LOAN DOCUMENT

PHOTOGRAPH THIS SHEET

DTIC ACCESSION NUMBER

LEVEL

INVENTORY 0

BIOVENTING TEST WORK PLAN...

DOCUMENT IDENTIFICATION

MAY 92

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited

DISTRIBUTION STATEMENT

HANDLE WITH CARE

ACCESSION FOR
NTIS GRA&I ☑
DTIC TRAC ☐
UNANNOUNCED ☐
JUSTIFICATION

BY

DISTRIBUTION/

AVAILABILITY CODES

DISTRIBUTION	AVAILABILITY AND/OR SPECIAL	
A-1		

DISTRIBUTION STAMP

DATE ACCESSIONED

DATE RETURNED

20001226 042

DATE RECEIVED IN DTIC

REGISTERED OR CERTIFIED NUMBER

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-FDAC

DTIC FORM 70A JUN 90

DOCUMENT PROCESSING SHEET

PREVIOUS EDITIONS MAY BE USED UNTIL STOCK IS EXHAUSTED.

LOAN DOCUMENT

PART I

BIOVENTING TEST WORK PLAN FOR FIRE TRAINING PIT 1 AND SPILL SITE 1 F.E. WARREN AFB, WYOMING

ENGINEERING-SCIENCE

Prepared For

Air Force Center for Environmental Excellence
Brooks AFB, Texas
and

90th Support Group/DEVR
F.E. Warren AFB, Wyoming

ES
Engineering-Science, Inc.
1700 BROADWAY, SUITE 900
DENVER, COLORADO 80290

May 1992

DEFENSE TECHNICAL INFORMATION CENTER
REQUEST FOR SCIENTIFIC AND TECHNICAL REPORTS

Title: AFCEE Collection

1. Report Availability *(Please check one box)*

☒ This report is available. *Complete sections 2a - 2f.*

☐ This report is not available. *Complete section 3.*

2a. Number of Copies Forwarded: 1 each

2b. Forwarding Date: July/2001

2c. Distribution Statement *(Please check ONE box)*

DoD Directive 5230.24, "Distribution Statements on Technical Documents," 18 Mar 87, contains seven distribution statements, as described briefly below. Technical documents MUST be assigned a distribution statement.

☒ DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

☐ DISTRIBUTION STATEMENT B: Distribution authorized to U.S. Government Agencies only.

☐ DISTRIBUTION STATEMENT C: Distribution authorized to U.S. Government Agencies and their contractors.

☐ DISTRIBUTION STATEMENT D: Distribution authorized to U.S. Department of Defense (DoD) and U.S. DoD contractors only.

☐ DISTRIBUTION STATEMENT E: Distribution authorized to U.S. Department of Defense (DoD) components only.

☐ DISTRIBUTION STATEMENT F: Further dissemination only as directed by the controlling DoD office indicated below or by higher authority.

☐ DISTRIBUTION STATEMENT X: Distribution authorized to U.S. Government agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with DoD Directive 5230.25, Withholding of Unclassified Technical Data from Public Disclosure, 6 Nov 84.

2d. Reason For the Above Distribution Statement *(in accordance with DoD Directive 5230.24)*

2e. Controlling Office: HQ AFCEE

2f. Date of Distribution Statement Determination: 15 Nov 2000

3. This report is NOT forwarded for the following reasons. *(Please check appropriate box)*

☐ It was previously forwarded to DTIC on _____ *(date)* and the AD number is _____

☐ It will be published at a later date. Enter approximate date if known. _____

☐ In accordance with the provisions of DoD Directive 5200.12, this requested document is not supplied because: _____

Print or Type Name: Laura Perin

Telephone: 210-536-4321

Signature:

AD Number: M01-03-0582

PART I
BIOVENTING TEST WORK PLAN FOR FIRE TRAINING PIT 1 AND SPILL SITE 1 F.E. WARREN AFB, WYOMING

Prepared for:

