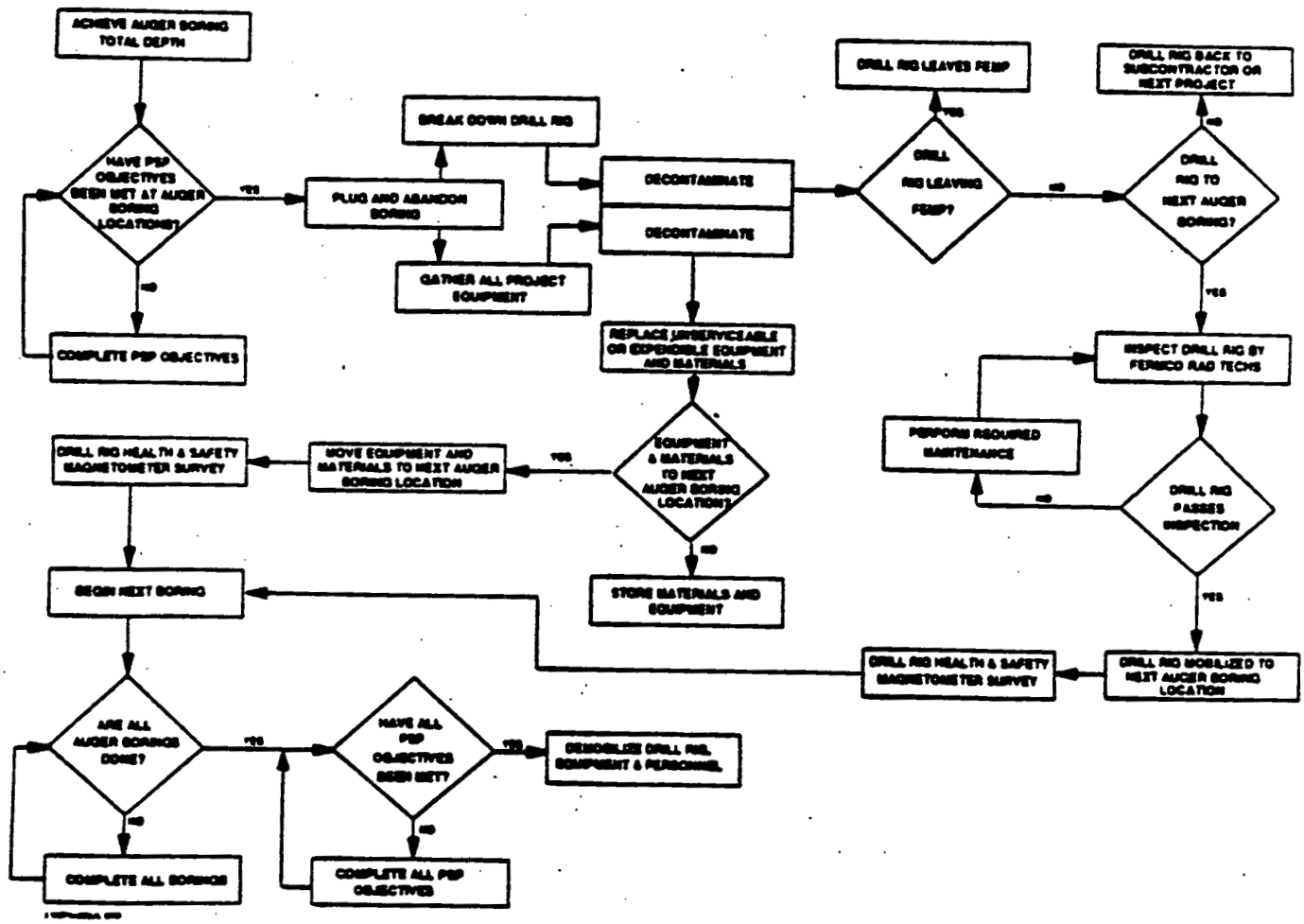
ATTACHMENT M

AUGER BORING PROJECT COMPLETION FLOWCHART



Fernald Environmental Management Project Fernald Environmental Restoration Management Corp. REMEDIATION SUPPORT OPERATIONS DOCUMENT PROGRAM	Page 1 of 9 Revision No. 1 Revision Date: 05-04-94

REMEDIATION SUPPORT OPERATIONS PROCEDURE	CONTROL AND UTILIZATION OF CONTAMINATED TRASH DUMPSTERS	SOP 20-C-604 Area: As Applicable

(Signature on File) Authorization: M.L. West, Manager, Environmental Waste Management	Supersedes: 20-C-604 Dated: 05-24-88	Issue Date: 10-18-93

1.0 PURPOSE

The purpose of this document is to provide the procedure for moving, filling, securing, and inspecting the dumpsters for contaminated trash containment on the controlled side.

2.0 APPLICABILITY

This procedure is applicable to contaminated trash dumpsters at the FEMP.

3.0 RESPONSIBILITIES

NON-CONTROLLED COPY

3.1 Supervisors shall be responsible for the following:

3.1.1 Ensuring that personnel are qualified per the established training requirements identified by the Department/Section Manager.

3.1.2 Maintaining training records of personnel who are using the dumpsters.

3.1.3 Providing training records to Environmental Waste Management.

3.1.4 Contacting Environmental Safety and Health (ES&H) to determine the appropriate respiratory protection for handling contaminated trash.

3.1.5 Providing Contaminated Trash Handlers with the required respiratory protection.

3.1.6 Reviewing applicable Material Safety Data Sheets with Contaminated Trash Handlers.

3.2 Contaminated Trash Generators shall be responsible for ensuring that prohibited items are not placed into trash receptacles.

3.3 Dumpster Owners shall be responsible for the following:

3.3.1 Ensuring that designated contaminated trash dumpster access doors remain locked when not in use.

R 3.3.2 Ensuring that contaminated trash does not accumulate around the dumpsters unless the dumpster is full.

3.3.3 Maintaining ownership (or delegating ownership) of the key to open the "master" lock on the contaminated trash dumpster.

3.0 RESPONSIBILITIES (cont.)

R 3.3.4 Notifying Waste Generation Control (WGC) when key control has been
R delegated to someone other than the designated key-holder.

3.3.5 Notifying WGC of problems associated with contaminated trash dumpsters.

R 3.3.6 Ensuring that unidentified (un-labelled) bags that have been "dropped"
R at the dumpster are marked with a large red "X" and placed in the
R dumpster for segregation and internal inspection at the contaminated
R trash baler.

R 3.3.7 Arranging for a Motor Vehicle Operator (MVO) to empty/transport full
R dumpsters.

R 3.3.8 Coordinating with Contaminated Trash Handlers to ensure that bags are
R inspected visually (externally) and prohibited items are detected at the
R point of generation.

