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OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP) TREATABILITY STUDY WORK PLAN - AUGUST, 1994 *****FINAL*****

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WORK PLAN

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

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

AUGUST 1994

U.S. DEPARTMENT OF ENERGY
FERNALD FIELD OFFICE

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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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LIST OF ACRONYMS

AC	alternating current
ASTM	American Society for Testing and Materials
AWWT	Advanced Wastewater Treatment (facility)
BDN	Biodenitrification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CL	low-plasticity clays
CPT	cone penetrometer test
CRU3	CERCLA-RCRA Unit 3
cy	cubic yards
DC	direct current
DEEP	Dewatering Excavation Evaluation Program
DOE	U.S. Department of Energy
EM	electromagnetic
E-O	electro-osmosis
EPA	U.S. Environmental Protection Agency
ETS	Effluent Treatment System
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FFCA	Federal Facilities Compliance Agreement
FS	Feasibility Study
ft	feet
GS	General Sump
GMR	Great Miami River
h	horizontal
HNT	High Nitrate Storage Tank
Kwh	horizontal kilowatt-hour(s)
MAWS	Minimum Additive Waste Stabilization (Program)
MH	high-plasticity silts
MH-175	Manhole 175

LIST OF ACRONYMS
(Continued)

ML	low-plasticity silts
MREM	Millirem
MSDS	Material Safety Data Sheet
NESHAP	National Emission Standards for Hazardous Air Pollutants
NP	non-plastic silts
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
PID	photoionization detector
PPE	personal protective equipment
PSP	project specific plan
RCRA	Resource Conservation and Recovery Act
RD/RA	remedial design/remedial action
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SCAPS	Site Characterization and Analysis Penetrometer System
SCQ	Sitewide CERCLA Quality Assurance Project Plan
SM	silty sands
SPT	standard penetration test
SSOP	Site Standard Operating Procedures
UAP	uranyl ammonium phosphate
USCS	Unified Soil Classification System
V	vertical

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.

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, AN 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.

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	

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

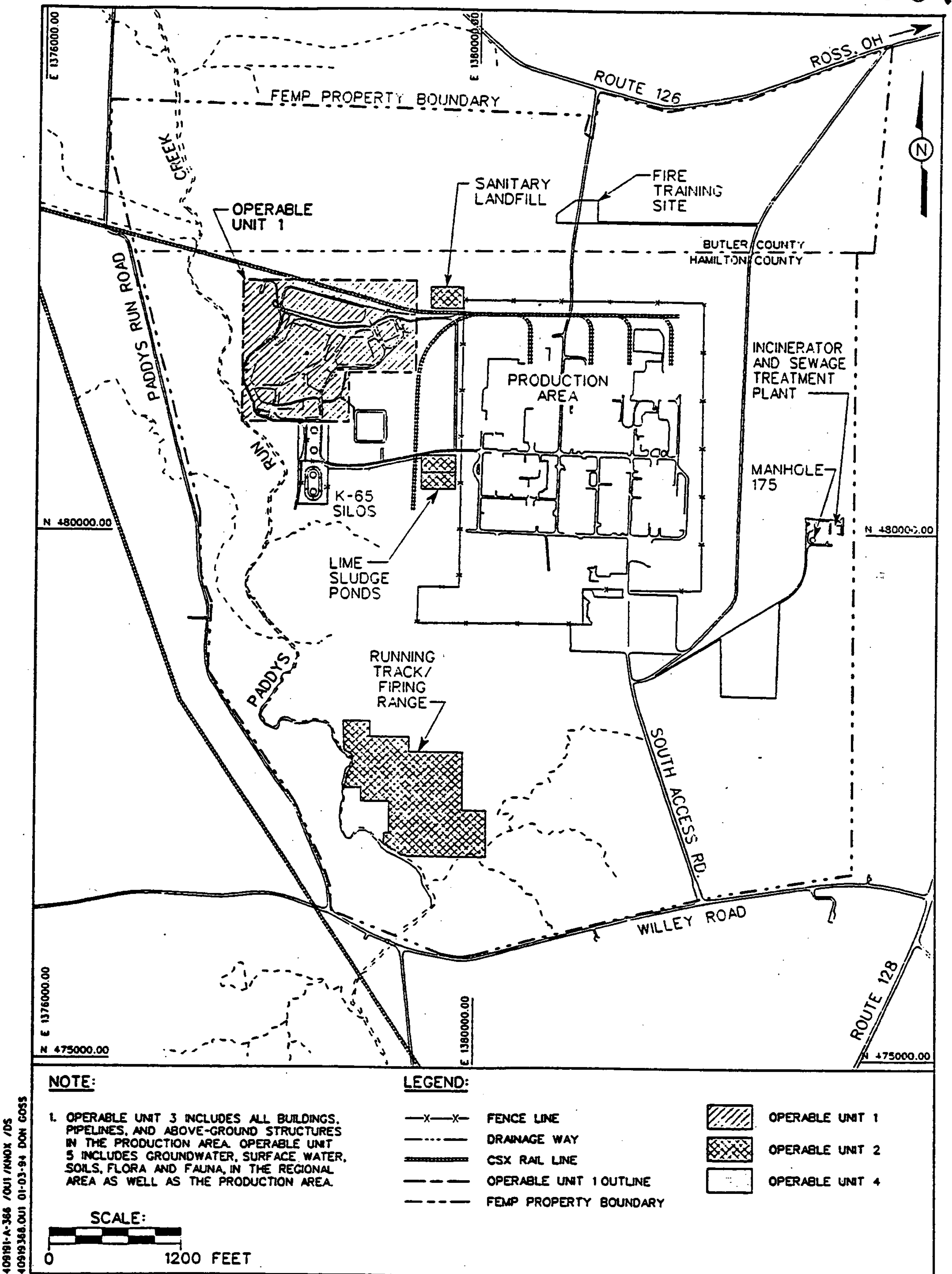
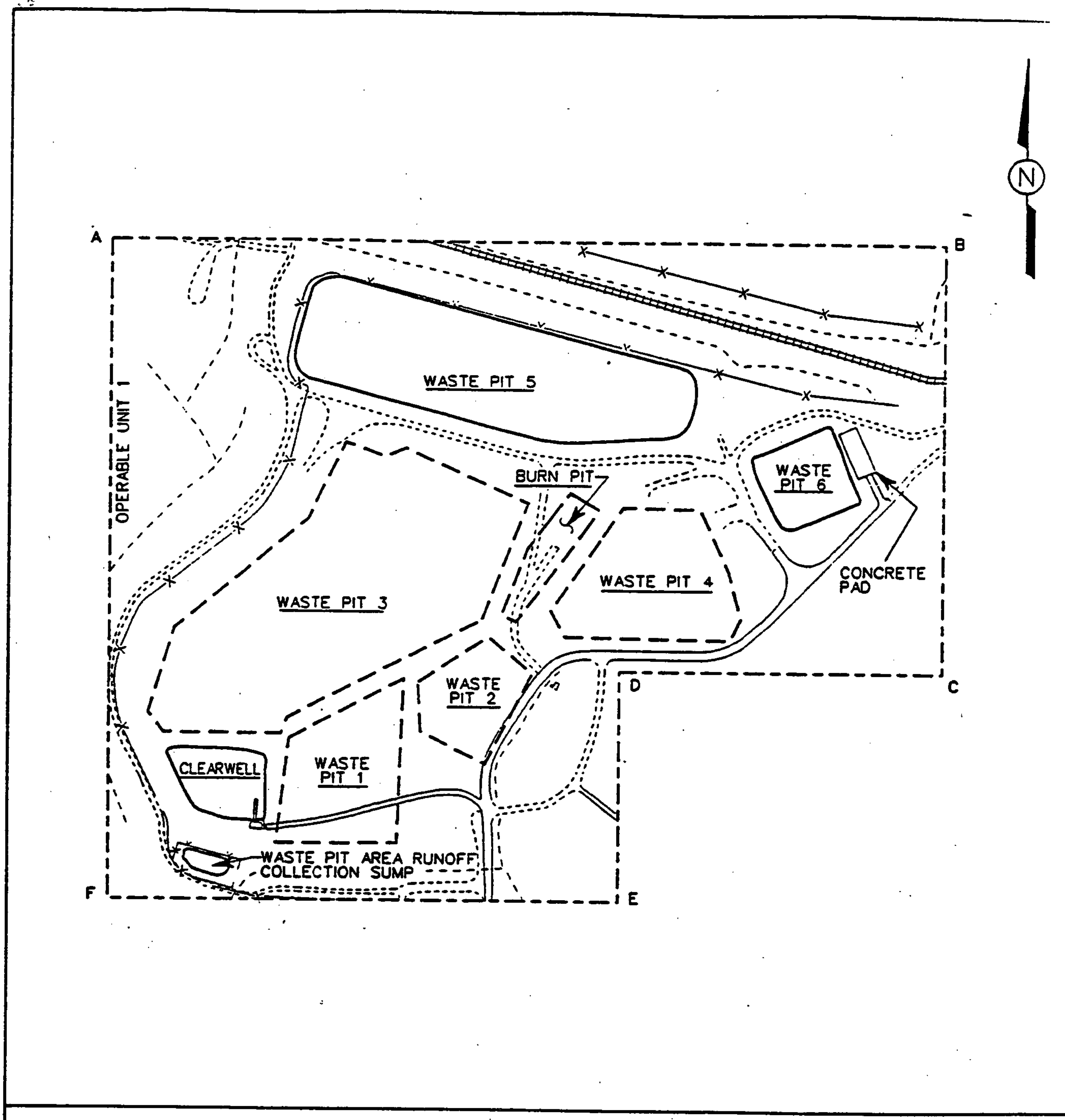


FIGURE 1-1. LOCATION OF OPERABLE UNIT 1 WITHIN THE FEMP



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:

- 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
4091910.OU1 02-10-94 DON GOSS

FIGURE 1-2. OPERABLE UNIT 1 SITE MAP

yield information on the effectiveness of the dewatering, i.e. through an increase in strength of the material and a reduction in moisture content.

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 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

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

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.

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.

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 2-1
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

TABLE 2-1
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.

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

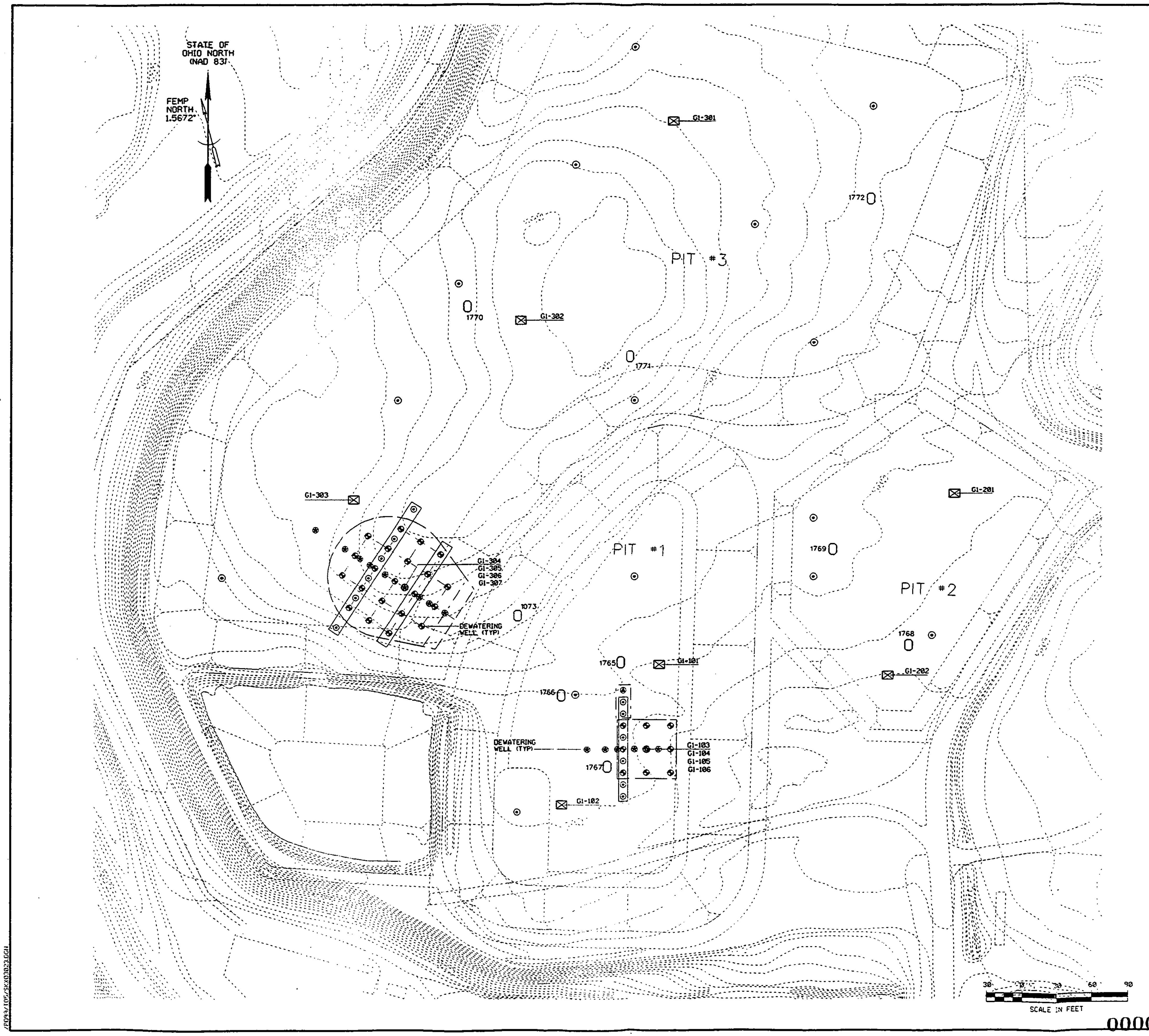
Boring No. or Trench Location	Boring Type[1]	Grain-size	Atterberg Limits	Moisture Content	Unit Weight	Specific Gravity	Triaxial Comp. (CUw/pp)[2]	Standard Proctor
G1-101[3]	T	2	2	3	2	1		
G1-102	T	2	2	3	2	1		
G1-103	B	2	2	4	2	2	2	
G1-104	D	1	1	2	2	1		
G1-105	D	1	1	2	2	1		
G1-106	A	1	1	2	2	1	2	
Trenches 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.

000048



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
G1-101	481,405.4	1,346,851.3
G1-102	481,286.4	1,346,769.6
G1-103	481,335.7	1,346,838.3
G1-104	481,335.7	1,346,843.3
G1-105	481,330.7	1,346,838.3
G1-106	481,330.7	1,346,843.3
G1-201	481,551.1	1,347,099.5
G1-202	481,396.2	1,347,044.0
G1-301	481,866.8	1,346,862.8
G1-302	481,698.2	1,346,734.0
G1-303	481,546.0	1,346,593.1
G1-304	481,473.7	1,346,633.6
G1-305	481,473.7	1,346,638.6
G1-306	481,468.7	1,346,633.6
G1-307	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:

- **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.

- **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.

- **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.

- **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.

- **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.

- **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.

- **Ease of Handling Excavated Waste** - Anticipated and unanticipated difficulties associated with mechanical excavation of the waste will be observed and recorded. Some 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. 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

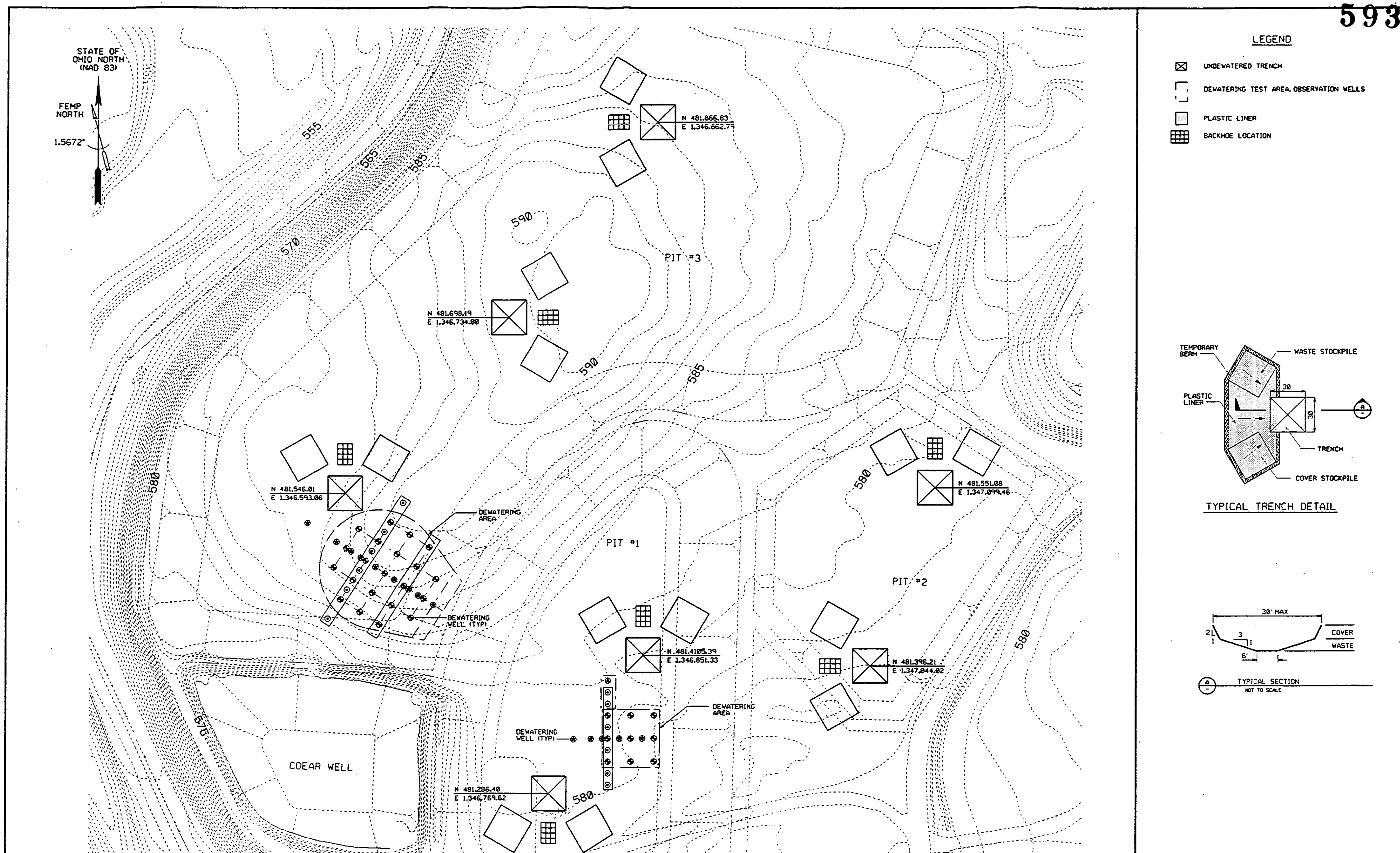
Waste will be controlled to prevent release to the environment during this test. Waste will be pumped in a sealed line (preferably double walled) to prevent spills. The hose will be attached to the pump and the tank. The ground under the hose will be lined with plastic and graded to drain back into the 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



LOCATION MAP
WET EXCAVATION

FIGURE 3-1

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. ±).