Air Force Center for Environmental Excellence
Brooks AFB, Texas

and

90th Support Group/DEVR
F.E. Warren AFB, Wyoming

by:

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, Colorado

August 1992

CONTENTS

FIGURES

BIOVENTING TEST WORK PLAN FOR FIRE TRAINING PIT 1 AND SPILL SITE 1 F. E. WARREN AFB, WYOMING

Prepared for

Air Force Center for Environmental Excellence
Brooks AFB, Texas

and

90th Support Group /DEVR
F.E. Warren AFB, Wyoming

by

Engineering-Science, Inc
1700 Broadway, Suite 900
Denver, Colorado

May 1992

BIOVENTING TEST WORK PLAN FOR FIRE TRAINING PIT 1 AND SPILL SITE 1 F. E. WARREN AFB, WYOMING

1.0 INTRODUCTION

This test work plan presents the scope of an in situ bioventing pilot test for treatment of fuel contaminated soils at Fire Training Pit 1 and Spill Site 1 on F. E. Warren AFB, WY. The pilot tests have three primary objectives: 1) to assess the potential for supplying oxygen throughout the contaminated soil depth, 2) to determine the rate at which indigenous microorganisms will degrade fuel when stimulated by oxygen rich soil gas, and 3) to evaluate the potential for sustaining these rates of biodegradation until fuel contamination is remediated below regulatory standards.

If bioventing proves to be feasible at these sites, pilot test data will be used to design a full-scale remediation system and to estimate the time required for site cleanup. An added benefit of the pilot testing at Spill Site 1 is that a significant amount of the fuel contamination should be biodegraded during the one year pilot test since the testing will take place within the most contaminated soils on the site.

Because the remedial investigation has not been completed at FTP 1, only a brief 8-hour pilot test will be conducted on this site to determine the air permeability of the soil. This test will involve one vent well and a 40 scfm blower and should produce a radius of influence of less than 40 feet. In situ rates of fuel biodegradation will be determined for individual soil vapor monitoring points but will not significantly impact soil contamination or the results of the upcoming remedial investigation.

Additional background information on the development and recent success of the bioventing technology is found in the attached document entitled "Test Plan and Technical Protocol For A Field Treatability Test For Bioventing." This protocol document will also serve as the primary reference for pilot test well designs and detailed procedures which will be used during the test.

2.0 SITE DESCRIPTION

2.1 Fire Training Pit 1

2.1.1 Site Location and History

Fire Training Pit 1 (FTP 1) is located approximately 400 feet north of Missile Drive. The site is located on gently sloping land which drains northward to Crow Creek located approximately 450 feet from the site. Two bermed pits were located at the site ranging from approximately 150 to 300 feet in diameter. The majority of the soil contamination on the site is beneath and adjacent to the smaller of these bermed pits. Figure 2.1 shows the location of the pits in relation to Missile Drive and Crow Creek.

Fire training exercises were conducted at this site from 1950 to 1965. Typically, the bottom of the pit was filled with a layer of jet fuel and then ignited. Fire fighters would practice extinguishing the flames which generally surrounded a mock metal aircraft in the pit. Unburned fuel soaked into the ground creating the contaminated soil column now found beneath the pit. Prior to strict environmental regulations, waste oil and solvents were also placed in the pit for burning. The resulting hydrocarbon contamination and minor solvent contamination found at this site are the targets for bioventing treatment.

2.1.2 Site Geology

Because the bioventing technology is applied to the unsaturated soils, this section will primarily address soils above the shallow aquifer. Soils at this site consist of quaternary alluvial deposits which results in non-uniform layers of sand, gravel, silt and clay beneath the site. Ground water is encountered at a depth of approximately 9 feet and generally flows northward toward Crow Creek with a gradient of approximately .01 ft/ft.