R 3.3.9 Ensuring that labeled, acceptable contaminated trash is deposited in
R dumpsters or ensuring that only authorized contaminated trash handlers
R deposit trash into dumpsters.

R 3.4 Contaminated Trash Handlers/MVOs shall be responsible for complying with this SOP.

3.5 RSO Operations and Waste Generation Control (WGC) shall be responsible for the following:

3.5.1 Periodically updating the prohibited items list that is posted on the contaminated trash dumpsters.

3.5.2 Initiating the appropriate action to take if prohibited items are found.

3.5.3 Maintaining a list of dumpster owners.

3.5.4 Retaining duplicate keys to the dumpster locks.

3.5.5 Routinely issuing "employee updates" to inform personnel of the requirements for disposing of contaminated trash.

3.5.6 Determining placement of contaminated trash dumpsters to better serve the site needs.

R 3.5.7 Coordinating with Dumpster Owners to ensure that authorized Contaminated
R Trash Handlers deposit waste material in dumpsters.

3.6 Quality Control (QC) shall be responsible for the following:

3.6.1 Performing weekly inspections of the dumpsters.

3.6.2 Notifying dumpster Owners of deviations and forwarding copies of DCARs to QA & WGC.

3.0 RESPONSIBILITIES (cont.)

3.7 Quality Assurance shall be responsible for the following:

3.7.1 Evaluating the Contaminated Trash Dumpster per the QC Inspection Checklist form and documentation from the package certifiers (pre-baled trash inspection) and baler operators.

3.7.2 Contacting Dumpster Owners and issuing Deviation Reports whenever appropriate.

4.0 DEFINITIONS

4.1 Contaminated Material - A substance containing radioactive constituents that are above the limit for unrestricted release (1,000 dpm/cm^2).

4.2 Contaminated Trash Dumpsters - Gray, secured containers for contaminated trash that are located throughout the controlled area.

4.3 Contaminated Trash Generator - Any person who works in, or will access, the controlled area to perform duties, and subsequently be disposing of trash.

4.4 Contaminated Trash Handler - Any person (porter, laborer, HAZWAT, chemical operator, sub-contractor, MVO, or radiation technician) that will collect contaminated trash for disposal.

4.5 Contaminated Trash - Any waste that is suspected to have contaminated material which would prevent the disposal at a sanitary landfill.

5.0 APPLICABLE DOCUMENTS

5.1 Drivers

5.1.1 PO-D-026, "Site Services Document Program"

5.1.2 RM-0012, "Quality Assurance Program Description"

5.2 References

None

6.0 INDUSTRIAL HEALTH AND SAFETY REQUIREMENTS

6.1 Safety glasses with side shields shall be worn unless other eye protection is specified by ES&H or posted signs.

6.2 Respiratory protection issued by the supervisor shall be worn when required by ES&H.

6.3 Leather-palm gloves shall be worn when handling rough and/or contaminated material.

6.4 Contaminated trash shall not be allowed to accumulate around the dumpsters.

6.0 INDUSTRIAL HEALTH AND SAFETY REQUIREMENTS (cont.)

6.5 Contaminated Trash Handlers/MVOs shall have reviewed and be familiar with MSDSs for hazardous materials/chemicals that may be used or handled.

6.6 Any circumstance which could have resulted in an intake of radioactive materials by inhalation, ingestion, or absorption shall immediately be reported to a Supervisor. The Supervisor shall immediately report the circumstance of possible radioactive materials intake to ES&H Radiological Control Department for evaluation. When the suspect isotope is uranium, the involved personnel shall report to the Urine Sampling Station at the end of their shift to complete an Incident Investigation Report (IIR) (Form No. FS-F-1458), and submit an incident urine sample. The involved personnel shall also report to the Urine Sampling Station at the start of their next shift to submit a follow up urine sample. When the suspect isotope is other than uranium, the involved personnel shall report to the Dosimetry Section of the Radiological Control Department for further determination of actions. Employees are responsible for complying with additional requirements as specified by the Radiological Control Section.

6.7 Any situation which could have resulted in the inhalation, ingestion, or absorption of a hazardous material shall immediately be reported to a Supervisor or to the Assistant Emergency Duty Officer (AEDO), who will immediately report the circumstances to Medical and Industrial Hygiene. The involved personnel shall be directed by the Supervisor or AEDO as to when and where to report for medical evaluation, completion of an Incident Investigation Report (IIR) (Form No. FS-F-1458), and submitting bioassay samples (e.g. blood, urine). Employees are responsible for complying with any additional requirements as specified by ES&H.

7.0 GENERAL

7.1 Warnings, Cautions, and Notes precede the Item or Step to which they apply.

8.0 PROCEDURE

8.1 Bag Inspection

CONTAMINATED TRASH HANDLER

8.1.1 Visually examine the trash for prohibited items or categories of waste (Refer to Table 1) as the clear plastic bags are filled.

8.1.1.1. If inspection of the trash is not possible, perform an external visual inspection through the bag.

8.1.2 Remove prohibited items from the trash.

8.1.3 Contact the supervisor and dumpster owner and request disposition instructions.

8.1.3.1 If the supervisor or dumpster owner are unable to determine disposition contact Waste Generation Control (Telephone No. 738-8444).

8.0 PROCEDURE (cont.)

8.1.4 Dispose of prohibited items in approved manner (Refer to Table 1) as instructed by the supervisor or Waste Generation Control.

8.1.5 Ensure the building, office area, or project from which the trash originated is clearly marked on the accumulation bags with a permanent marker or paint pen.

8.2 Filling Contaminated Trash Dumpsters

CONTAMINATED TRASH HANDLER

8.2.1 Dispose of small or loose items as follows:

8.2.1.1 Inspect small/loose material for prohibited items (Refer to Table 1).

8.2.1.2 Set prohibited items, if any, aside for disposal.

8.2.1.3 Place the trash in a clear plastic bag.

8.2.1.4 Gather or twist the open end of the bag until the opening is closed.

8.2.1.5 Using tape, secure the bag.

8.2.1.6 Ensure that the building, office area, or project from which the trash originated is clearly marked on the accumulation bags with a permanent marker or paint pen.

8.2.1.7 Contact the supervisor or WGC (738-8444) and request instructions for prohibited items that were removed.

8.2.2 Contact the Dumpster Owner (listed on the information sheet posted on the dumpster) to obtain approval for disposal and to obtain the lock key (See Figure 1).

8.2.3 Unlock the dumpster.

CAUTION

Piping and pieces of wood over two feet in length shall not be placed in the dumpster.

8.2.4 Place bulky items (such as oversize pieces of cardboard) directly into the dumpster.

8.2.5 Inspect the bags for damage.

8.2.5.1 Place damaged bags into undamaged bags.

8.2.5.2 Identify the bag with the same markings as the damaged bag.

8.2.6 Check bags for identification marking and "clean" trash bags.

8.2.6.1 Mark bags without identification with a large red "X."

8.0 **PROCEDURE** (cont.)