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 <u>Phase 3 - Full Installation Dewatering Testing</u>

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:

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

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

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

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

$$T = Kb$$

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

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

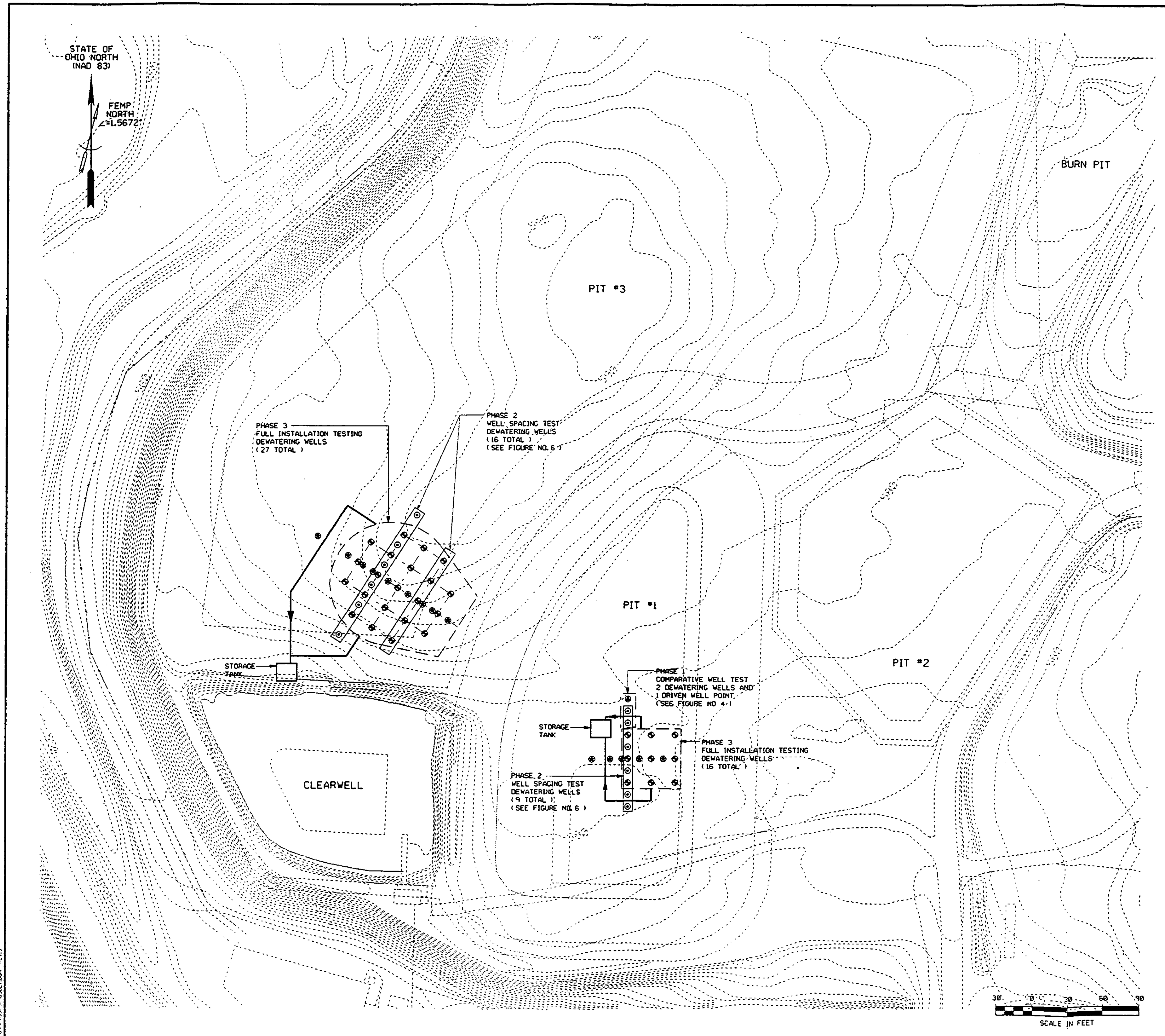
4.5 DEWATERING RESIDUALS MANAGEMENT

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.

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

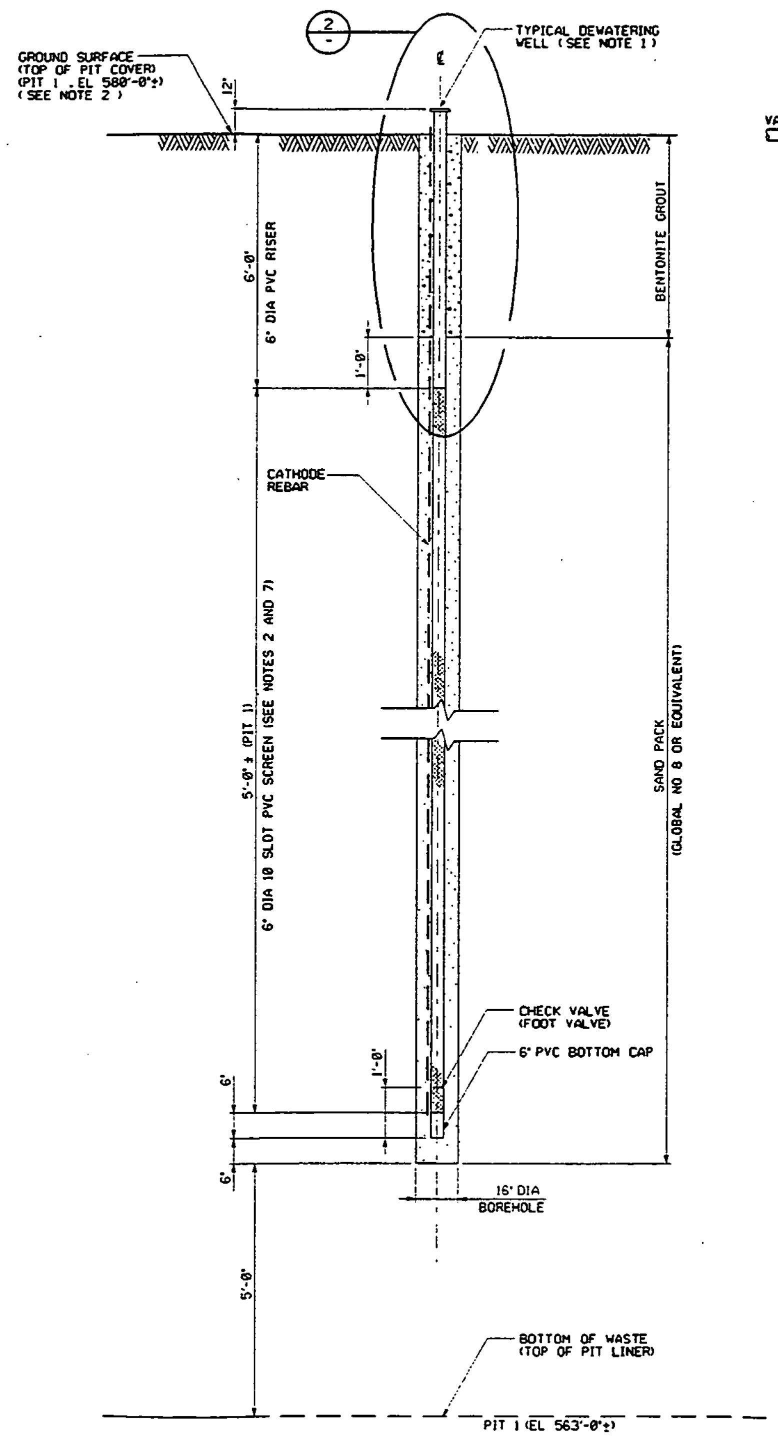
- DEWATERING WELL
- COMBINED VACUUM AND WATER TABLE PIEZOMETER
- WELLS UTILIZED FOR SPACING TEST (PHASE 2)
- DRIVEN WELL POINT

GENERAL LOCATION MAP
PHASES 1, 2 AND 3

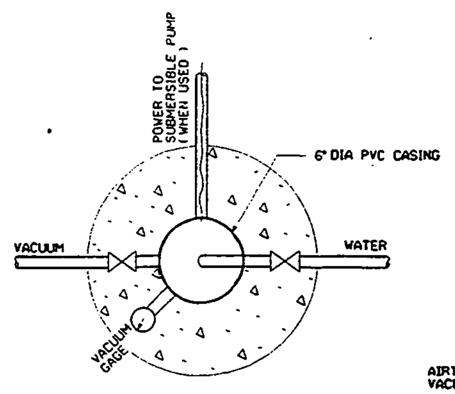
TESTING SYSTEMS LOCATIONS
IN PITS 1 AND 3

FIGURE 4-1

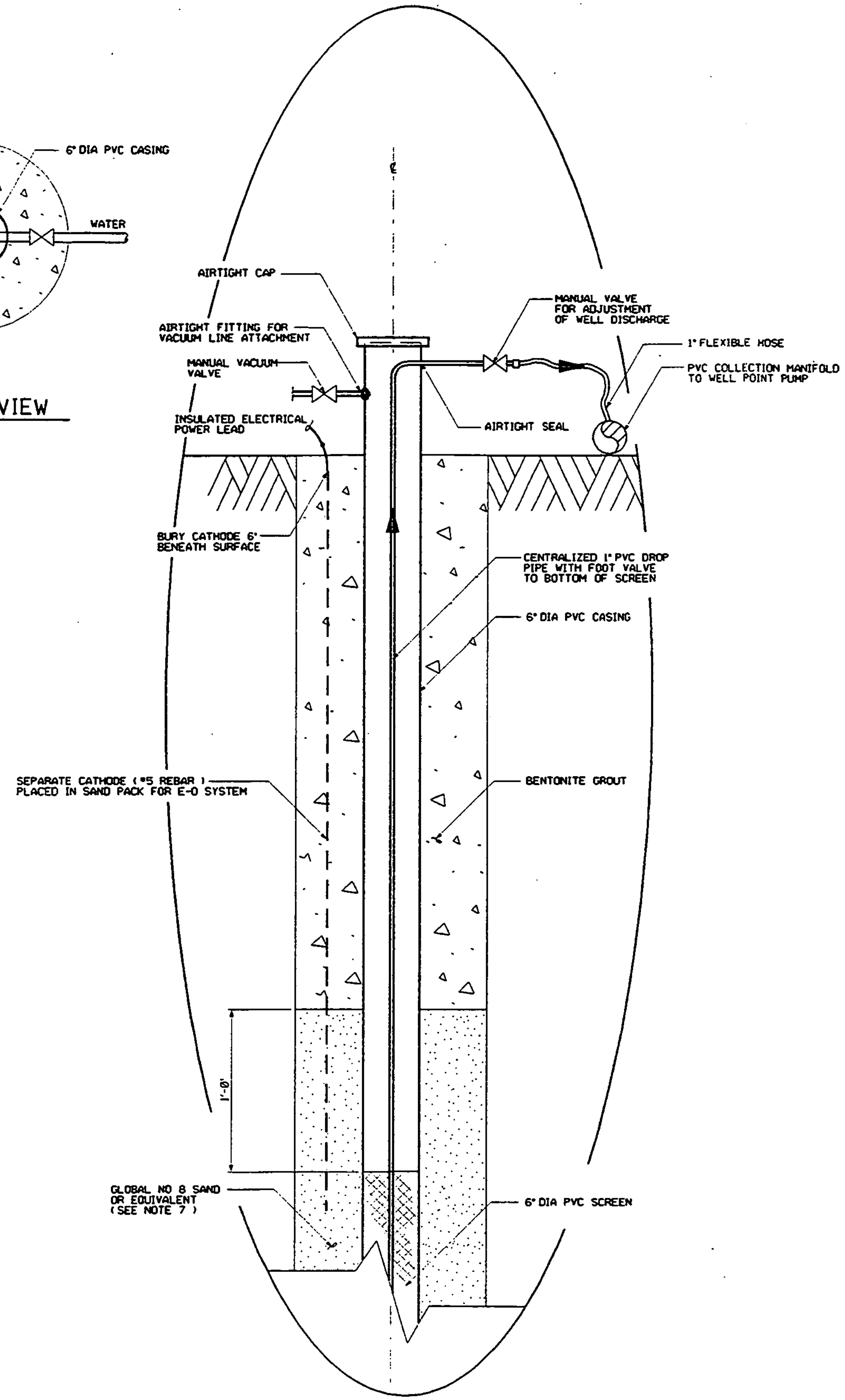
000081



DETAIL 1 REF FIGURES NO. 5 & 7
NTS



TYP PLAN VIEW



DETAIL 2
NTS

NOTES 5937

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.