Due to the heterogeneous nature of these soils the permeability of soils to air flow will vary by orders of magnitude across the site. The key to effective bioventing on

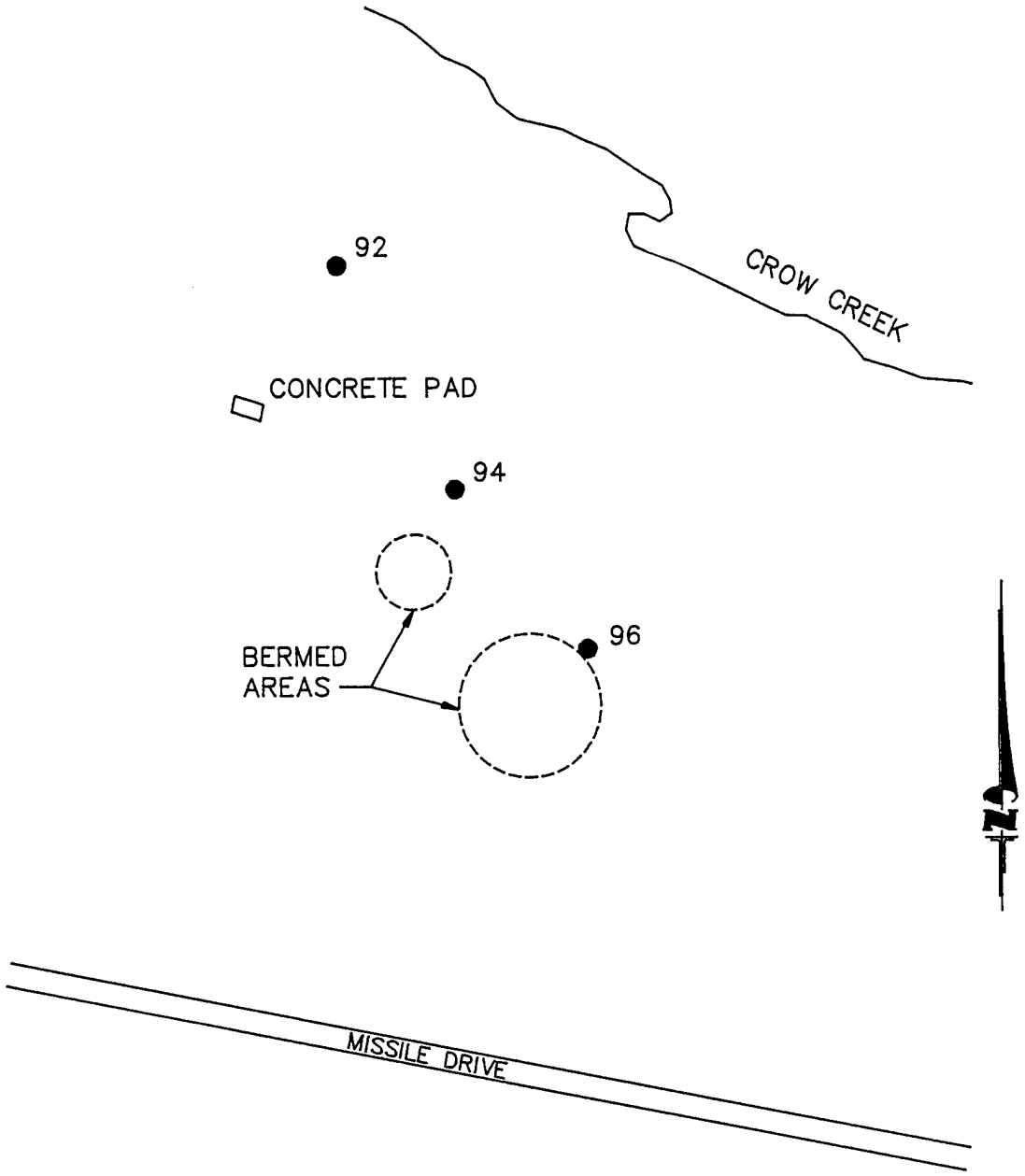


FIGURE 2.1

SITE MAP
FIRE TRAINING PIT 1

F.E. WARREN A.F.B., Wyoming

ENGINEERING–SCIENCE, INC.
Denver, Colorado

ES

26802–02, 05/04/92 at 10:20

this site will be to maintain high levels of oxygen within sand and gravel layers and rely on molecular diffusion to increase oxygen levels within the less permeable clay lenses. Engineering-Science has completed successful bioventing projects within similar alluvial deposits and we are confident that oxygen can be distributed in these soils. Soil vapor monitoring points will be positioned in three locations and at two depths to study the subsurface oxygen distribution pattern during the pilot test.