NOTE 1: Unsecured and/or unidentified bags or damaged bags shall not be placed in the dumpster.

NOTE 2: Green-tinted "clean office trash bags" shall not be placed in the dumpsters. Clean bags are disposed of differently than contaminated trash. Clean office trash in green-tinted bags are accumulated next to the contaminated trash dumpsters. The bags are picked up by transportation twice per week.

8.2.7 Place identified contaminated trash (excluding items in Table 1) in the dumpster.

8.2.8 Lock the dumpster.

8.2.9 Return the lock key to the Dumpster owner.

8.2.10 Notify Dumpster owner when a full dumpster requires emptying.

8.3 Transporting Contaminated Trash Dumpsters

MOTOR VEHICLE OPERATOR (MVO)

8.3.1 Transport the contaminated trash dumpsters according to the established schedule (Refer to Figure 1).

8.3.2 Pick up prohibited items that have been segregated.

8.3.3 Transport prohibited items to the designated locations for disposal.

8.3.4 Contact Dumpster Owner when transport schedule cannot be met.

8.4 Dumpster Inspection

QUALITY CONTROL

8.4.1 Inspect dumpsters (monthly) and document the inspection.

8.4.2 Notify the Dumpster Owner and Waste Generation Control of inspection results.

9.0 **APPLICABLE FORMS**

9.1 NN, "Contaminated Trash Dumpsters"

TABLE 1

NTS Waste Stream -- ONLO-00000007
"Contaminated Trash"

Allowed Items	Restrictions
Certain Batteries	No Lead-Acid (vehicle) or Ni-Cad (rechargeable)
Empty Cans	No Prohibited Item Residue
Metal	Less than 2 ft. in length. Free from grease, oil, residues, lead-based paint
Paper/Cardboard	
Personal Protective Equipment (Anti-C's, Boots, Gloves, Tyvek)	Unless specifically restricted by Work Plan
Plastic	
Rope, Twine, String	
Styrofoam, Rubber	
Wood	Less than 2 ft. in length. Free from creosote, residue, stains, lead-based paint

Dumpster Usage Instructions:

1. All trash MUST be marked with the building or area of origin.
2. All trash MUST be placed inside the dumpster (**except green-bagged Office Trash**).

Prohibited Items	Examples	Where to Go	Who to Contact
Asbestos Containing Material	Transite, Pipe Insulation, Floor Tile	—	Leigh Fisher, x8638
Batteries	Auto, Ni-Cad Rechargeable	Plant 6	Susan Hoskins, x6826
Compressed Gases and Aerosol Cans (unpunctured)	Spray Paint, Deodorant Cans, Spray Disinfectant Cleaner, WD-40, Propane	Plant 1	Sam Laupola, xo052
Glass	Bottles, Jars, Light bulbs	Plant 1	Sam Laupola, x6052
Lead-bearing Material	Lead metal, Pipe dope, Lead flashing, Oil filters	Satellite Accum. Areas	John Grace, x8924
Liquids	Water, Coffee, Ice, Pop	Sink	—
Mercury-bearing Material	Switches, Vaccuum Pumps	Satellite Accum. Areas	John Grace, x8924
Particulates (unbagged)	Ashes, Dust, Pad Sweepings	—	Chris Gilbert, x6428
Solvents and Soaked Rags	Kerosene, Toluene, Acetone	Satellite Accum. Areas	John Grace, x8924
UNCONTAMINATED TRASH	Office Trash, Paper, Non-radioactive trash	—	Chuck Menche, x6428
Wood	Pallets, 2x4's, Lumber	Plant 1	Lori Hurst, x8448

Any Questions...Call
Waste Generation Control - x8444

Contaminated Trash Dumpsters – Master

No.	Chase Dr.	New Lock	Hazardous Waste Item	Hazardous Waste Item Not	Hazardous Waste Item Not	Hazardous Waste Item Not	Location	Description	Facility Dumpster Owner	Phone	Key holder(s)	Phone
1		X2342		x			Pit 1 N	E Bldg 1 Pit 1	Brenda Perkins	6301	Brenda Perkins	6301
2		2703					Lab S	Lab S	Ken Bell	6376	Ken Bell	6376
3		2408		x			South of Lab Bldg.	South of Lab Bldg.	Jim Hay	6416	Bob Godfrey	6416
4		2159					South of Lab Bldg.	Gravel Area - N	Ken Peters	6451	Ken Peters	6451
5		2677		x			Pit 1 NE	NE corner	Dale Woodson	6418	Dale Woodson	6418
6		2816					Pit 5	E side of Pit 5	Ken Peters	6451	Alan Blundell	6451
7		2112	x				Pit 6 Imp	W side of Pit 6	Ken Peters	6451	Alan Blundell	6451
8		2549	x	x			Pit 6 N	W side of Pit 6	Doug Blanchard	6441	Wanda Burk	6441
9		X2727		x	x		Lab Pad W	Wood of Lab Dock	Gene Bakemeier	6422	Tim Fearne	6422
10		X2721			x		Garage	E side pole barn	Kurt Lamoller	6408	Paul Fisch	6408
11		X2649	x				Bldg 12 SE	SE end of Bldg	Kurt Lamoller	6408	Lark Collins	6408
12		X2643		x			Bldg 12 SW	SW end of Bldg	Kurt Schmale	6473	Sam Langrock	6473
13							Pit 1	West Pad 1 Pit	Sam Langrock	6473	Roy Douglas	6473
14		2549		x			Decontamination	SE corner	Jerry Weight	6776	Bill Gibson	6776
15		2247					Pit 1 W	NW corner	Ken Peters	6451	Bill Gibson	6451
16		2326		x			Bldg 12 N	Vertical bldg attached (Bldg)	Bill Gilbert	6435	Bill Gilbert	6435
17		X2408	x				Pit 1	Near loading dock	Sam Langrock	6473	Sam Langrock	6473
18		2653	x				Plant Plant	Between Lab and Pit 1 Plant	Brenda Perkins	6301	Brenda Perkins	6301
19		2254		x	x		Pit 1	Near offices on west side	Sam Langrock	6473	Sam Langrock	6473
20		X2408		x			Lab W	West of lab dock	Doug Blanchard	6441	Wanda Burk	6441
21		2716			x		Bldg 2005	NE corner	C.K. Smith	6663	C.K. Smith	6663
22		X2440					Services Bldg	W side, near Laundry	Joe Loggia	6175	Joe West	6175
23		2742					Hot Pit Waste Bldg	South side	Brenda Perkins	6301	Brenda Perkins	6301
24		2760		x			Pit 5 W	West side of Pit 5 near cement	Ken Peters	6451	Pat Wiers	6451
25		X2722					Pit 1	NE of Bldg 71	Sam Langrock	6473	Sam Langrock	6473
26		X2642			x		Plant 221 B	Beam Alley	Brenda Perkins	6301	Brenda Perkins	6301
27		2343		x			Boiler Plant	Beneath "Electrostatic Precipitator" sign	Bill Nabor	6434	Bill Nabor	6434
28		2131					N-05	East of N-05 silo	Ken Gleason	6442	Roy Rosenberry	6442
29		2406		x			Line Bldg	S. of Bldg Line Handling Building	Ron Young	6433	James Ellis	6433