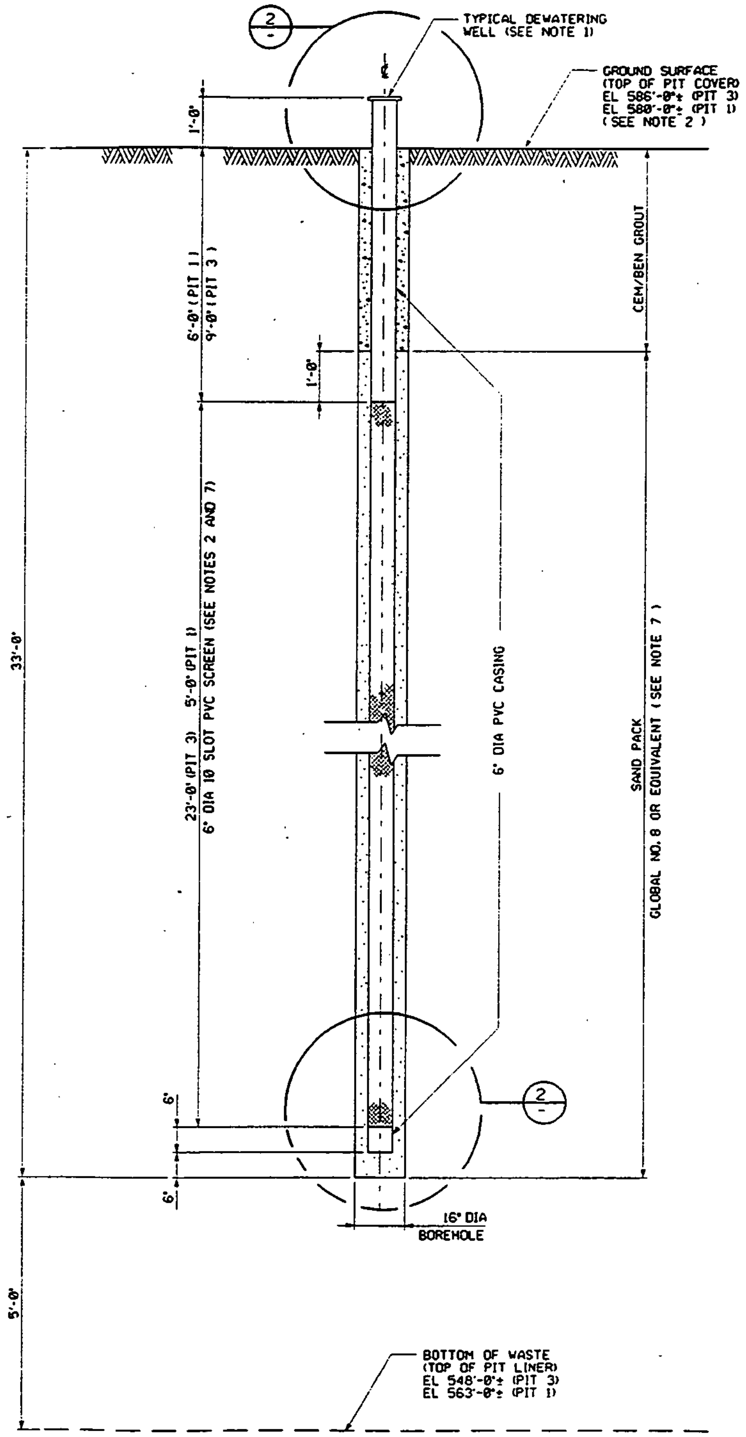
DEWATERING WELL DESIGN
SURFACE LOCATED WELL POINT PUMP

FIGURE 4-2

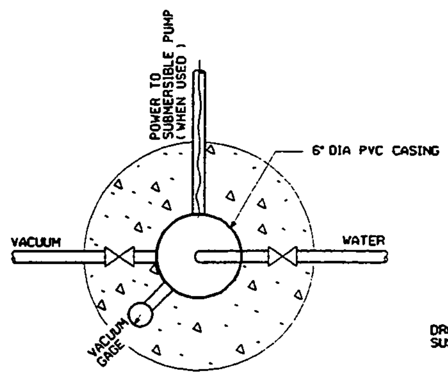
P019/CRU1

000082

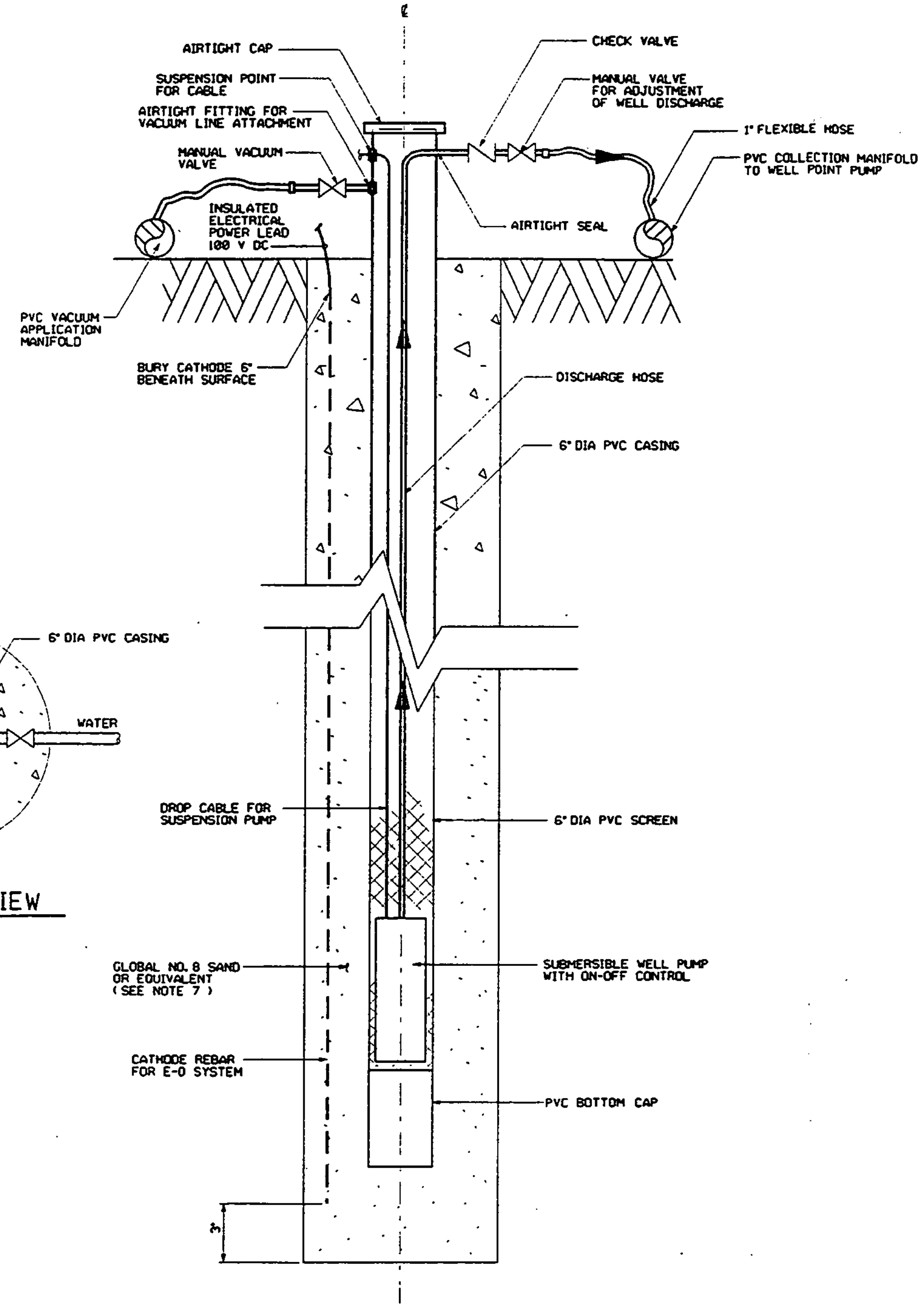
5937



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



TYP PLAN VIEW



DETAIL 2 NTS

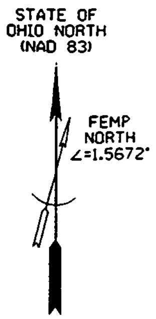
NOTES

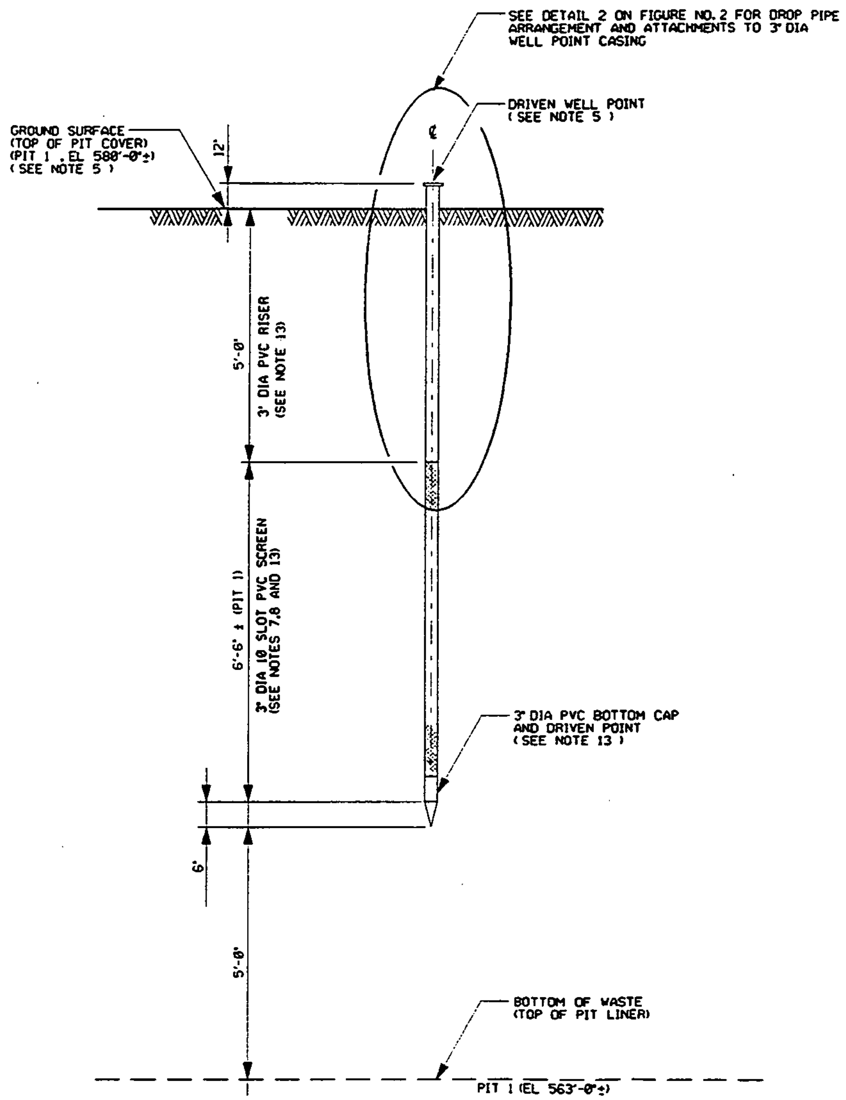
1. WELL LOCATIONS ESTABLISHED/SURVEYED BEFORE AND AFTER WELL CONSTRUCTION.
2. ESTABLISH WELL SCREEN LENGTH BASED ON SURVEYED GROUND ELEVATION AT WELL LOCATION ; ASSUME PIT-3 WASTE BOTTOM EL 548'-0" AND PIT 1 WASTE BOTTOM EL 563'-0".
3. ALL SCREEN AND RISER DIMENSIONS ARE GIVEN IN NOMINAL PIPE SIZE.
4. 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

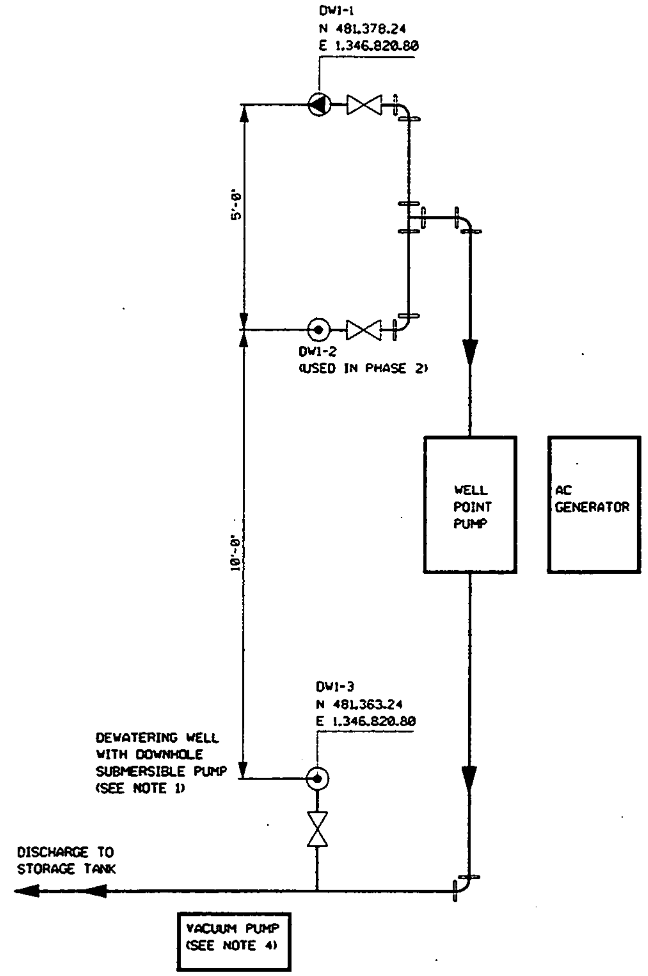
FIGURE 4-3

P019/CRU1





DRIVEN WELL POINT
DWI-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.

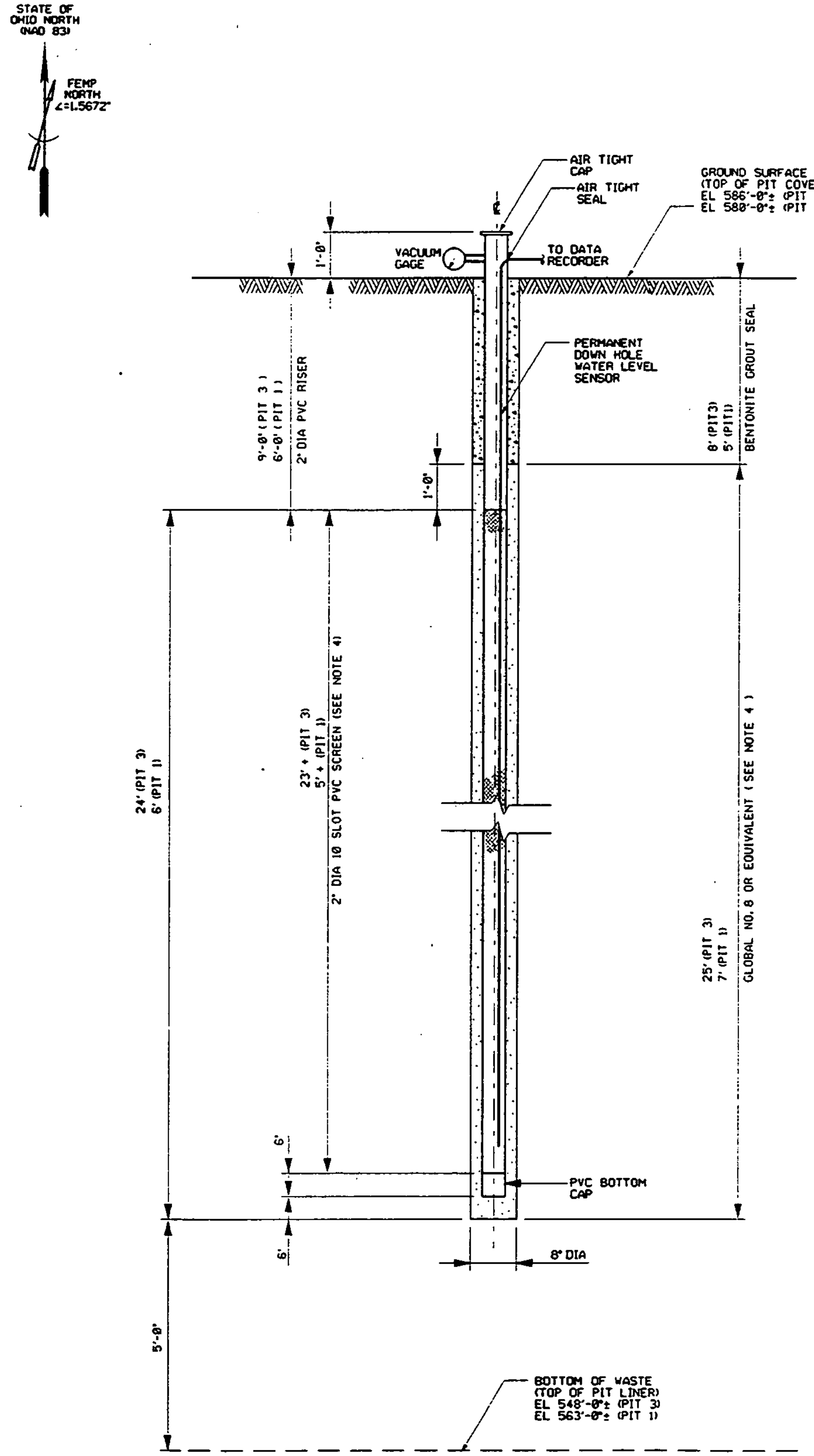
LEGEND

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

GENERAL ARRANGEMENT PLAN
PHASE 1 - COMPARATIVE WELL TEST

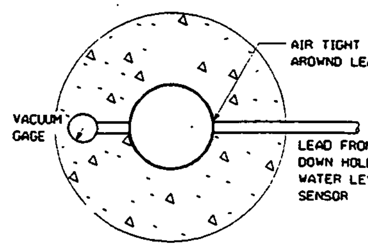
FIGURE 4-4

P019/CRU1

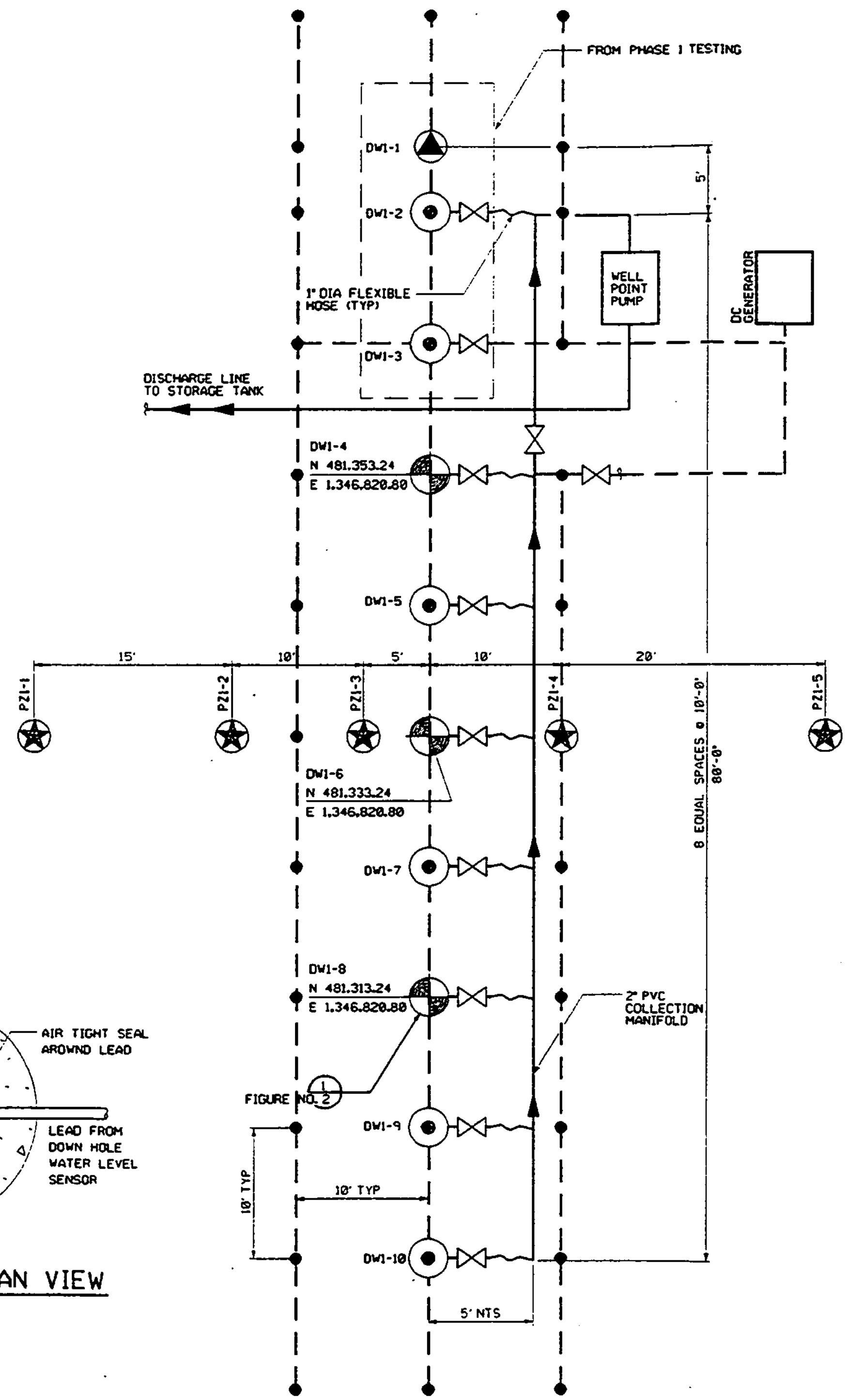


COMBINED WATER TABLE AND VACUUM PIEZOMETER

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 DWI-1, AND WELLS DWI-2 AND DWI-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.