2.1.3 Site Contaminants

The primary contaminants on this site are fuel residuals which have migrated to a depth of approximately 9 feet where shallow groundwater is encountered. Free product has not been observed in monitoring wells on the site, however, the fact that TPH concentrations as high as 8,800 mg/kg have been detected in the 7 - 9 feet depth interval indicates that free product may have existed during the period of active fire training. Figure 2.2 shows a typical cross-section across the center of the site. Maximum TPH concentrations range from 8,800 mg/kg in the 7-9 feet interval to 8,480 mg/kg in the 0-3 feet interval.

Total benzene, toluene, ethylbenzene and xylenes (BTEX) in the soils were detected at a maximum concentration of 43 mg/kg, however, benzene was not detected. Trichloroethene is the primary chlorinated compound found in site soils with a maximum detection of only 19.9 mg/kg. Due to the short duration of the air permeability and in situ respiration tests at FTP 1, little or no change in contaminant levels will occur.

2.2 Spill Site 1

2.2.1 Site Location and History

Spill site 1 is located at the base service station (Bldg 400) near the main entrance to the base and just 200 feet south of Randall Avenue (Figure 2.3). In 1973, an estimated 2,000 to 2,500 gallons of leaded gasoline leaked into the soil and ground water and spread nearly 400 feet to the east. Other potential sources of contamination at the site were aboveground and below ground waste oil tanks located east of Bldg 400. Several site investigations have been conducted on the site