CONTAMINATED TRASH DUMPSTERS
Figure 1

RECORD OF ISSUE/REVISIONS

DATE	REV. NO.	DESCRIPTION AND AUTHORITY
05-24-88	0	New procedure issued from CIO C88-014 per Request No. P88-056, initiated by J. E. Harmon.
12-27-90	1	Revised procedure to incorporate CIO C90-024 per Request No. P90-255.
01-28-91	2	Revised to incorporate CIO C91-061 per Request No. P92-015.
12-08-92	3	Revised to incorporate CIO C92-015 (P92-284) and update to current procedure program requirements.
10-18-93	0	Reissued to update to current requirements per Request No. P93-1006, initiated by C. Gilbert. Also CIO C93-717 (P93-1007) was incorporated.
05-04-94	1	Revised to incorporate CIOs C93-757 (per Request P94-0248) and C94-002 (per Request P94-0249).

APPENDIX E

ASTM METHODS

ASTM STANDARD NUMBER	ASTM STANDARD TITLE
D 422-63	Standard Test Method for Particle-Size Analysis of Soils
D 698-91	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))[1]
D 854-92	Standard Test Method for Specific Gravity of Soils
D 1140-92	Standard Test Method for Amount of Material in Soils Finer Than the No. 200 Sieve
D 1557-91	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))[1]
D 1586-84	Standard Method for Penetration Test and Split-Barrel Sampling of Soils
D 1587-83	Standard Practice for Thin-Walled Tube Sampling of Soils
D 1883-92	Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils
D 2166-91	Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
D 2435-90	Standard Test Method for One-Dimensional Consolidation Properties of Soils
D 2487-93	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
D 2488-90	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
D 3441-86	Standard Test Method for Deep, Quasi-Static, Cone and Friction-Cone Penetration Tests of Soil
D 3740-92	Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
D 4318-84	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
D 4767-88	Standard Test Method for Consolidated-Undrained Triaxial Compression Test on Cohesive Soils
D 5299-92	Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities

THE PREVIOUS TABLE LISTS THE AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS FOLLOWED DURING THE PERFORMANCE OF THE DEEP FIELD AND LABORATORY WORK. THESE STANDARDS HAVE BEEN REFERENCED AS PART OF THIS WORK PLAN.

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APPENDIX F

EXAMPLE FIELD FORMS

FEMP
FIELD ACTIVITY LOG

CONTROL NUMBER:	DATE:	Page of

PROJECT NAME:

PROJECT NUMBER:

FIELD TEAM LEADER:

FIELD TEAM MEMBERS:

FIELD ACTIVITY SUBJECT:

WEATHER CONDITIONS:

RELATED FIELD FORM CONTROL NUMBERS:

TEAM LEADER SIGNATURE:

DATE

ALPHA METER S.N.:

BETA/GAMMA METER S.N.:

TIME	DESCRIPTION OF ACTIVITY

WATER QUALITY METER SERIAL NO.:

INITIALS/DATE:

TEMP.:

METER CALIBRATION

	pH (STD UNITS)		SP. COND. (µmhos/cm)		D.O. (mg/L)	TURBIDITY (NTU)	TEMP. (°C)	SALINITY (mg/L)	PID SERIAL NO.	PID STAND.	PID LOT NO.	PID READING	PID SPAN
	4	7	HIGH	LOW									
Manual Calibration:													
Auto Calibration:													

VISITORS

NAME(S)	ORGANIZATION(S)	TIME ARRIVED	TIME LEFT

000560

FS-F-3682 (REV. 9/10/93)

CONTROL NUMBER:	FEMP LITHOLOGIC LOG	Page of

PROJECT NAME:	PROJECT NUMBER:

BORING NUMBER:	COORDINATES:	RELATED FAL NUMBERS:

SURFACE ELEVATION:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE STARTED:
GEOLOGIST:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED:

WATER USED DURING DRILLING:	DRILLING CONTRACTOR:	DRILLING EQUIPMENT:	DRILLER/HELPER:

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

* Samples collected per ASTM Standard Penetration test.

FS-F-3681 (8/18/93)