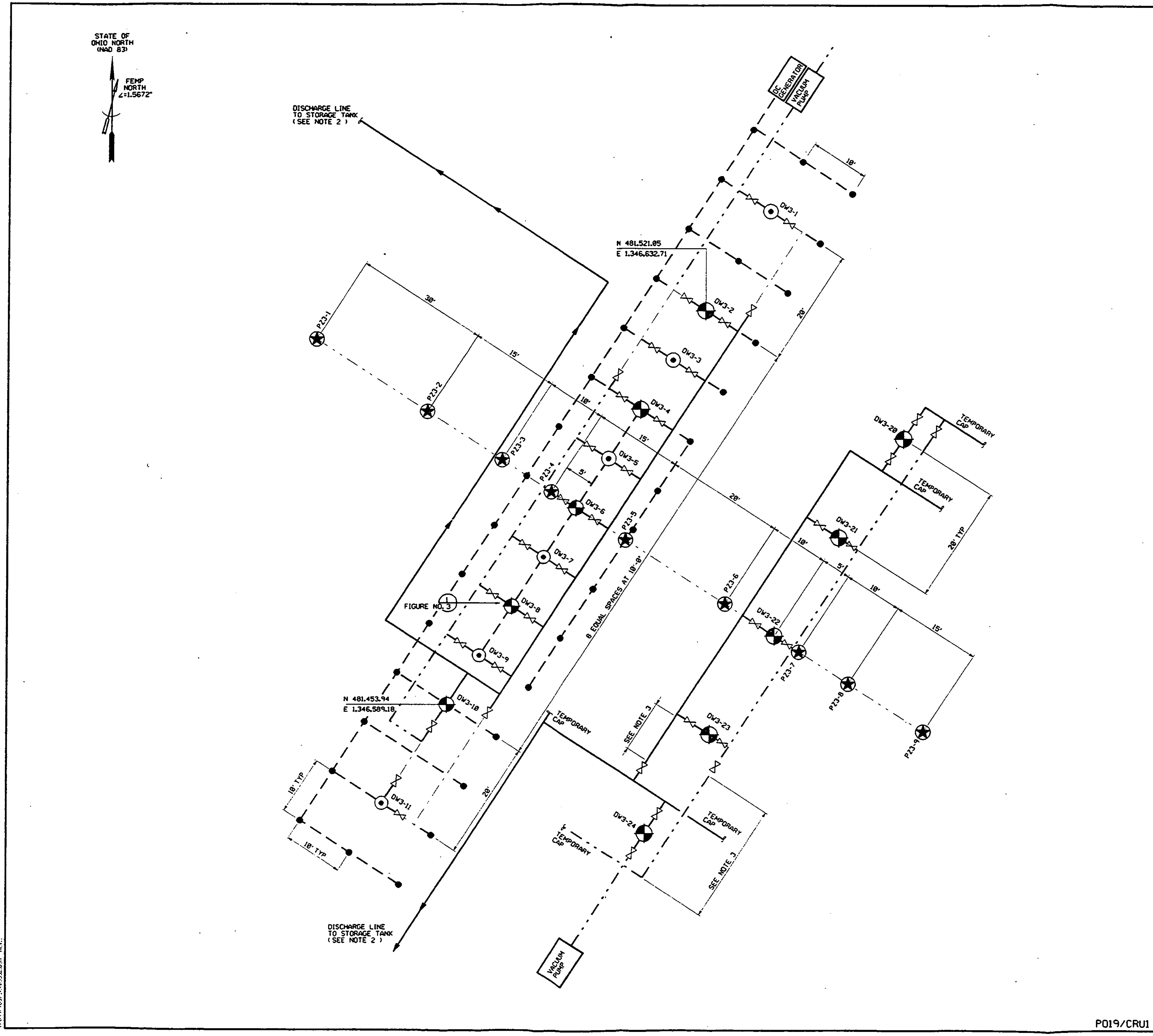
LEGEND

- 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

P019/CRU1

FIGURE 4-5



NOTES

ELECTRICAL NOTES:

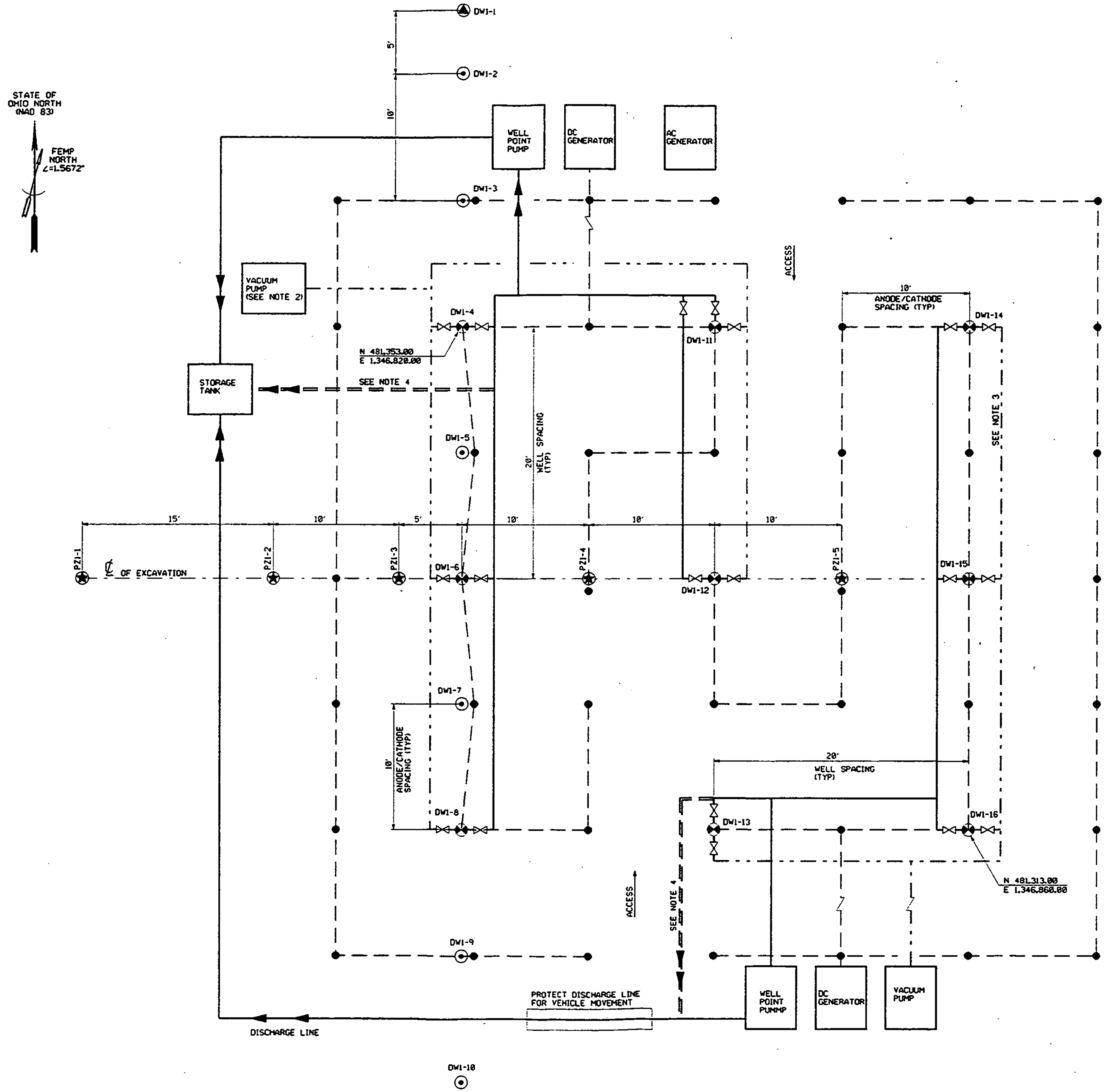
1. LOCATE WELL POINT PUMP, E-O DC SUPPLY, AND DATA LOGGER AT APPROXIMATE LOCATIONS SHOWN OUTSIDE OF APPROXIMATE DEWATER ZONE BOUNDARY.
2. FOR GENERAL LAYOUT AND EQUIPMENT ARRANGEMENT, SEE FIGURE NO. 8
3. THIS SECTION TO BE REMOVED WHEN PHASE 2 WORK IS COMPLETE.

LEGEND

Symbol	Description
⊙	WELL NOT PART OF THE PATTERN EXPECTED FOR THE FINAL DEWATER TESTING SYSTEM (PHASE 3), 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

FIGURE 4-6



GENERAL LAYOUT AND EQUIPMENT ARRANGEMENT
WELL POINT ARRAY - PIT 1

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

Symbol	Description
(driven well point symbol)	DRIVEN WELL POINT
(combined piezometer symbol)	COMBINED VACUUM AND WATER TABLE PIEZOMETER
(well symbol)	WELL (PHASE 3)
(spacing well symbol)	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

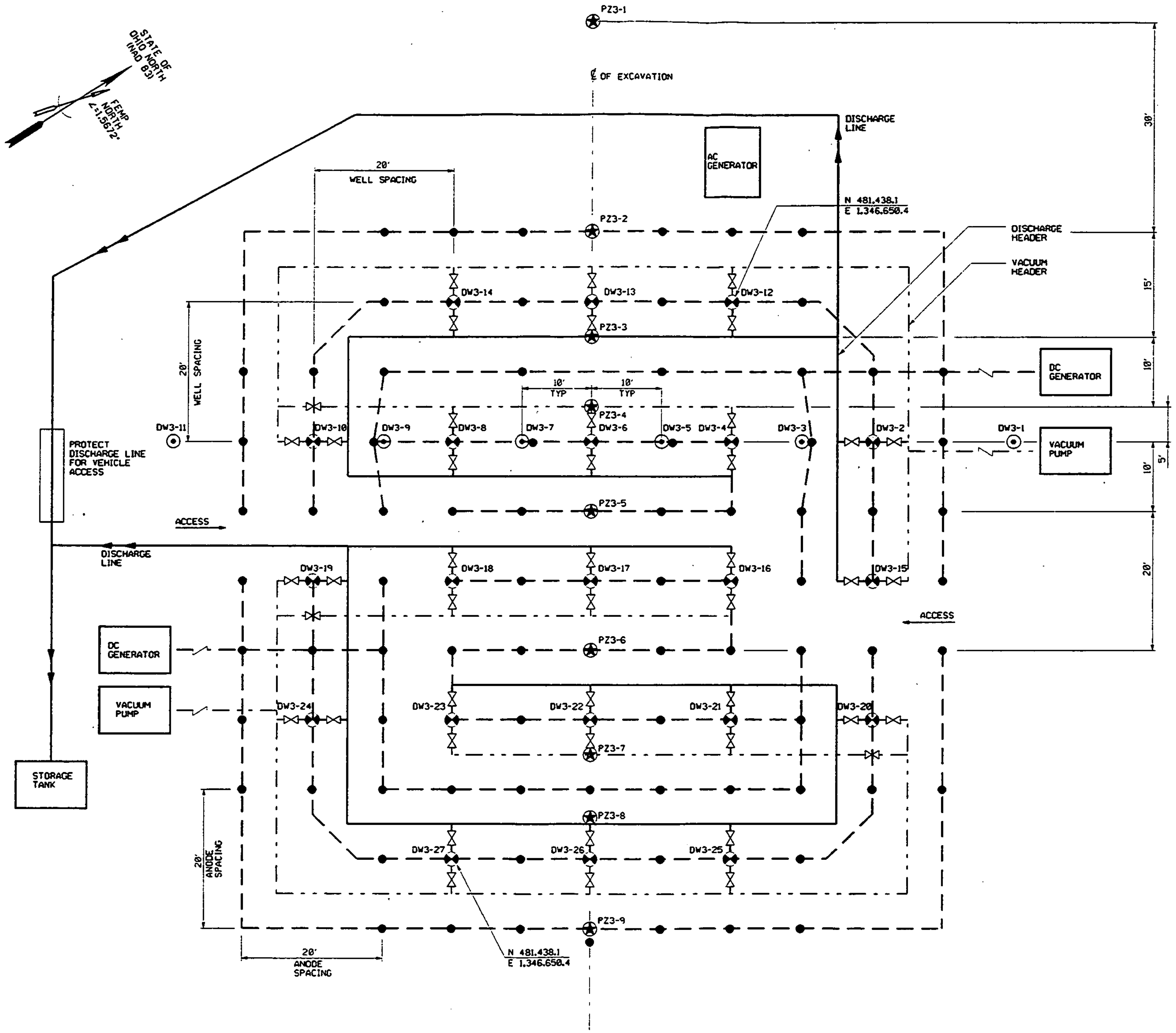
FULL INSTALLATION TESTING WELLS, FOR PIT 1

FIGURE 4-7

P019/CRU1

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.



GENERAL LAYOUT AND EQUIPMENT ARRANGEMENT
WELL ARRAY - PIT 3

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

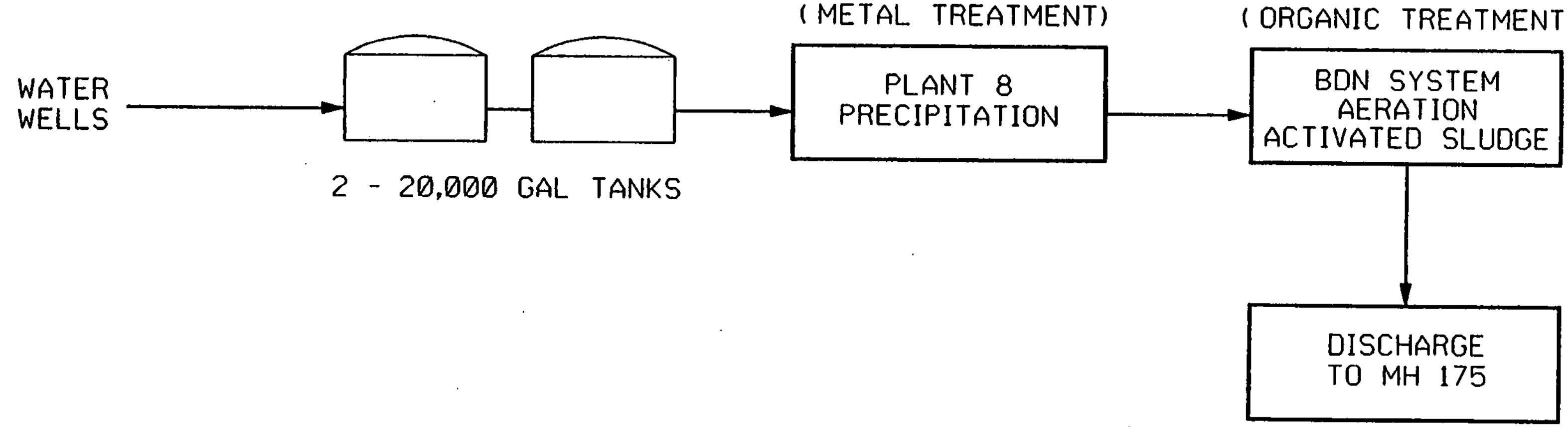


Figure 4-9

DEEP WATER TREATMENT

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.