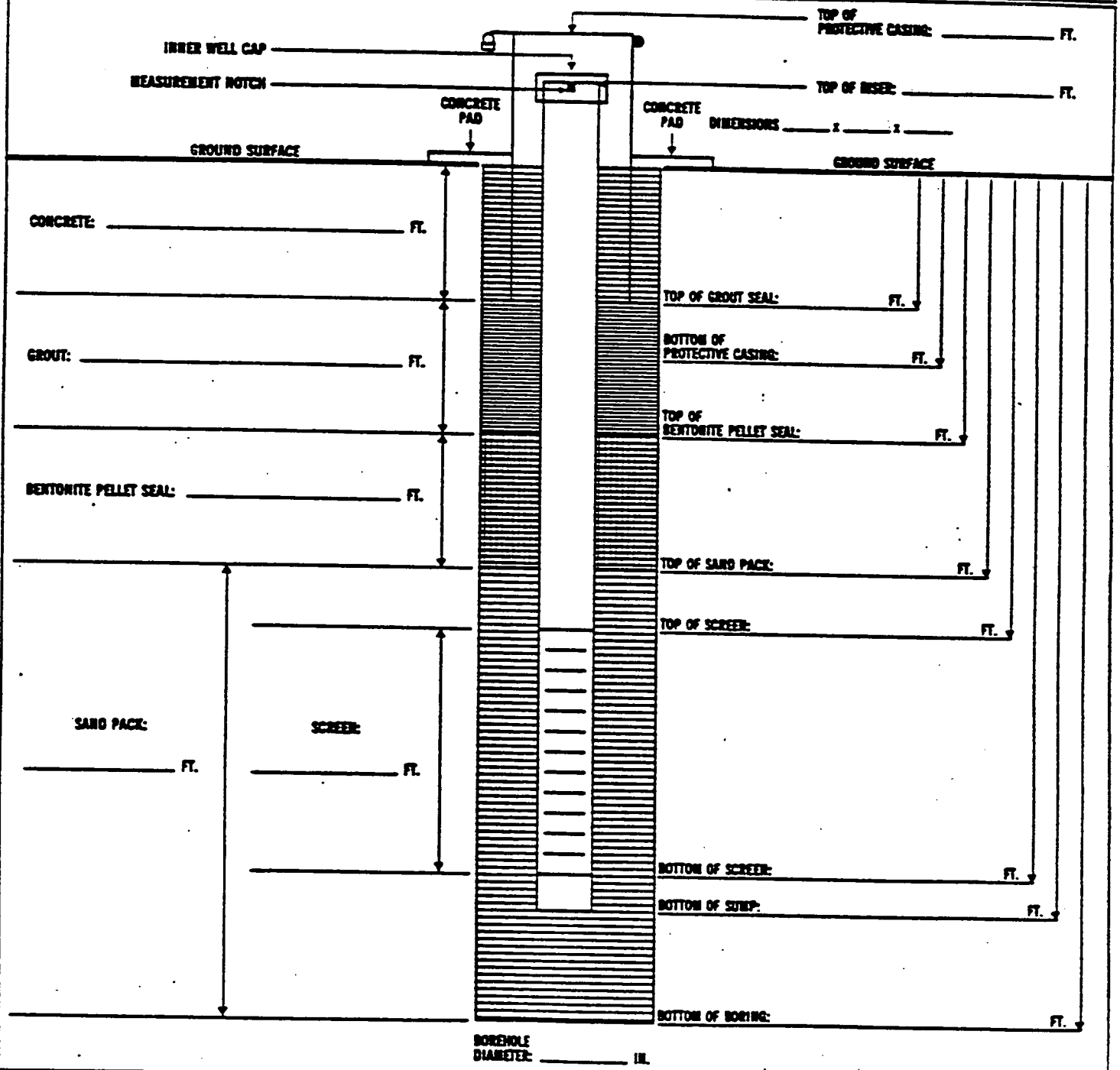
000561

FEMP

WELL COMPLETION LOG

WELL NUMBER:	CONTROL NUMBER:
PROJECT NAME:	PROJECT NUMBER:
GEOLOGIST:	DRILLING METHOD:

DATES OF INSTALLATION:	WATER LEVEL (RL):	DATE:	RELATED FAL NUMBERS:	CHECKED BY:



TYPE AND AMOUNT OF GROUT USED:	BENTONITE PELLETS (5-GALLON BUCKETS):	DEEPEST TEMPORARY DRILLING CASING PENETRATION: FT.
VOLUME OF WATER USED DURING DRILLING: GAL	RISER MATERIAL:	VOLUME OF WATER USED FOR GROUT HYDRATION: GAL

RISER WALL THICKNESS:	TYPE OF SAND PACK:	SCREEN MATERIAL:	DRILLING CASING DIAMETER: IN.
RISER/SCREEN DIAMETER: IN.	SCREEN SLOT SIZE: IN.	SCREEN TYPE:	DEPTH OF CENTRALIZER(S): FT.

000562

FS-F-3684 (9/10/93)

FEMP

SAMPLE COLLECTION LOG

CONTROL NUMBER:

Page _____ of _____

SAMPLE LOCATION:

PROJECT NAME:

SAMPLE TEAM LEADER:

SAMPLE TEAM:

PROJECT NUMBER:

RELATED FAL NUMBER(S):

000563

UNIQUE SAMPLE NUMBER	SAMPLE TYPE CODE	SAMPLE SCREEN RESULTS (PID)	SAMPLE SCREEN RESULTS (RAD)	COLLECTION START		COLLECTION STOP		SAMPLE DEPTH INTERVAL	PRESERVATIVE CODE	NUMBER OF CONTAINERS	SAMPLE CONTAINER TYPE & SIZE	ANALYTICAL PARAMETERS (OR TARGET ANALYTE LIST)	VISUAL DESCRIPTION OF SAMPLE	DUPLICATE OF SAMPLE NUMBER	QA/QC SAMPLE DESIGNATION
				DATE	TIME	DATE	TIME								

REMARKS:

SF-3714 (10/13/93)

FEMP

RSO - ANALYTICAL

SITE-WIDE ANALYSIS REQUEST/CUSTODY RECORD

Form Number: ____ - ____ - ____

Page ____ of ____

PROJECT:

☐ PLAN NO.: OR ☐ PROJECT NO.:

PROJECT MANAGER/ENGINEER:

SAMPLER: PHONE:

CHARGE NUMBER: LOT MARKING CODE:

SAMPLER SIGNATURE(S):

SEND RESULTS TO:

FOR SAMPLE RELATED PROBLEMS, CONTACT:

ORGANIZATION:

NAME: PHONE:

SAMPLER REMARKS:

CHECK FOR: ☐ S R LAB ☐ BIO LAB ☐ WTP LAB

SAMPLE SOURCE, DESCRIPTION/IDENTIFICATION, ANALYSIS REGIMEN

ITEM NO.	SAMPLE NUMBER	CUSTOMER NUMBER	SAMPLE POINT	MATRIX CODE	COLLECTED DATE	COLLECTED TIME	CONTAINER/ VOLUME	COMPOSITE	GRAB	NO. OF CONTAINERS	ANALYTES CODE - (UNITS CODE)	REMARKS
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

ITEM/REASON	RELINQUISHED BY	RECEIVED BY	DATE	TIME	ITEM/REASON	RELINQUISHED BY	RECEIVED BY	DATE	TIME

NO.	DISTRIBUTION OF COPIES
1	LABORATORY
2	REQUESTER
3	SAMPLER

FS-F-3361 (REV. 3/25/93)

000564

12

APPENDIX G

SAMPLE NUMBERS

SAMPLE NUMBERS

NOTE: **A block of 300 unique six-digit sample numbers (400510 - 400809) have been assigned to this project. Due to the nature of the sampling, the sample numbers will not be assigned to each sampling interval. The Field Geologist will determine if a sample is to be tested for tests listed in Table 3-2, and will assign six-digit sample numbers as needed.**

Boring #11506

Sample Interval (ft.)	split-spoon sample*	thin-walled tube sample to be Archived for potential Undisturbed tests	bulk sample
0.0 - 1.5	X		
1.5 - 3.0	X		
3.0 - 6.0		X	
6.0 - 7.5	X		
7.5 - 10.5		X	
10.5- 12.0	X		
12.0 - 15.0		X	
15.0 - 16.5	X		
16.5 - 19.5		X	
19.5 - 21.0	X		
21.0 - 24.0		X	
24.0 - 25.5	X		
25.5 - 28.5		X	
28.5 - 30.0	X		
5.0 - 10.0			X

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

SAMPLE NUMBERS

Boring #11507

Sample Interval (ft.)	split-spoon sample*	thin-walled tube sample to be Archived for potential Undisturbed tests
0.0 - 1.5	X	
1.5 - 4.5		X
4.5 - 6.0	X	
6.0 - 9.0		X
9.0 - 10.5	X	
10.5 - 13.5		X
13.5 - 15.0	X	
15.0 - 18.0		X
18.0 - 19.5	X	
19.5 - 22.5		X
22.5 - 24.0	X	
24.0 - 27.0		X
27.0 - 28.5	X	
28.5 - 30.0	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

SAMPLE NUMBERS

Boring #11508

Sample Interval (ft.)	split-spoon sample*	thin-walled tube sample Archived for potential Undisturbed tests
0.0 - 1.5	X	
1.5 - 4.5		X
4.5 - 6.0	X	
6.0 - 9.0		X
9.0 - 10.5	X	
10.5 - 13.5		X
13.5 - 15.0	X	
15.0 - 18.0		X
18.0 - 19.5	X	
19.5 - 22.5		X
22.5 - 24.0	X	
24.0 - 27.0		X
27.0 - 28.5	X	
28.5 - 30.0	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX G (cont.)

SAMPLE NUMBERS

Boring #11509

Sample Interval (ft.)	split-spoon sample*	thin-walled tube sample to be Archived for potential Undisturbed tests	bulk sample
0.0 - 1.5	X		
1.5 - 3.0	X		
3.0 - 4.5	X		
4.5 - 6.0	X		
6.0 - 9.0		X	
9.0 - 10.5	X		
10.5 - 12.0	X		
12.0 - 13.5	X		
13.5 - 15.0	X		
15.0 - 16.5	X		
16.5 - 18.0	X		
18.0 - 19.5	X		
19.5 - 21.0	X		
21.0 - 22.5	X		
22.5 - 24.0	X		
24.0 - 25.5	X		
25.5 - 27.0	X		
27.0 - 28.5	X		
28.5 - 30.0	X		
5.0 - 10.0			X

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

SAMPLE NUMBERS

Boring #11510

Sample Interval (ft.)	split-spoon sample*	thin-walled tube sample Archived for potential Undisturbed tests
0.0 - 1.5	X	
1.5 - 3.0	X	
3.0 - 6.0		X
6.0 - 7.5	X	
7.5 - 10.5		X
10.5 - 12.0	X	
12.0 - 15.0		X
15.0 - 16.5	X	
16.5 - 19.5		X
19.5 - 21.0	X	
21.0 - 24.0		X
24.0 - 25.5	X	
25.5 - 28.5		X
28.5 - 30.0	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

SAMPLE NUMBERS

Boring #11511

Sample Interval (ft.)	split-spoon sample*	thin-walled sample Archived for potential Undisturbed tests	bulk sample
0.0 - 1.5	X		
1.5 - 3.0	X		
3.0 - 6.0		X	
6.0 - 7.5	X		
7.5 - 10.5		X	
10.5 - 12.0	X		
12.0 - 15.0		X	
15.0 - 16.5	X		
16.5 - 19.5		X	
19.5 - 21.0	X		
21.0 - 24.0		X	
24.0 - 25.5	X		
25.5 - 28.5		X	
28.5 - 30.0	X		
5.0 - 10.0			X

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX G (cont.)

SAMPLE NUMBERS

Boring #11512

Sample Interval (ft.)	split-spoon sample*	thin-walled tube sample Archived for potential Undisturbed tests
0.0 - 1.5	X	
1.5 - 4.5		X
4.5 - 6.0	X	
6.0 - 9.0		X
9.0 - 10.5	X	
10.5 - 13.5		X
13.5 - 15.0	X	
15.0 - 18.0		X
18.0 - 19.5	X	
19.5 - 22.5		X
22.5 - 24.0	X	
24.0 - 27.0		X
27.0 - 28.5	X	
28.5 - 30.0	X	

* At the Lead Geologist's discretion, samples will be collected and tested for the disturbed geotechnical tests listed in Table 3-2.

APPENDIX H

PROJECT SPECIFIC HEALTH AND SAFETY PLAN

NOTE: This copy of the Project Specific Health and Safety Plan is an uncontrolled document. Verify current revision is being used prior to implementation.

Fernald Environmental
FERMCO
Restoration Management Corporation

FERNALD ENVIRONMENTAL

RESTORATION MANAGEMENT CORPORATION

CERCLA / RCRA UNIT #1 (CRU1)

PROJECT SPECIFIC HEALTH & SAFETY PLAN FOR DEWATERING EXCAVATION EVALUATION PROGRAM

AMENDMENT FOR MODULAR PROCESS AREAS GEOTECHNICAL SAMPLING

OCTOBER 1994

EMERGENCY PHONE NUMBER ON-SITE 738-6511
RADIO: "CONTROL"

APPROVALS:

Robert Fellman 10/14/94
Robert T. Fellman, CRU1 Director — Date

10/14/94
Daryl Mills, Occupational Safety & Health Compliance Manager — Date

for Mike Davis 10/14/94
Michael S. Davis, CRU1 Health & Safety Manager — Date

REV 1 - October 14, 1994

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1.2 WORK AREA CHARACTERIZATION 3

1.3 WORK DESCRIPTION 3

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2.3 CRU1 HEALTH AND SAFETY MANAGER 4

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4.0 TRAINING 4
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7.0 HAZARD CONTROL 4
7.1 ADMINISTRATIVE/ENGINEERING CONTROLS 4
7.2 PERSONAL PROTECTIVE EQUIPMENT/RESPIRATORY PROTECTION 4

10.0 CHANGES TO THE PSHSP 4
10.1 CONTROL OF HEALTH AND SAFETY PLAN 4

1.0 INTRODUCTION

The Operable Unit 1 Dewatering Excavation Evaluation Project (DEEP) Treatability Study Work Plan has been amended to include the collection of remedial design information related to proposed waste processing and handling facilities within Operable Unit 1. These facilities, or Modular Process Areas (MPAs), will support the removal of excavated pit wastes, associated wastes processing storage and transportation systems, and other modular facilities ancillary to the drying of pit waste.

1.2 WORK AREA CHARACTERIZATION

Work associated with the Modular Process Areas (MPA) will be conducted in the northeastern area of Operable Unit 1. Standard Penetration Tests will be conducted in the vicinity of , and southeast of Waste Pit 6.

See Attachment F for map of the work area.

Characterization data of the work area has been reviewed by CRU1 Health and Safety Manager and FERMCO Radiological Engineering.

Based on review of the data, the potential for personnel exposure to volatile organic compounds and heavy metals is very low.

Based on review of the data, U-238 concentrations in surface soil range from 0 to greater than 100 pCi/g at the surface to 6 inches. U-238 concentrations decrease after 6 inches (Westin 1987).