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.

5.2.1.5 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

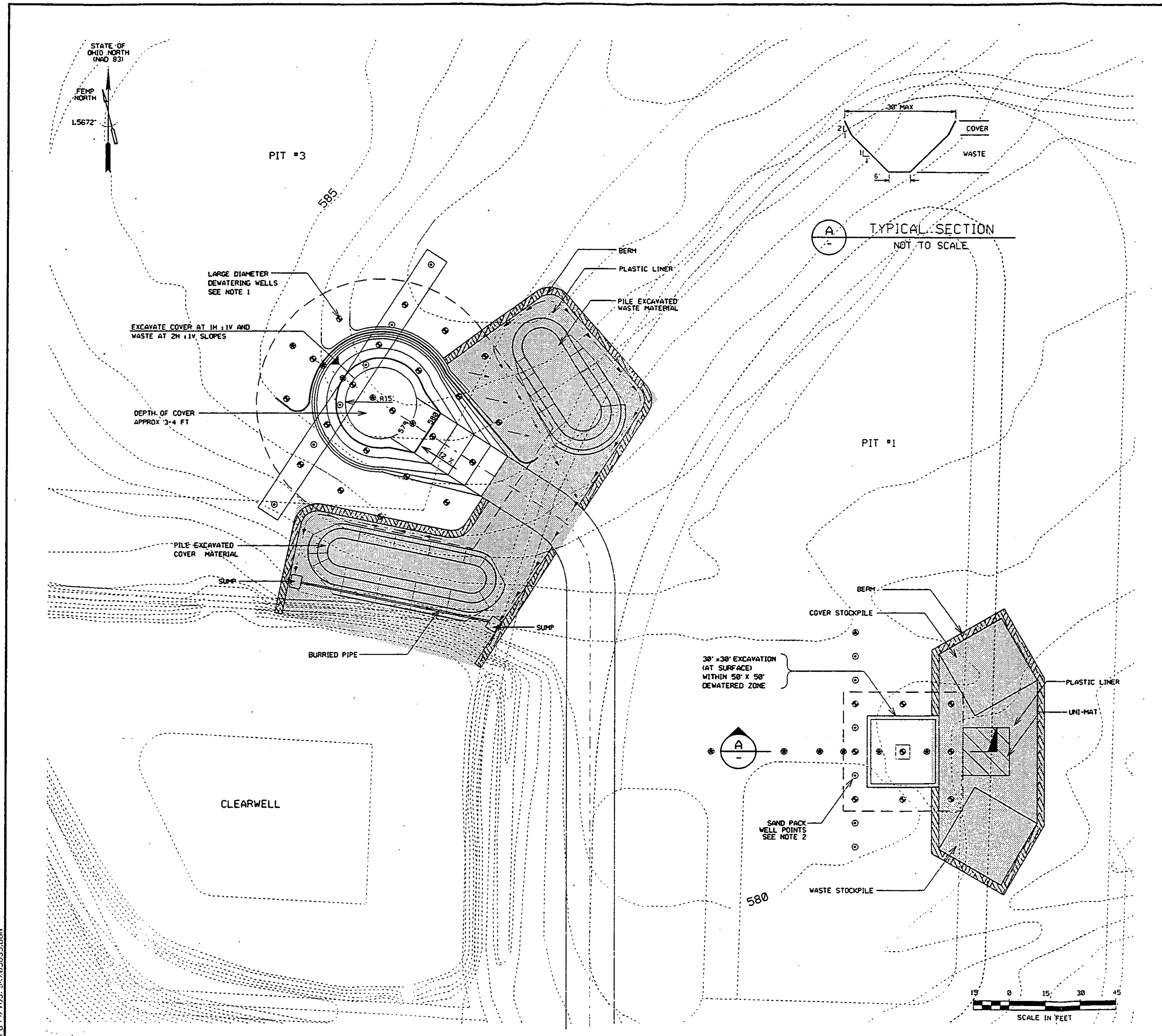
Supplies:

- 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

/PO94/TD5/SKY03035.DGN

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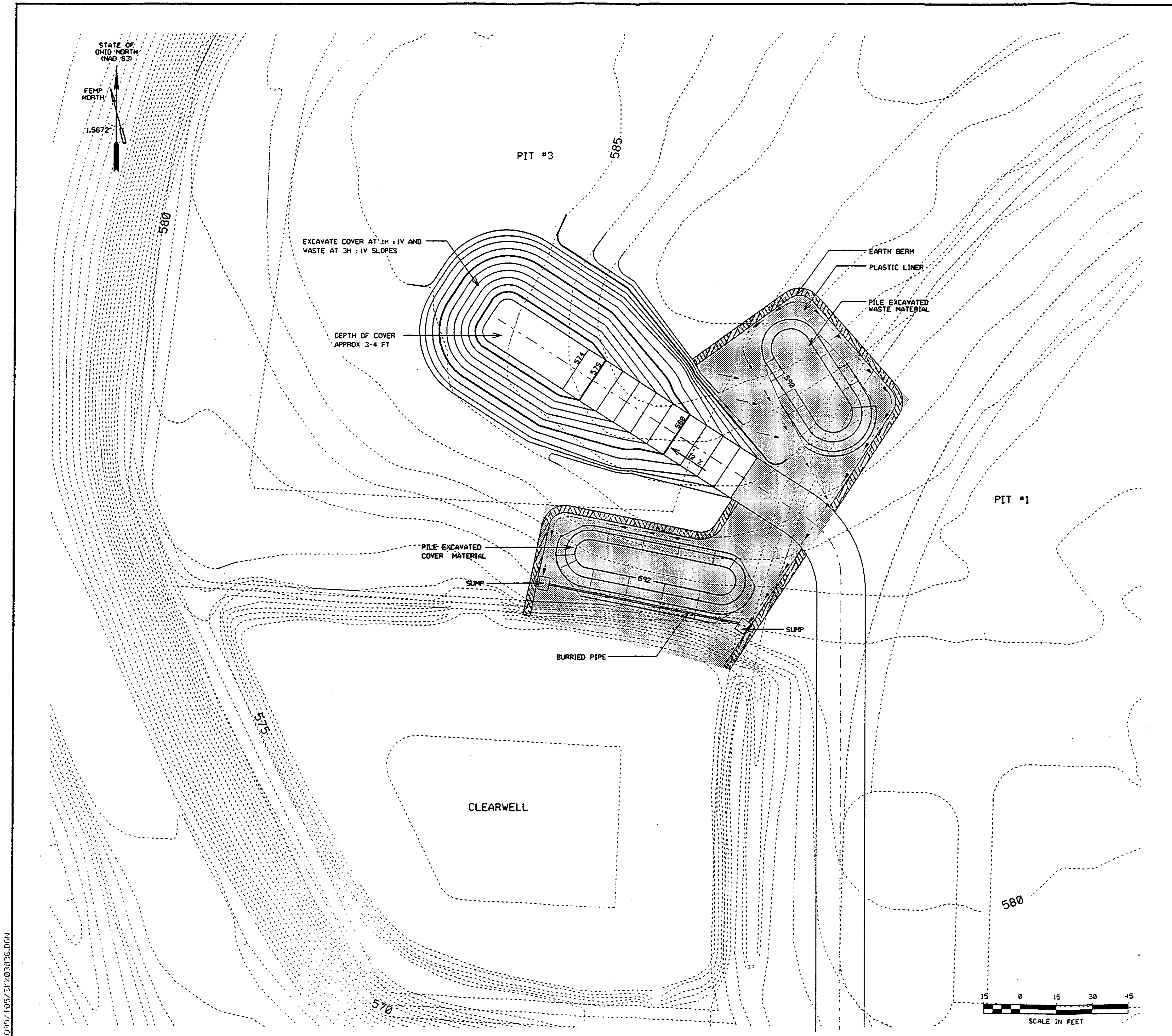


WASTE PIT 3
RAMP EXTENSION

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.

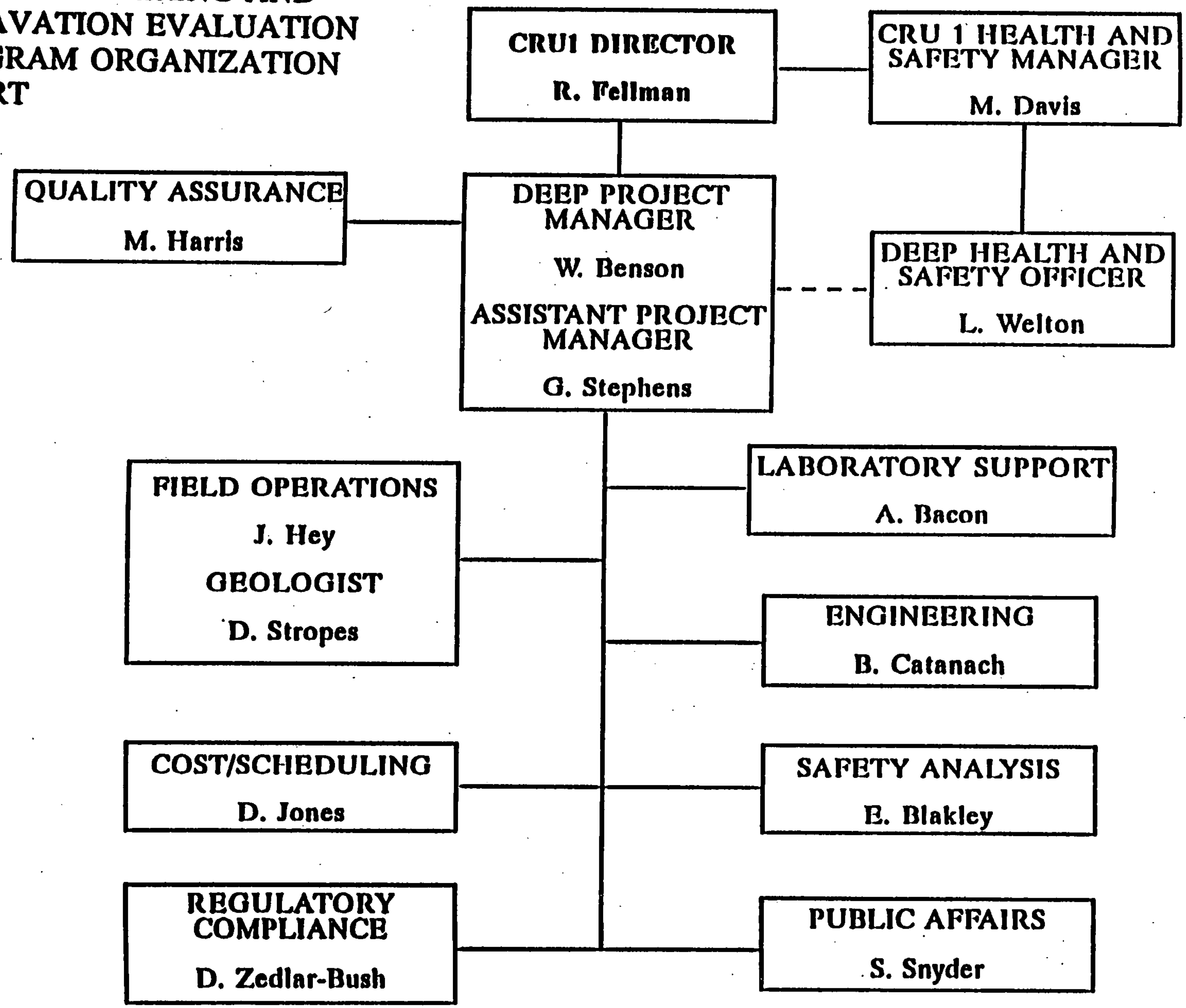
6.6 REPORTS

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



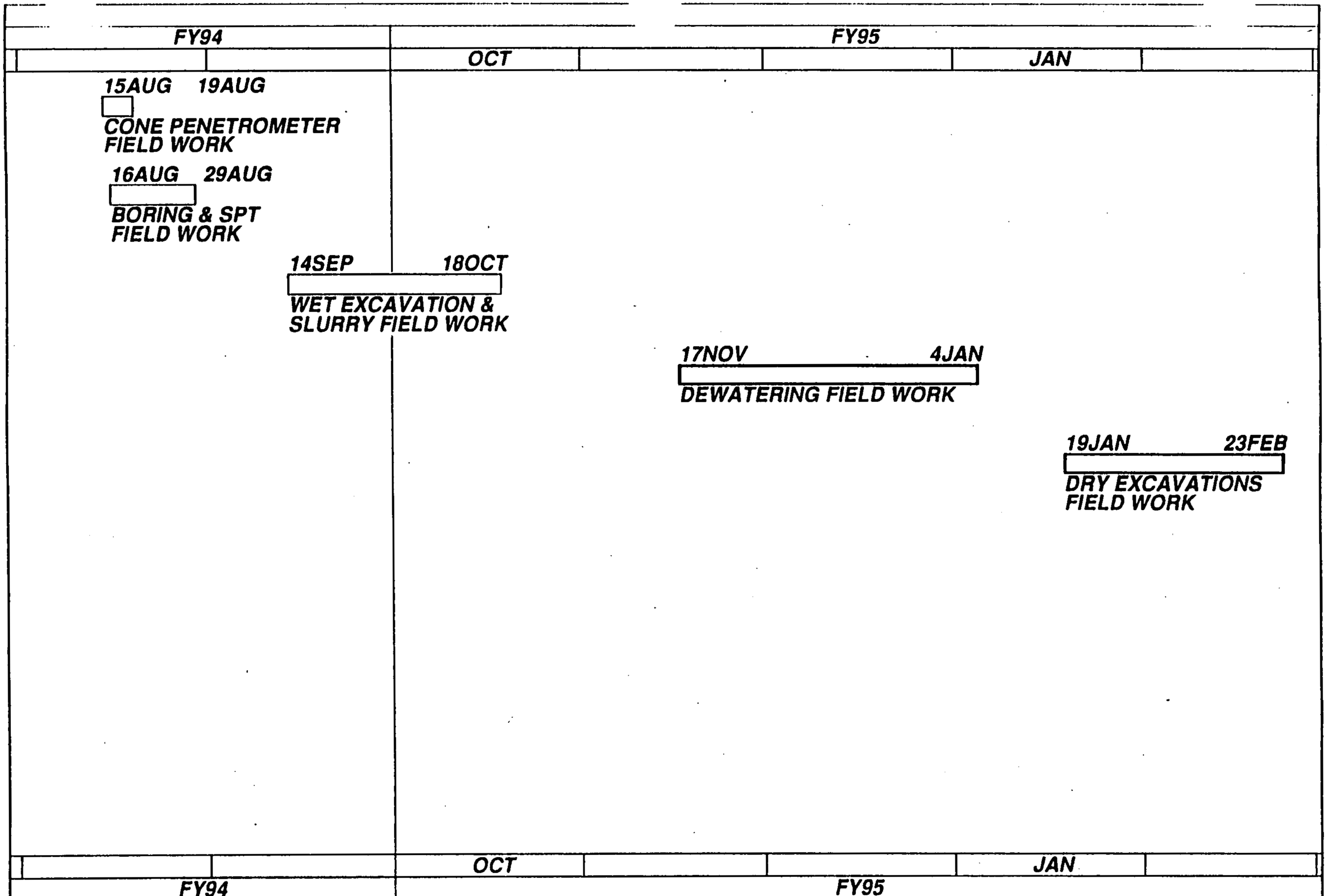


Figure 6-2

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
Milestone/Flag Activity

Sheet 1 of 1

OU 1 FY 94-99 BASELINE

D.E.E.P. FIELD STUDY

Date	Revision	Checked	Approved

REFERENCES

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ATTACHMENT A

DRAFT TASK-SPECIFIC HEALTH AND SAFETY PLAN

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4.0 TRAINING

Training requirements specific to each task to be performed are outlined in the Project Specific Health and Safety Requirements Matrix provided as Attachment A to this PSHSP.

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 FERMCO (Industrial Hygiene) for review prior to the product or chemical arriving on site. 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 FEMP site materials determined to present a hazard for work covered by this PSHSP are included in Attachment D for use by the subcontractor to comply with the Subcontractor's Written Hazard Communication Program. Additional FEMP MSDSs are available through the CRU1 Health and Safety Manager, as needed.

4.1.2 Job Briefings/Safety Meetings

All personnel involved in this project shall be given a briefing on the PSHSP prior to receiving authorization to begin work. A prework/kickoff safety meeting will be conducted by the CRU1 Health and Safety Manager with the CRU1 Site Supervisor, Construction Contracts Manager, Subcontractor Site Supervisor, and Subcontractor Health and Safety Officer; this meeting will satisfy the requirements for the PSHSP safety briefing. As a minimum, safety meetings shall be held weekly. The safety meetings will be conducted by the Site Supervisor, 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 CRU1 Health and Safety Manager for review.

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 CRU1 Health and Safety Manager for review and approval.

4.3 VISITORS

Anyone accessing the work site 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.

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1.0 INTRODUCTION

This Project Specific Health and Safety Plan (PSHSP) provides the methods for dealing with potential hazardous substances and situations associated with the CERCLA/RCRA Unit 1 (CRU1) field operations being performed for the Dewatering, Excavation Evaluation Program (DEEP).