1.3 WORK DESCRIPTION

To characterize the nature of the surface and subsurface of MPA sites prior to construction of the support facilities' foundations, geotechnical studies of the soil, subsoil, and glacial overburden will need to be performed. These studies will determine the physical properties of the geologic materials required for wastes processing support facility foundation design considerations.

The geotechnical study will consist of two types:

A. Standard Penetration Test (SPT) Borings

Standard Penetration Tests (SPT), will be performed using a split spoon sampler, in combination with either a Shelby, Piston, or Dennison sampler, as appropriate, to obtain undisturbed samples. Boring installation will be performed with an auger drilling rig.

All seven (7) of the borings will be drilled to a depth of 30 feet.

2.0 ORGANIZATION STRUCTURE AND KEY PERSONNEL RESPONSIBILITIES

2.3 CRU1 HEALTH AND SAFETY MANAGER

Jack Craighead is the alternate for Michael Davis for this project.

3.0 SITE CONTROL

3.1 WORK AREA REQUIREMENTS

3.1.2 Exclusion Areas

No barricade fence will be required for this operation.

All work associated with the Modular Process Areas Geotechnical Sampling will be conducted in a Controlled Area.

An exclusion zone will be established at all boring locations. The exclusion zone boundary shall be at least ten (10) feet from the mast of the drill rig. The zone shall be delineated with yellow caution tape.

Constant coverage by a Radiological Control Technician (RCT) will be provided on this job. If conditions warrant (i.e., if contamination is unearthed above limits), a Contamination Area will be set up in accordance with site procedures.

4.0 TRAINING

4.3 VISITORS

Visitors who need to enter the exclusion zone must have authorization from the CRU1 Health and Safety Manager or his alternate.

7.0 HAZARD CONTROL

7.2 PERSONAL PROTECTIVE EQUIPMENT/RESPIRATORY PROTECTION

For the Modular Process Areas Geotechnical Sampling, FERMCO issued clothing is required. The use of Anti-Cs will be based on sampling conducted by FERMCO Radiological Control. The use of respiratory protection is not anticipated to be required.

10.0 CHANGES TO THE PSHSP

10.1 CONTROL OF HEALTH AND SAFETY PLAN

Radiological Control Technicians, Judy Hitt

ATTACHMENT A
PROJECT SPECIFIC HEALTH AND SAFETY REQUIREMENTS MATRIX SUMMARY

HEALTH AND SAFETY REQUIREMENTS MATRIX
PROJECT: OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP)
AMENDMENT FOR MODULAR PROCESS AREAS GEOTECHNICAL SAMPLING

The requirements listed in Section 1.0 of this matrix apply to all activities addressed on this matrix.

ACTIVITY (TASKS)	HAZARD IDENTIFICATION	FREQUENCY & TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING & SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE & ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION & DISPOSAL PROCEDURES
3)Slug Testing and Soil Borings	Rotating equipment Drill rig		Hard Hat (ANSI Z 89) within 10 feet of drill rig Leather gloves	Equipment operator training		All machine guards in place Kill switch	Penetration Permit General Work Permit	Shower at lunchtime and end of day Monitor equipment before removing from site
	Biological hazards Ticks Chiggers Insects Snakes	Personal visual monitoring			If stung or bitten, report to Medical Department at Bldg. 53			
	Noise	FERMCO periodic monitoring	Hearing protection			Hearing Protection Required at 85 DBA Post area as required		

The requirements of this document are based upon current conditions and/or operations in areas near the planned construction zone. This document is to be used as an aid in conjunction with the Project Specific Health and Safety Plan and assist the contractor in understanding the requirements of the project. This document does not relieve the contractor of planning for or providing a safe work site. This document does not relieve the contractor from recognizing and complying with other appropriate state, federal, and FEMP regulations.

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HEALTH AND SAFETY REQUIREMENTS MATRIX
PROJECT: OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP)
AMENDMENT FOR MODULAR PROCESS AREAS GEOTECHNICAL SAMPLING

The requirements listed in Section 1.0 of this matrix apply to all activities addressed on this matrix.

ACTIVITY (TASKS)	HAZARD IDENTIFICATION	FREQUENCY & TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING & SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE & ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION & DISPOSAL PROCEDURES
3) Slug Testing and Soil Borings (continued)	Electrical power supply			Operation Manual for Equipment Lock and Tag SSOP 719		Inspect generators Lock and Tag Program Inspect cords GFCI		
	Drill rig failure			Qualified Operator		Site Procedure Daily inspection of cables/ equipment		
	Overhead Power lines are located within 10 feet of boring locations GI-601,603,606			Lock and Tag training for personnel preforming lock and tag		Power to the electrical lines will be disconnected. Lock and Tag		

The requirements of this document are based upon current conditions and/or operations in areas near the planned construction zone. This document is to be used as an aid in conjunction with the Project Specific Health and Safety Plan and assist the contractor in understanding the requirements of the project. This document does not relieve the contractor of planning for or providing a safe work site. This document does not relieve the contractor from recognizing and complying with other appropriate state, federal, and FEMP regulations

000581

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HEALTH AND SAFETY REQUIREMENTS MATRIX
PROJECT: OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP)
AMENDMENT FOR MODULAR PROCESS AREAS GEOTECHNICAL SAMPLING

The requirements listed in Section 1.0 of this matrix apply to all activities addressed on this matrix.

ACTIVITY (TASKS)	HAZARD IDENTIFICATION	FREQUENCY & TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING & SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE & ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION & DISPOSAL PROCEDURES
7)Split-spoon and Shelby Tube sampling	Radiological contamination (U238)	If contamination area is created based on radiological monitoring, boundary Gas and Personal Air samples will be taken	Nitrile gloves If contamination area is created: full Anti-Cs, water resistant required for wet conditions			Radiological control will provide constant coverage		In-place gross decontamination and/or material sent to D&D facility
	Sealing of Shelby Tubes		Leather Gloves	Fire Watch		Fire extinguisher Fire watch	Flame Permit	

The requirements of this document are based upon current conditions and/or operations in areas near the planned construction zone. This document is to be used as an aid in conjunction with the Project Specific Health and Safety Plan and assist the contractor in understanding the requirements of the project. This document does not relieve the contractor of planning for or providing a safe work site. This document does not relieve the contractor from recognizing and complying with other appropriate state, federal, and HEMP regulations.