All personnel entering a defined work area will be required to read or receive orientation about this PSHSP. In addition, all personnel will receive orientation on the Project Specific Health and Safety Requirements Matrix (PSHSRM) (Attachment A). Upon reading, all personnel must sign an acknowledgement form (Attachment B) stating they have read, understand, and agree to abide by the conditions of this plan. The form will be controlled by the Project Field Manager during the work and then forwarded to Document Control as part of the project files.

1.1 SITE DESCRIPTION AND HISTORY

Operable Unit 1 consists of Waste Pits 1 through 6, Clearwell, Burn Pit, miscellaneous structures/facilities, and environmental media within the Operable Unit 1 boundary. Radioactive wastes, consisting of radionuclides generated from uranium ore processing, and various chemicals are stored in the Operable Unit 1. Remediation of the Operable Unit 1 Waste Pits will require removal of the waste from the waste pits prior to treatment and disposal. Mechanical excavation is the proposed method for removing the waste from the waste pits. DEEP was developed to provide the necessary information to determine how to optimize and refine plans for mechanical excavation. The intent of the DEEP program is to obtain geotechnical information that will be required during the remedial design. An alternative method of removing the waste from the waste pits, slurrying, will also be tested.

1.2 WORK AREA CHARACTERIZATION

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

1.2.1 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.

1.2.2 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.

1.2.3 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.

1.3 WORK DESCRIPTION

This PSHSP for the FEMP DEEP activities will be used by FERMCO and any subcontractors conducting field activities as described herein. The major tasks to be completed during the performance of this project 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.

- 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 all 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. Next, the cap material will be placed 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; the equipment will then be wrapped in plastic and sent to the FEMP decontamination Facility. After the equipment is fully decontaminated, it will be released for off-site use. (See Section 8 of this PSHSP.)

2.0 ORGANIZATION STRUCTURE AND KEY PERSONNEL RESPONSIBILITIES

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

2.2 MANAGER, OCCUPATIONAL SAFETY & HEALTH TECHNICAL SUPPORT - Laurie Hagen. Responsible for CRU1 health and safety oversight. Michael Davis is the alternate for Laurie Hagen on this project.

2.3 CRU1 HEALTH AND SAFETY MANAGER - Michael S. Davis. Responsible for the overall CRU1 Health and Safety Program. Performs inspections to assure compliance with health and safety requirements. Laurie Hagen is the alternate for Michael Davis for this project.

2.4 CRU1 PROJECT DIRECTOR - Robert T. Fellman. 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. Terry Hagen is the alternate for Robert Fellman for this project.

2.5 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.

2.6 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.

2.7 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.

2.8 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 FERMCO Construction Manager 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 CRU1 Health and Safety Manager (HSM) 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 CRU1 HSM.

3.0 SITE CONTROL

3.1 WORK AREA REQUIREMENTS

FERMCO and all subcontractors shall ensure that all personnel entering the work area are in full compliance with all the requirements within this PSHSP and all other FEMP Health and Safety requirements. During the conduct of activities, various work areas will be established as follows:

3.1.1 Radiological Areas

All drilling and excavations will be performed inside a radiologically controlled area. Areas will be posted in accordance with contamination conditions as determined by radiological assessment. Entrances to and perimeters of radiological areas will be defined by yellow magenta rope or, where practical, by physical structures such as fences or buildings. 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:

Controlled Areas - A controlled area is any area, room, or enclosure to which a 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.

Soil Contamination Area - Soil Contamination Areas are areas where soils have been exposed to radioactive contamination.

Radioactive Material Area - A Radioactive Material Area is an area where radioactive material is used, handled, or stored.

Contamination Area - A Contamination Area is an area where removed radiological contamination is greater than DOE surface contamination guideline the isotope of concern.

Entry into the controlled areas will require the following:

- The wearing of dosimeters
- Radiation safety training

- Limitations on entry for personnel with open wounds or recent medical tests using radionuclides.
- Radiological area postings
- Protective clothing
- Limitations on smoking, drinking, and eating/chewing
- Contamination control
- Monitoring requirements upon exiting from the controlled area and radiological areas.
- A Radiation Work Permit with the specifications of this Plan will be required for work in the controlled areas of the DEEP project.

3.1.2 Exclusion Areas

A barricade fence (snow type) will be established around each DEEP work area. The Radiological Controls Dept. will establish controls consisting of step-off pads in those areas posted for radiological reasons (e.g., at the controlled area exit points). This contamination reduction zone will be used for monitoring at the step-off pad and for removal of disposable personal protective equipment (PPE). Exclusion zones shall be designated by the use of yellow caution tape. The area shall have a sign posted to specify the hazard(s) in the exclusion zone. When an exclusion zone contains radiological contamination, the zone will be controlled as a radiological "controlled" area.

5.0 MEDICAL MONITORING AND SURVEILLANCE

5.1 REQUIREMENTS

All personnel will be required to participate in the FEMP medical monitoring program. 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 FEMP Medical Services.

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

5.1.1 Bioassay Requirements

Personnel who must enter a Contamination Area for work are required to participate in the FERMCO bioassay program. Each individual will be required to leave urine samples at the beginning of the project. Each individual will also be required to leave a prejob (baseline) fecal sample.

The urine sampling frequency is based on the potential for internal exposure to Class W soluble uranium.

The baseline fecal sampling requirement is a one-time sample collection, based on the potential for internal exposure to thorium-containing compounds.

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 FERMCO bioassay program.
- Baseline fecal sampling is required for all project personnel who must access the posted Contamination/Airborne Radioactivity Area.
- 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 FERMCO Medical Section 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 will 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.

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)

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 and have an OSHA TWA limit of 0.2 mg/cu.Meter.

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).

6.2 INDUSTRIAL HYGIENE ISSUES

6.2.1 Chemical Hazards

Chemical analyses of the contents of Waste Pits 1, 2, and 3 indicate that the following are the primary Chemical Hazard concerns.

Arsenic, Inorganic

Arsenic is a shell gray metal in its pure form. Arsenic 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.

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 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.

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.

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.

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

Low levels of a variety of organic compounds were identified during soil sampling activities. Identified compounds include: chlorinated solvents, polynuclear aromatics, aromatics, ethers, ester and alcohols.

6.2.2 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 and must wear clothing 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 FERMCO Medical Services for observation.

6.2.3 Temperature Extremes

6.2.3.1 Heat Stress

Precautions must be taken in hot weather to avoid heat stress, particularly when heat stress can occur even when not wearing PPE. When the temperature reaches 80°F or above, the Industrial Hygiene Department will determine the actual level of stress being created and the time duration allowed for wearing protective equipment in order for FERMCO and subcontractors' employees to continue working at the job site.

6.2.3.2 Cold Stress

When the wind chill index falls below 0°F in the job site area, the CRU1 Health and Safety Manager will provide information to the people working outdoors concerning cold stress injuries such as frostbite, shivering, and lethargy (indicating deep body cooling). The Industrial Hygiene Department will determine the actual level of stress being created and the time duration allowed for wearing protective equipment in order for FERMCO and subcontractors' employees to continue working at the job site.

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 E to the PSHSP.

6.3.1 Physical Hazards

6.3.1.1 Noise

Personnel performing activities in areas where noise levels could exceed 85 dba will be required to utilize adequate hearing protection.

6.3.1.2 Lifting

All personnel should know their lifting limits, the proper way(s) to lift, and 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, such as the drilling rig, backhoe, front end loader, and other similar equipment present a possible sinking hazard due to the high potential for soft, spongy sub-surface conditions. A pre-placement inspection shall be performed prior to movement. Personnel will be instructed to avoid travel over any soft/spongy areas. Vehicles will be watched closely during moves, and if any excessive sinking of tires 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 to spread the load evenly over the surface.

The number of personnel in the area around operating heavy equipment shall be minimized at all times. 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 FERMCO 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. Drillers are the only people allowed within four feet of a rotating auger. All Radiological and/or Industrial Hygiene monitoring shall be performed at this distance or when the auger is stopped. 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. Work/casual observers will not be allowed to be 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 work/casual observer be allowed to enter a trench or excavation.

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. All cords shall be protected from damage by vehicles and equipment.

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 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. Because of the possibility of personnel being exposed to splash/slurried hazardous materials, there shall be made available an adequate emergency eyewash station will be maintained in a sanitary condition near the work area.

6.3.1.8 Fire Protection

Because of the extreme heterogeneity of the Waste Pits, there is a potential for fire and/or chemical reactions resulting from the penetration of the pit contents, including steel drums of waste material. To protect against fires and chemical reactions, the drill holes and excavations will be monitored by FERMCO for flammable vapors and explosive atmospheres. All work will stop if detected.

Flammable or combustible liquids with a flash point of 140 degrees 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 lids. All safety cans shall be properly marked with the name of the contents and the hazards of the material.

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, tarps, drainage control and area monitoring.

Administrative controls used to address potential hazards include this PSHSP, all FERMCO requirements, and work plans dictating operational procedures.

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. The majority of task will require full radiological dressout and full face positive air purifying respirators (PAPR) with combination HEPA and organic vapor cartridges. Exposure to wet materials will require the addition of Saranex outer coverings. 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 site.

In addition, respiratory protection may be upgraded or downgraded as deemed appropriate by the CRU1 Health and Safety Manager or designee within the constraints of this PSHSP. With the written approval of the CRU1 Heath and Safety Manager, substitution of some PPE items may be appropriate. Approved written revisions will be made in the PSHSP and Project Specific Health and Safety Requirements Matrix.

8.0 DECONTAMINATION

Area decontamination of chemical and radioactive materials should be done with a combination of scraping to remove the gross contamination, 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 PERSONAL

Personal contamination on the skin, or on the inner personal company-issued clothing, shall require that the full-time Radiological Control Technician follow appropriate FEMP requirements for personnel decontamination, event notification and reporting of radiological control occurrences. Contaminated personnel are to initiate a bioassay analysis for assessing potential internal radiation dose from possible inhalation, ingestion, or absorption of radioactive materials.

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

8.2 EQUIPMENT

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."

9.0 EMERGENCY/CONTINGENCY PLANS

9.1 REPORTING

9.1.1 Site Notification Procedures

All emergencies shall be reported to the FERMCO "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
- Activate a local site fire alarm pull station
- Radio to "Control"

Any injury, no matter how minor, shall be reported to FEMP Medical Services for evaluation and treatment. The injured employee shall be accompanied to Medical by the supervisor in charge or designee. The FERMCO CRU1 Project Director and the CRU1 Health and Safety Manager 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.

9.1.2 Emergency Numbers

NAME	FEMP TELEPHONE NO.	RADIO
Ambulance	738-6511	CONTROL
Hospital	738-6511	CONTROL
Fire	738-6511	CONTROL
Security	738-6511	CONTROL
Emergency Response	738-6511	CONTROL
CRU1 Health & Safety Manager	738-6492	538
Industrial Hygiene	738-6207	357
Rad Con Technicians (Off-shift)	738-6257/6577 738-6889	355
Fire and Safety Inspectors	738-6235	303
Assistant Emergency Duty Officer (AEDO)	738-6295/6431	202/CONTROL
Accountability Center	738-6202	CONTROL
Construction Logistics Group	738-6489	517/401

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, and are to **stay on the phone line until the dispatcher hangs up.**

The following information must be given to the Communications 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 G.

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

9.4 EMERGENCY RESPONSE

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

9.4.2 Fire Emergencies

Due to the extreme heterogeneity of the Waste Pits, it is possible that an adverse chemical reaction could occur (i.e., fumes, smoke, fire, etc.). In this instance, the operator shall, if practical and without personal endangerment, immediately backfill sufficient waste or sludge into the trench excavation to stop such adverse chemical reaction. If the operator judges that s/he is in imminent and immediate danger from fumes, smoke, or spreading fire, s/he shall immediately lower the bucket, turn off, and vacate the equipment.

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

The FEMP 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:

- Activate nearest fire alarm if possible. Note: Notify other employees by alternate method if fire alarm is not available
- Evacuate building or 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 FERMCO Medical Services.

When contaminated with other materials, contact Industrial Hygiene and remain at the work location until a representative of Industrial Hygiene arrives and provides further instructions.

All instances of personnel chemical contamination shall be reported to Industrial Hygiene, the CRU1 Health and Safety Manager, Construction Engineer and the AEDO.

9.4.5 Radiological Emergencies

9.4.5.1 Releases

The release area shall be evacuated. The supervisor in charge, AEDO, Radiological Control Technicians, and CRU1 Health and Safety Manager 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, CRU1 Health and Safety Manager, Construction Engineer and the AEDO.

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 FERMCO Medical Services and to the Construction Contract Manager. Should a serious accident/injury occur, the involved area should not be disturbed until approved by the CRU1 Health and Safety Manager.

10.0 CHANGES TO THE PSHSP

This Project Specific Health and Safety Plan for CRU1 DEEP activities is based on information available at the time of preparation. It is important that this document be routinely reassessed by supervision, project management and the CRU1 Health and Safety Manager. In addition, unexpected conditions/events may arise which require reassessment of the health and safety issues. Upgrading or downgrading of precautions, personal protective equipment, etc. identified in this plan must be approved in writing by the CRU1 Health and Safety Manager, or designee. Amendments to this plan are not required for such changes in activity; however, formal documentation of the change must be made.

Unplanned operations and/or changes in work scope shall require a review and may require an amendment to the Project Specific Health and Safety Plan. All amendments must be approved by the CRU1 Director, CRU1 Health and Safety Manager and the Manager of 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
CRU1 Health and Safety Manager, Michael S. Davis
DEEP Project Manager, William M. Benson
Quality Assurance Officer, Marc Q. Harris
Industrial Hygiene, Dave Jackson
Industrial Hygiene Technicians, Jack Patrick
Medical Services, Doran Christensen

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 CRU1 Health and Safety Manager for currency and applicability to job tasks. Required revisions (only affected pages) will be submitted to ES&H Document Control for update and distribution.

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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 & TYPE OF AIR AND PERSONNEL MONITORING REQUIRED	PERSONAL PROTECTIVE EQUIPMENT	TRAINING REQUIREMENTS	MEDICAL MONITORING & SURVEILLANCE REQUIREMENTS	ADMINISTRATIVE & ENGINEERING CONTROL MEASURES	PERMIT(S)	DECONTAMINATION & DISPOSAL PROCEDURES
1) Minimum Project Requirements	• Uranium contamination • General construction hazards • Not all hazards are specified on this Matrix	• Thermolumineseat Dosimeter (TLD)	• FERMCO issued clothing, steel toed safety shoes • Subcontractor supplied hard hats, safety glasses w/rigid side shields to their employees • FERMCO supplied hard hats, safety glasses w/rigid side shields to their employees • Full-face, powered, air-purifying respirator (PAPR) with yellow and magenta cartridge required for all work activity	• Site Worker • General Employee Training (GET) • Rad Worker II • 24-hour Field Experience • Eight-hour Supervisor's Training for Supervisory Personnel • Orientation of PSHSP • Orientation on Project H&S Requirements Matrix • Orientation on Project Specific MSDSs	• FERMCO or approved physical • Respirator medical approval • Initial, annual, and termination in-vivo • Initial, every 60 days and termination urinalysis • Fecal sampling at beginning of project	• P.S.H.S.P. and matrix • Site Policies • Site Procedures • Warning signs • Warning posters • Exclusion zone boundaries	• RWP	All tools and equipment will be scraped of gross contamination. Small items will be double wrapped in plastic sheet and sent to next location for use. Upon completion of project, equipment will be sent to Decon for final decontamination and smear survey for free release. Large equipment will be gross decontaminated, taken to Pit 6 concrete pad (west side) and high-pressure water cleaned and sent to Decontamination Facility for final cleaning & Survey.

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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)

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
2) Site Mobilization	• Uranium contamination	• Periodic monitoring by Rad Safety for alpha, bata, gamma • BZ Monitoring • General air sampling by Rad & I. H.	• Anti-Cs for wet (i.e. Saranax) • Leather gloves	• Respirator Training and Fit Test • Equipment Operator Training	• Respirator, medical approval	• Contamination zone established • Site entrance and exit route • Two-way radio • Fire extinguisher • Equipment alarm	• General Work Permit • Excavation Penetration	• Monitor equipment / employees before leaving area
3) Slug Testing and Soil Borings	• Rotating equipment Drill rig	• BZ Monitoring	• Anti-Cs for wet or dry and taped to prevent loose fitting • Leather gloves with liners	• Knowledge of contents of MSDS		• All machine guards in place • Kill switch	• Penetration Permit	• Shower at lunchtime and end of day • Monitor equipment before removing from site
	1. Exposure to heavy metals and VOCs	• Volatile organic compounds (VOC) • Personal Air Monitoring • Nuisance dust • monitoring by RAM-1					• Chemical Hazardous Work Permit	
	• Biological hazards • Ticks • Chiggers • Insects • Snakes	• Personal monitoring			• If stung or bitten, report to Medical Department at Bldg. 53	• Mow grass off pits work location		

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.

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 & 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)	2. Noise	• FERMCO periodic monitoring	• Hearing protection			• Hearing Protection • Required at 85 DBA • Post area as required		
	3. Heat stress	• Physiological monitoring of workers	• Cool vest			• Work/rest schedule • Contact IH when temperature reaches 80°F • Adequate water supply		
	• Electrical power supply			• Operation Manual for Equipment • Lock and Tag SSOP 719		• Inspect generators • Lock and Tag Program • Inspect cords • GFCI		
	• Fire, open flames		• Welding shields/goggles • Welding gloves	• Fire Watch Person for Welding Operations		• Fire extinguishers • Fire watch • Monitor heat source	• Burning Welding Permit	
	• Drill rig failure			• Qualified Operator		• Site Procedure • Daily inspection of cables/equipment		

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.

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 & 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
4) Well Encasement Installation and Piping to Dewater	• Collapse of pit		• Anti-C for wet (i.e. Saranex) • Leather gloves			• Visual inspection of drill area • Placement of Unimat System and if needed	• General Work Permit • Excavation Penetration	• Monitor equipment and personnel before removing from site.
	• Spread of contamination					• Ensure proper connection of piping to tanks • Inspection of piping tanks • Flag or barricade pipe line to prevent tripping hazard		
	• Electric pumps and cords 1. Exposure to heavy metals and VOCs 2. Noise 3. Heat stress					• Inspect cords • Flag cords to prevent tripping or crushing • Ensure proper grounding • Lock & Tag Program		
5) Setting Unimat	• Lifting unimats by crane			• Qualified Operator		• Lift Plan • Tag lines • Barricade swing radius of crane • No-one under lifted/suspended load	• General Work Permit	Remove all gross contamination

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.

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 & 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
5) Setting Unimat (continued)	• Spread of contamination 1. Exposure to heavy metals and VOCs 2. Noise 3. Heat stress							
6) Excavating Test Pits	• Trench collapse	• Visual inspection from manlift		• Five-minute safety talks on trenching		• Barricade area • No personnel in barricaded area • Video taping from overhead manlift basket	• Excavation and Penetration	
	• Fall protection	• Inspect harness before each use	• Harness and Lanyard while in manlift	• Proper Use of Harness • Trained Operator for Manlift		Tieoff on manlift		
	• Equipment operation 1. Exposure to heavy metals and VOCs 2. Noise 3. Heat stress			• Trained Operator		• Alarms • Seatbelts • Barricade Swing Radius		

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.

ATTACHMENT B

ACKNOWLEDGEMENT FORM

ATTACHMENT B

HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT FORM

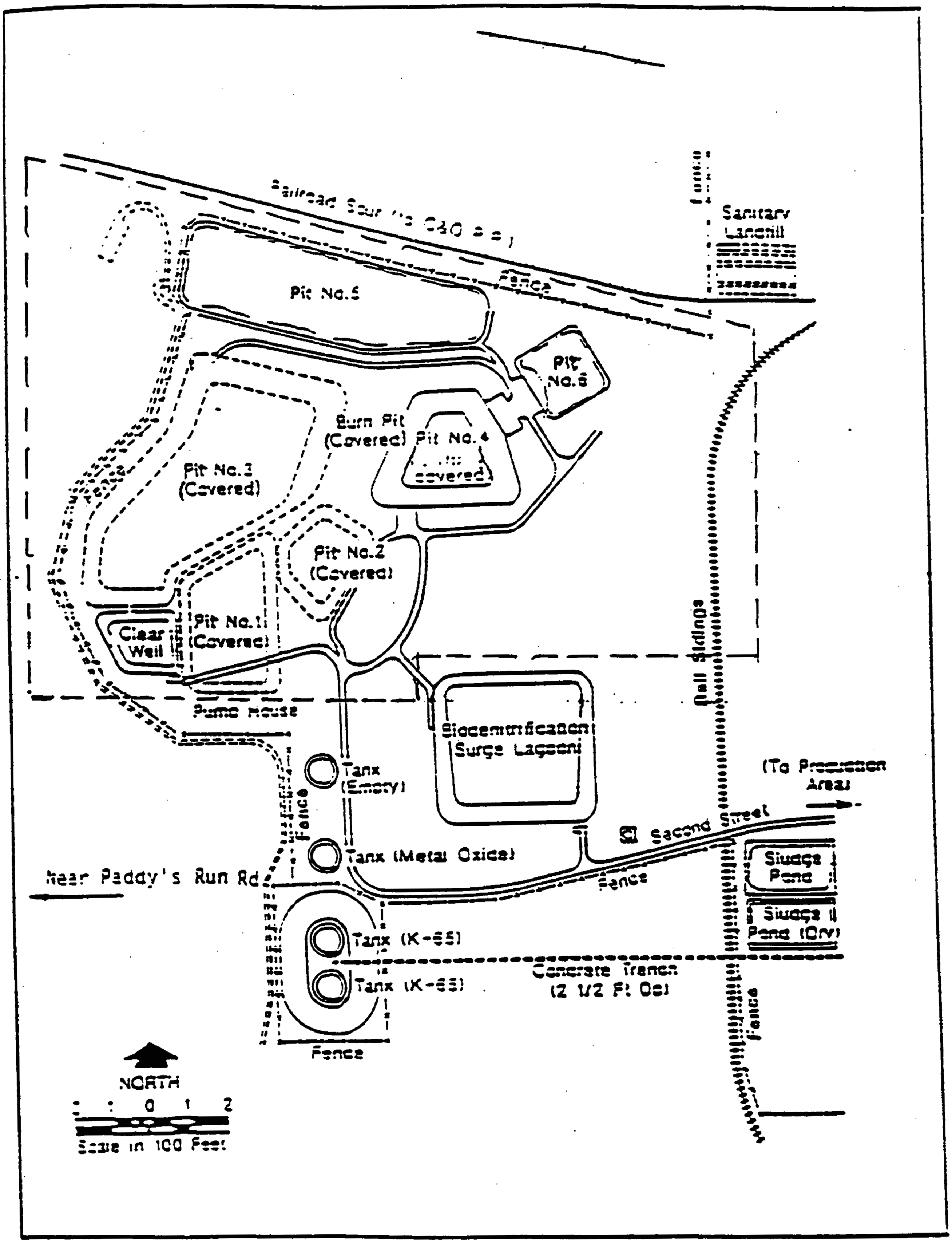
I have been informed and understand and will abide by the procedures set forth in the Health and Safety Plan and Amendments for the FEMP Dewatering, Excavation, Evaluation Program.

Printed Name	Signature	Badge No.	Representing	Date

ATTACHMENT C

WORK AREA MAP

WORK AREA MAP



CRU 1 — — —

PIT 1 - PIT 2 - PIT 3 - PIT 4 - PIT 5 - PIT 6

CLEAR WELL BURN PIT

ATTACHMENT D

WORK AREA MATERIAL SAFETY DATA SHEETS (MSDSs)

UNITED STATES DEPARTMENT OF ENERGY
MATERIAL SAFETY DATA SHEET

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,

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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. INHALATION 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

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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; $BaCO_3$; $BaCl_3$
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); $BaCl_3$— 1560 C (2840 F)
Specific gravity: $Ba(NO_3)_2$— 3.24; BaO— 5.72; $BaCO_3$—4.25; $BaCl_3$— 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) $BaCl_3$— 963 C (1765 F)
Vapor pressure: Essentially zero
Solubility in water: $Ba(NO_3)_2$— 9.2; BaO— Reacts; $BaCO_3$— 0.0022; $BaCl_3$— 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, lifting the lower and upper lids cocasionally; get medical attention immediately; contact lenses should not be worn when working with solutions of barium compunds.
Skin: Flush contaminated skin area with water; if soaked through clothing, remove clothing immediately and flush the skin with water; if irritation persists, get medical attention immediately.
Breathing: Move the exposed person to fresh air at once; if breathing is stopped, perform artificial respiration; keep affected person warm and at rest; get medical attention immediately.
Swallowing: If conscious, give the person large quantities of water immediately. After the water has been swallowed, try to induce vomiting by having the person touch the back of his throat with his finger. If unconscious, do not induce vomiting; get medical attention immediately.

VII. PERMISSIBLE EXPOSURE LIMIT

OSHA TWA: 0.5 mg/m^3
IDLH: 250 mg/m^3

VIII. PRECAUTIONS FOR USE AND SAFE HANDLING

Conditions contributing to instability: For barium nitrate, elevated temperatures may cause melting and decomposition; for other compounds, none hazardous
Incompatibilities: Contact of barium oxide with water, carbon dioxide, or hydrogen sulfide may cause fires and explosions; contact of barium carbonate with acids causes formation of carbon dioxide gas that may cause suffocation in enclosed spaces; contact of barium nitrate with organic matter and combustible materials may cause fires and explosions.
Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen and carbon monoxide) may be released in a fire involving barium nitrate.
Special precautions: None

IX. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spills: Restrict persons not wearing personal protective equipment and clothing from areas of spills until cleanup is completed. In case of a spill, take the following steps: ventilate area of spill; collect spilled material in the most convenient and safe manner and deposit in a secured sanitary landfill. Liquids containing sodium barium compounds should be absorbed in vermiculite, dry sand, earth, or a similar material.

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) Specific Gravity: 1.848
Vapor Pressure: 7.600 MM HG (AT 1910. C) Melting Point: 1278.000 C
Vapor Density: No Info. Solubility: No Info. (SLIGHT - INSOL HOT-COLD WATER)
Evaporation Rate: No Info. 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 Dermal Toxicity: No Info.
Comments: TCLO HUMAN, PULMONARY
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.

I. CHEMICAL IDENTITY

Common name: Cobalt metal, fume and dust
Formula: (example compounds) $Co/CoO/Co_2O_2/Co_2O_4$
Synonyms: None
CAS No.: (Cobalt) 7440-48-4
Carcinogen: N/A

II. REGULATORY INFORMATION

Hazardous substance: Some compounds, including cobaltous bromide, cobaltous formate, and cobaltous sulfamate (EPA)
Hazardous waste: No
DOT Hazard Class: ORM-E (same compounds as above)

III. PHYSICAL CHARACTERISTICS

Boiling point: 3100 C (5612 F)
Specific gravity: 8.8
Vapor density: N/A
Melting point: 1491 C (2715 F)
Vapor pressure: 0 mm Hg
Solubility in water: Insoluble
Evaporation rate: N/A
Appearance and odor: Odorless black solid or finely divided particulate dispersed in air.

IV. PHYSICAL HAZARDS

Flash point: N/A
Autoignition temperature: Specially prepared (by reducing the oxides in hydrogen) very fine cobalt dust will catch fire at room temperature.
Flammable limits in air (% by vol.): N/A
Extinguishants: Dry sand, dry dolomite, dry graphite powder

V. HEALTH HAZARDS

Can affect the body if inhaled or swallowed, or in contact with the eyes or skin. Irritates the nose and throat and has been known to cause respiratory disease and even death. The fumes and dust also can cause skin rash.

VI. EMERGENCY FIRST AID

Eyes: Irrigate immediately
Skin: Wash with soap.
Breathing: Move to fresh air and administer artificial respiration if necessary.

Swallowing: Get medical help. Give large quantities of water and induce vomiting unless the victim is unconscious.

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VII. PERMISSIBLE EXPOSURE LIMIT

OSHA TWA: 0.1 mg/m^3
ACGIH TLV: 0.5 mg/m^3

VIII. PRECAUTIONS FOR USE AND SAFE HANDLING

Conditions contributing to instability: None
Incompatibilities: Contact with dust or strong oxidants may cause fire and explosions.
Hazardous decomposition products: None
Special precautions: None

IX. SPILL, LEAK, AND DISPOSAL PROCEDURES

Wear protective clothing and equipment. If cobalt dust is spilled or if potentially hazardous amounts of cobalt metal fume are released, ventilate the area, collect the material in the most convenient and safe manner in sealed containers, and dispose in a secured sanitary landfill.

X. PROTECTIVE EQUIPMENT

Respirators–

0.5 mg/m^3: DMXS
1.0 mg/m^3: DMXSQ;FuHiEP
5 mg/m^3: HiEPF;SAF;SCBAF
20 mg/m^3: PAPHiEF;SAF:PD,PP,CF
Escape: HiEPF;SCBA

I. CHEMICAL IDENTITY

Common name: Lead and inorganic compounds
Formula: Pb (lead)
Synonyms: None
CAS No.: 7439-92-1 (lead)
Carcinogen: N/A

II. REGULATORY INFORMATION

Lead metal and all its inorganic compounds (as well as a class of organic compounds known as lead soaps) are regulated under an OSHA standard (29 CFR 1910.1025), which sets permissible exposure limits and requires monitoring, compliance plans, protective clothing and equipment, blood testing of employees, and temporary medical removal and return of an employee to assigned work if elevated levels of lead are found in the blood. The standard does not apply equally to all segments of industry and should be consulted for details. The OSHA standard is published in BNA's **Occupational Safety & Health Reporter** service.

Hazardous substance: EPA lists the acetate, arsenate, chloride, fluoborate, fluoride, iodide, nitrate, stearate, sulfate, sulfide, and thiocyanate.

Hazardous waste: EPA lists the acetate, phosphate, and subacetate.

DOT Hazard Class: Poison B (arsenate, arsenite, cyanide); oxidizer (nitrate, peroxide); ORM-B (chloride, fluoborate, fluoride); ORM-E (acetate, iodide, stearate, sulfate).

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III. PHYSICAL CHARACTERISTICS

Boiling point: 1620 C
Specific gravity: 11.337
Vapor density: N/A
Melting point: 327.5 C
Vapor pressure: N/A
Solubility in water: essentially insoluble
Evaporation rate: N/A
Appearance and odor: Dull gray metal

IV. PHYSICAL HAZARDS

Flash point: N/A
Autoignition temperature: N/A
Flammable limits in air (% by vol.): N/A
Extinguishants: N/A

V. HEALTH HAZARDS

Lead is a powerful systemic poison that can cause seizures, coma, and that can lead to death. Chronic long-term exposure can result in severe damage to the blood-forming organs, and the nervous, urinary, and reproductive systems. Symptoms include metallic taste in mouth, anxiety, constipation, nausea, pallor, weakness, insomnia, headache, muscle pain, and possible severe abdominal pain.

VI. EMERGENCY FIRST AID

Eyes: Irrigate immediately
Skin: Wash with soap or mild detergent
Breathing: Move to fresh air and perform artificial respiration if needed.
Swallowing: Give large quantities of water and induce vomiting. Get medical attention.

VII. PERMISSIBLE EXPOSURE LIMIT

OSHA TWA: 50 μ/m^3. The standard sets an action level of 30 μ/m^3; if this concentration is reached several requirements of the standards are triggered, including exposure monitoring, medical surveillance, and training and education.

VIII. PRECAUTIONS FOR USE AND SAFE HANDLING

Controlled by the OSHA standard.

IX. SPILL, LEAK, AND DISPOSAL PROCEDURES

Controlled by the OSHA standard.

X. PROTECTIVE EQUIPMENT

Controlled by the OSHA standard.

Respirators–

$<$0.5 mg/m^3: HiEP
$<$2.5 mg/m^3: HiEPF
$<$50 mg/m^3: PAPHiE; SA:PD,PP,CF
$<$100 mg/m^3: SAF:PD,PP,CF
$>$100 mg/m^3: SCBAF:PD,PP,CF
Firefighting: SCBAF:PD,PP,CF

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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 DOT
* 7440-61-1

TWA .2 mg/m3 Sol

.6 STEL

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. 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 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 OIL

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.

CHEMICAL CATEGORIES
05/23/1986

CATEGORY	CLASS NAME	CLASS CODE

***			
* CARCINOGEN	HUMAN		
* CHEMICAL	ACTINIDE METAL	U	
* HAZARD CODE	REACTIVITY	2	
* 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
* 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

ATTACHMENT E

OSHA AND DOE EMPLOYEES 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.

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

ATTACHMENT F

PERSONNEL AND ENVIRONMENTAL MONITORING AND ACTION LEVELS

ATTACHMENT F
PERSONNEL AND ENVIRONMENTAL MONITORING AND ACTION LEVELS

FEMP policy is to maintain exposures to radiation and chemical s As Low As Reasonably Achievable (ALARA). To comply with this policy, personal and environmental air monitoring shall be conducted during the performance of activities covered by this PSHSP. The PSHSRM outlines personal and general air monitoring requirements for each activity to be performed. During the performance of the tasks, personal air monitoring may be conducted. Workers may be required to wear personal air samplers to and compliance with current regulatory standards.

In the event an unknown or suspicious odor is detected personnel should leave the area and contact the Industrial Hygiene Department to investigate the situation.

Air monitoring indicates the amount of contamination in the air. When the concentration of a contaminant reaches a predetermined level (action level) workers shall leave the area and changes in PPE or operations will be implemented. action levels will be established based on the chemical and radiological concentration of the material worked with and the activities being conducted. FERMCO Industrial Hygiene and Radiological Control Technicians will provide monitoring support for all operations as required by this PSHSP.