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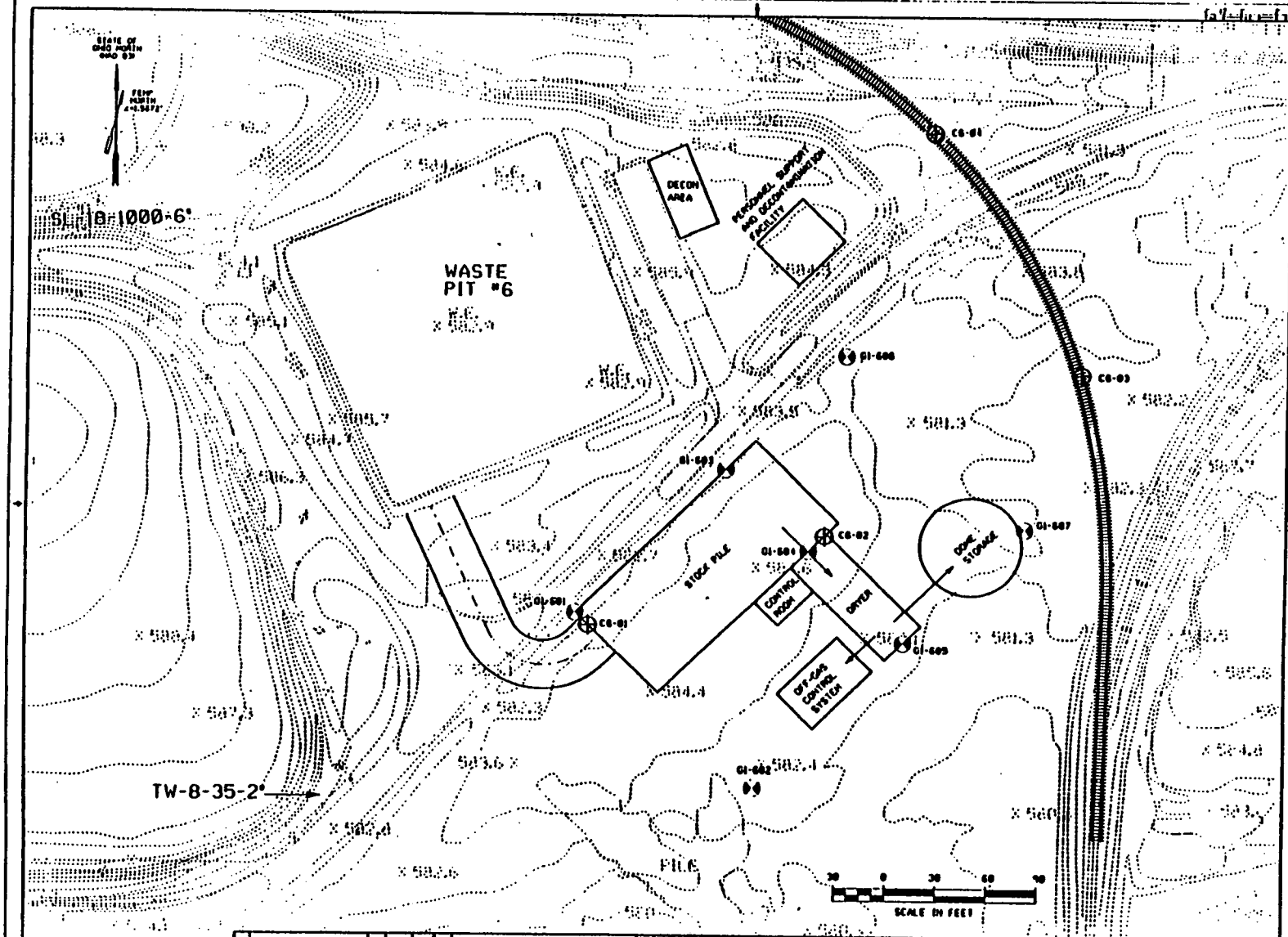
HEALTH AND SAFETY REQUIREMENTS MATRIX
PROJECT: OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP)
AMENDMENT FOR MODULAR PROCESS AREAS GEOTECHNICAL SAMPLING

The requirements listed in Section 1.0 of this matrix apply to all activities addressed on this matrix.

ACTIVITY (TASKS)	HAZARD IDENTIFICATION	FREQUENCY & TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING & SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE & ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION & DISPOSAL PROCEDURES
7)Split-spoon and Shelby Tube sampling, continued	Mishandle/dropped Shelby/split-spoon tube					Competent person shall be present during soil sampling and packaging activities		
8. Grouting	Exposure to grouting mix		Respirator with HEPA cartridges	Review of MSDS		Eyewash/safety shower		

ATTACHMENT F
WORK AREA MAPS



LEGEND

CPT PROBE ⊕ C6-02

PROPOSED BORING ◊ GI-604

PROPOSED BORING

NO	NORTH	EAST
GI-601	481,750.0	1,317,751.0
GI-602	481,611.0	1,317,860.0
GI-603	481,835.0	1,317,812.0
GI-604	481,785.0	1,317,872.0
GI-605	481,733.0	1,317,910.0
GI-606	481,985.0	1,317,913.0
GI-607	481,882.0	1,317,818.0

CPT PROBE

NO	NORTH	EAST
C6-01	481,752.0	1,317,761.0
C6-02	481,750.0	1,317,901.0
C6-03	481,835.0	1,318,051.0
C6-04	482,011.0	1,317,963.5

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

US DEPARTMENT OF ENERGY

CIVIL
BORING LOCATIONS
WASTE PIT #6 AREA

FIGURE 1

T2

000585

APPENDIX I

PROJECT SCHEDULE

RI/FS WBS NUMBER: 10.03.10
PROJECT TITLE: OU1 MODULAR PROCESS AREA GEOTECHNICAL INVESTIGATION

Activity Number	WBS.Task Number	Description	Early Start	Early Finish	Duration (Days)
	10.03.10.1020	Prepare PSP	10OCT94	11OCT94	2
	10.03.10.1030	Review/Approve PSP	12OCT94	13OCT94	2
	10.03.10.1040	Prepare HASP	10OCT94	11OCT94	2
	10.03.10.1050	Review/Approve HASP	12OCT94	13OCT94	2
	10.03.10.1060	Rec. Notice to Proceed	13OCT94	13OCT94	1
	10.03.10.1070	Obtain Permits	13OCT94	14OCT94	2
	10.03.10.1080	Conduct Task Briefing	14OCT94	14OCT94	1
	10.03.10.1090	Conduct Readiness Review	14OCT94	14OCT94	1
	10.03.10.1100	Mobilization	14OCT94	15OCT94	3
	10.03.10.1110	Collect Samples	15OCT94	28OCT94	14
	10.03.10.1130	Demobilization	28OCT94	31OCT94	3
	10.03.10.1140	Validate Field Data	31OCT94	11NOV94	12
	10.03.10.1150	Field Data in SED	14NOV94	25NOV94	12
	10.03.10.1160	Analyze Samples	17OCT94	2DEC94	45
	10.03.10.1190	Lab Data in SED	5DEC94	9DEC94	5
	10.03.10.1220	Disp. Wastes	31OCT94	26FEB95	110