PERSONNEL AND ENVIRONMENTAL MONITORING AND ACTION LEVELS

Activity (Tasks)	Contaminant	Occupational Exposure Limit 8-hour TWA	Action Level	Action	Monitoring Method
Slug Testing Soil Borings Wet Excavation Waste Material Removal Water Reslurring and Pump Test Dry Excavation Reclamation	Arsenic	0.01 mg/m^3	Detection to 10mg/M^3 10 mg/m^3	Full-Face w/ Magenta cartridges PAPR *2 w. Magenta cartridges P-D Airline w/ Escape Bottle or PD SCBA Cease operations and contact I.H.	RAM-1 Photometer
	Barium, Soluble	0.5 mg/m^3			
	Beryllium	0.002 mg/m^3			
	Cobalt	0.05 mg/m^3			
	Lead, Inorganic	0.05 mg/m^3			
	Nuisance Particulates	10 mg/m^3			
	Uranium, Soluble	0.05 mg/m^3			
	Organic Vapors (Based on Benzene)	Varies (1ppm)	> Detection to 25 ppm > 25 ppm	PAPR w/yellow cartridge cease operations and contact I.H.	Personal VOC Detectors

Notes
1. Uranium is the most restrictive and is the governing one for setting the action levels for all dusts
2. PAPR is an acronym for Powered Air Purifying Respirator

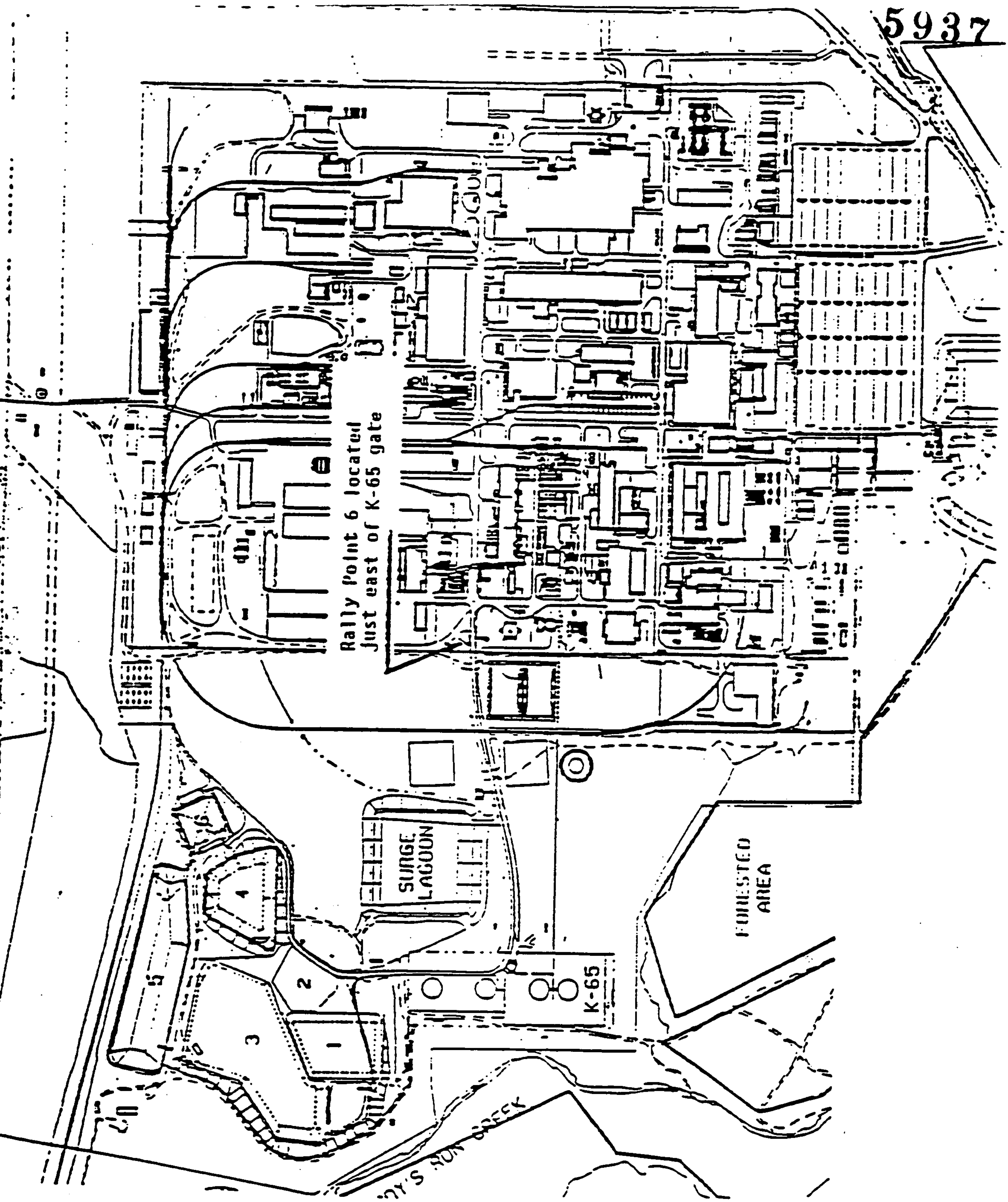
MD/DEEP/PEMAL.TAB/GSS/9/1/94- 8:42am

000165

ATTACHMENT G

FEMP RALLY POINTS

5937

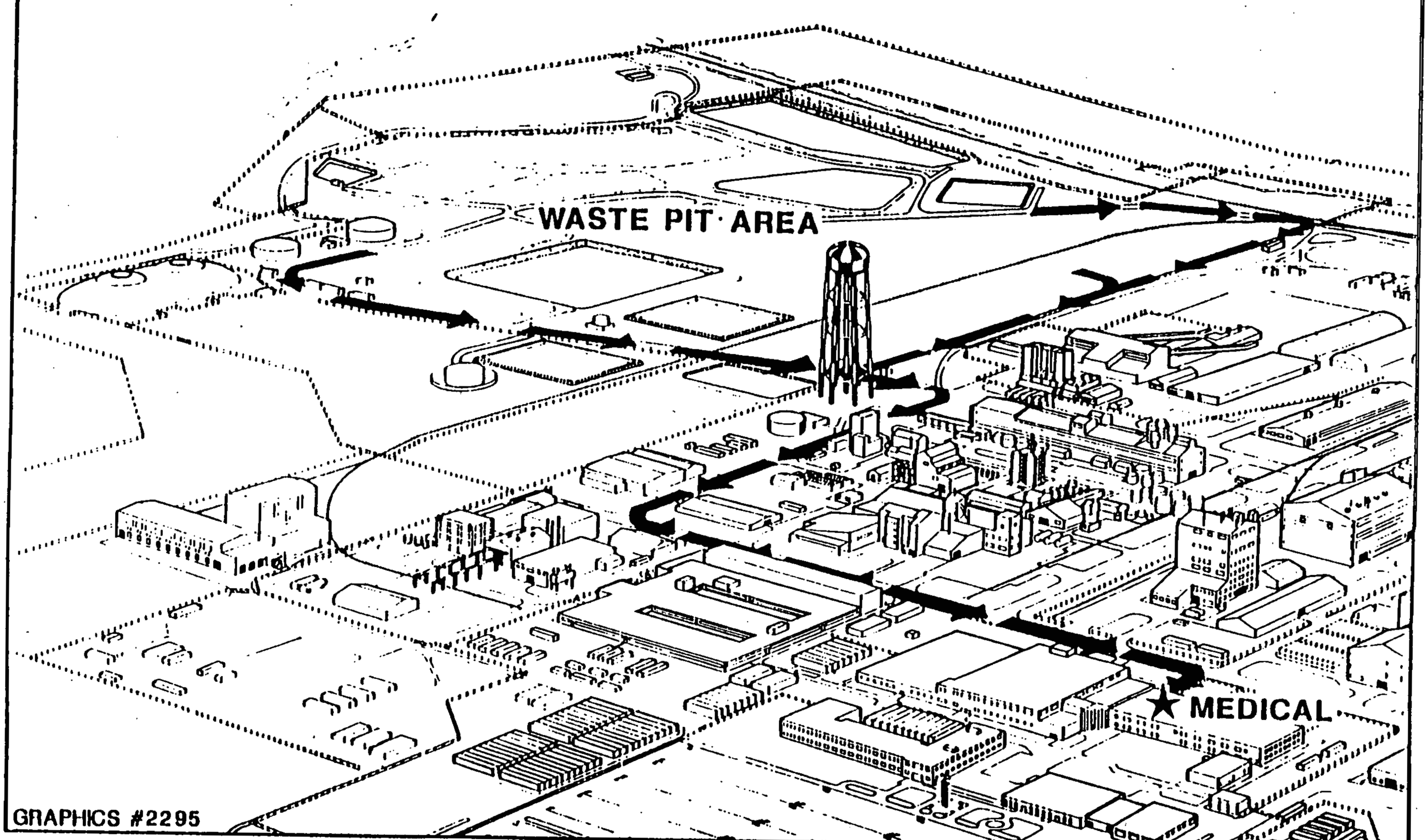

Rally Point 6 located
just east of K-65 gate
SURGE
LAGOON
FORESTED
AREA
K-65
1
2
3
4
5
6

000167

ATTACHMENT H

LOCATION OF FEMP MEDICAL FACILITY

"Route From Waste Pit Area to Medical"



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.

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).

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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.

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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

FS-F-3682 (REV. 9/10/93)

FEMP
LITHOLOGIC LOG

CONTROL NUMBER:	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)

000195

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)

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

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FS-F-3714 (10/13/93)

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										

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:

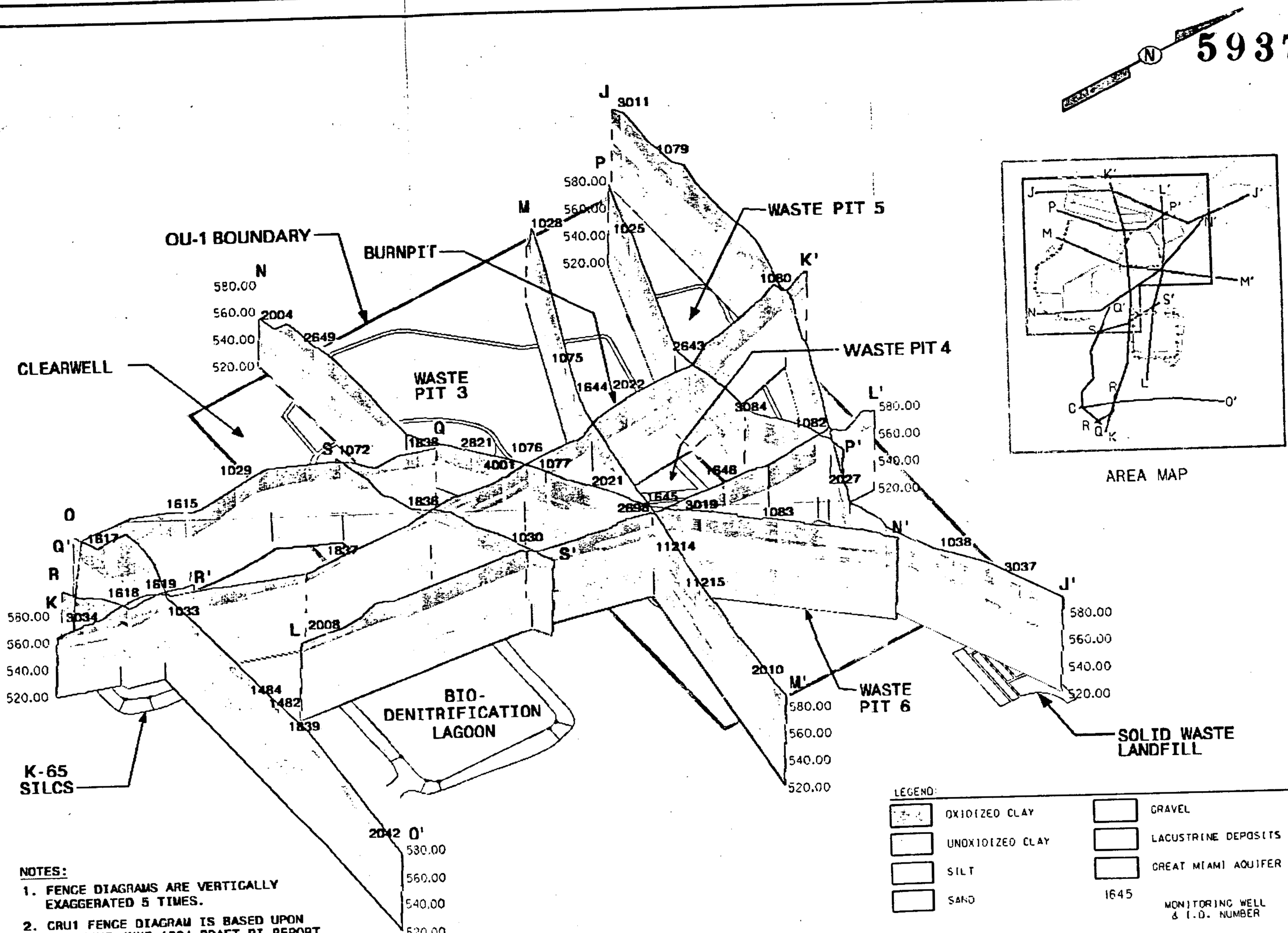
FIELD ENGINEER/GEOLOGIST:	DATE:	CHECKED/VERIFIED BY:	DATE:

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

5937



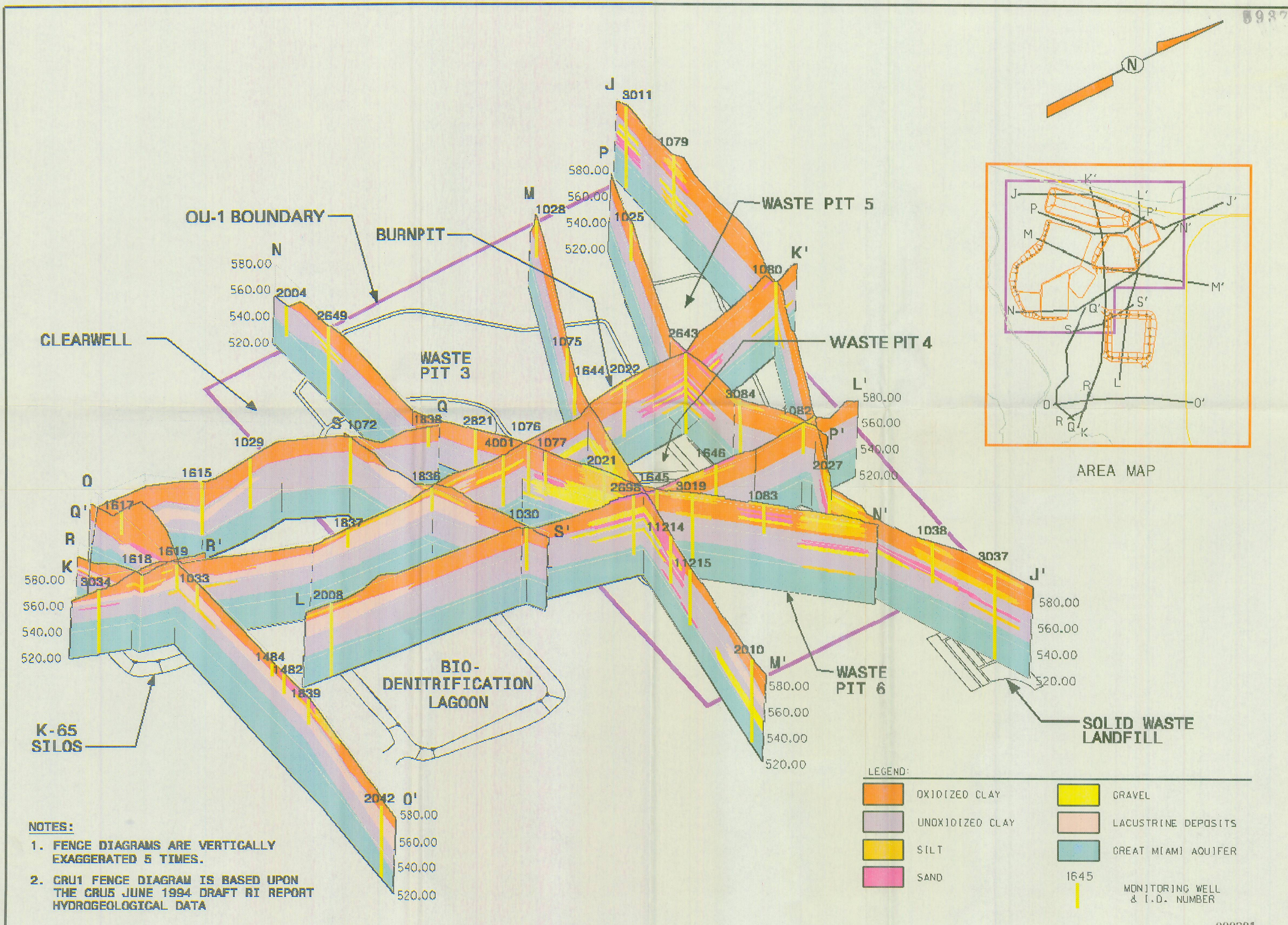
NOTES:

1. FENCE DIAGRAMS ARE VERTICALLY EXAGGERATED 5 TIMES.
2. CRU1 FENCE DIAGRAM IS BASED UPON THE CRU5 JUNE 1994 DRAFT RI REPORT HYDROGEOLOGICAL DATA

000202

[redacted]

CONCEPTUAL CROSS-SECTION OF THE CRU-1 (WASTE STORAGE AREA) GLACIAL OVERBURDEN



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

wpl1s.rgb 08-10-94 T.A.R.

000201

[redacted]

CONCEPTUAL CROSS-SECTION OF THE CRU-1 (WASTE STORAGE AREA) GLACIAL OVERBURDEN