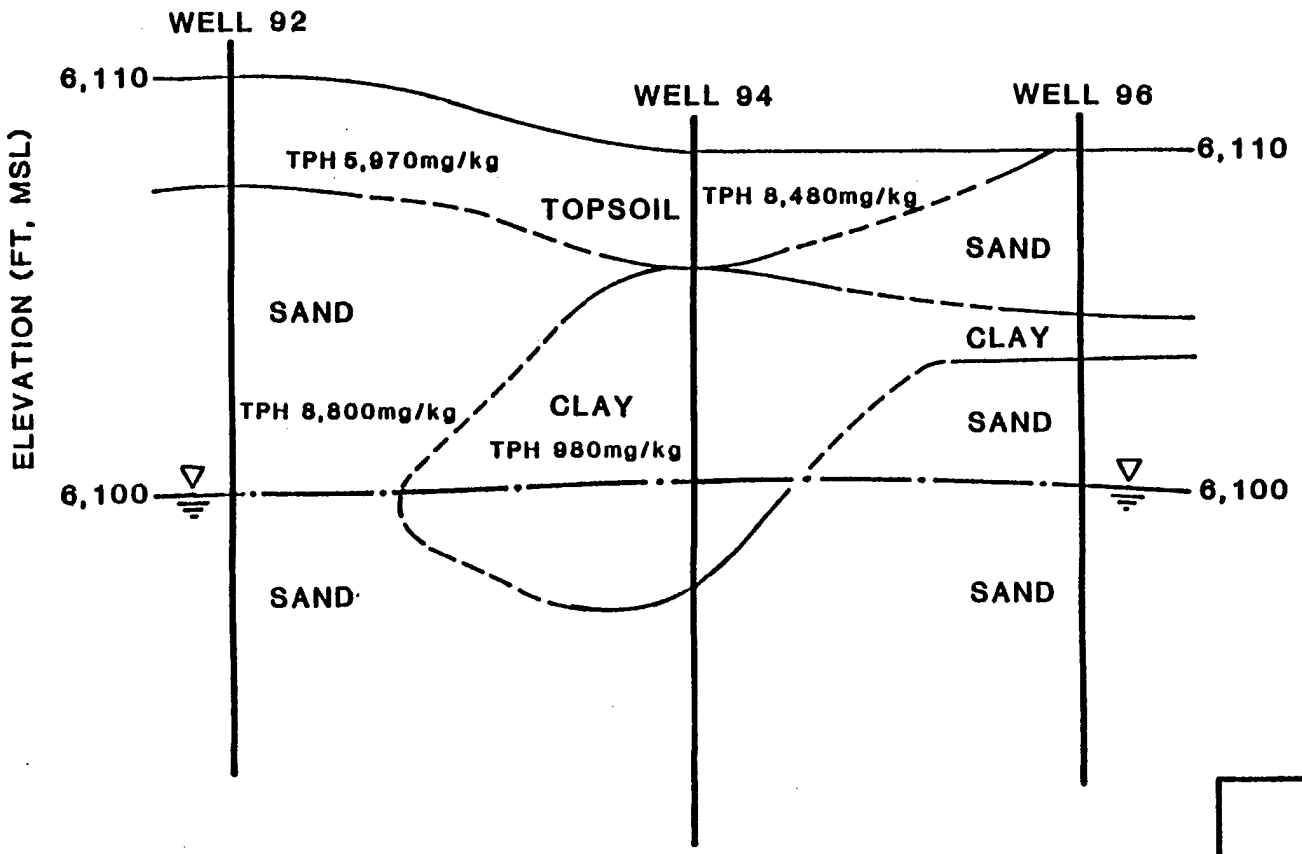


FIGURE 2.2

TYPICAL CROSS-SECTION
FIRE TRAINING PIT

FE WARREN AFB, WY

ENGINEERING–SCIENCE, INC.
Denver, Colorado

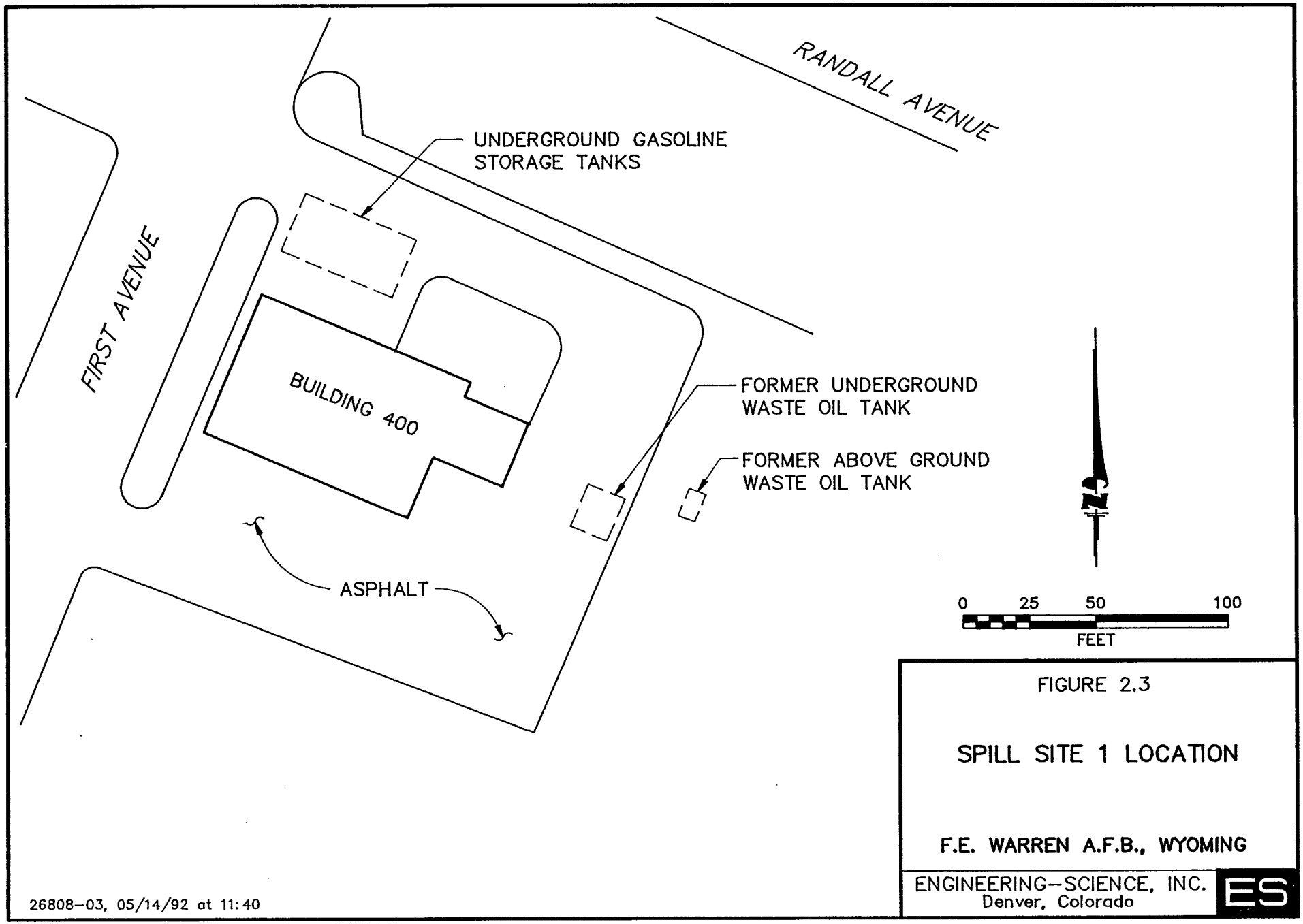


FIGURE 2.3

SPILL SITE 1 LOCATION

F.E. WARREN A.F.B., WYOMING

ENGINEERING–SCIENCE, INC.
Denver, Colorado

ES

26808–03, 05/14/92 at 11:40

since 1985. The most recent remedial investigation was completed by the U. S. Geologic Survey (USGS) in April of 1992. Although the soil sampling results of the latest investigation are not yet available, Engineering-Science has met with USGS geologist who performed the soil sampling and has incorporated his findings in the pilot test plan. As analytical data is received, the location of the test wells may be moved to focus on the most contaminated area of the site.

2.2.2 Site Geology

The geology of spill site 1 is similar to the FTP and consists of the same quaternary alluvial deposits. Groundwater at spill site 1 has been measured from 5 to 12 feet below the surface, however, the most common groundwater depth is approximately 11 feet. The response of site soils to bioventing is expected to be similar to the FTP, however, the greater depth to groundwater will allow for a deeper vent well screen and a greater radius of venting influence.

2.2.3 Site Contaminants

Prior to the recent USGS investigation, soil sampling has been limited to the waste oil tanks area east of Bldg 400. Four of the five boreholes in this area contained TPH concentrations in excess of 100 mg/kg and one boring 20 feet downgradient (southeast) of the former underground waste oil tank contained 1000 mg/kg of TPH and approximately 10 mg/kg BTEX at the 11 feet depth. A thin film of free product oil was also observed by the USGS in this area. Due to the known presence of hydrocarbons in this area, it has been selected as the primary bioventing pilot test site. If the results of the recent USGS sampling indicate that contamination is centered in another area, an alternate test area may be used.

3.0 SITE SPECIFIC ACTIVITIES

The purpose of this section is to describe the proposed location of the central vent well and vapor monitoring points at FTP 1 and Spill Site 1. Soil sampling procedures and the blower configuration that will be used to inject air (oxygen) into contaminated soils are also discussed in this section. No wells will be completed into the groundwater and no dewatering will take place during the pilot tests. Pilot

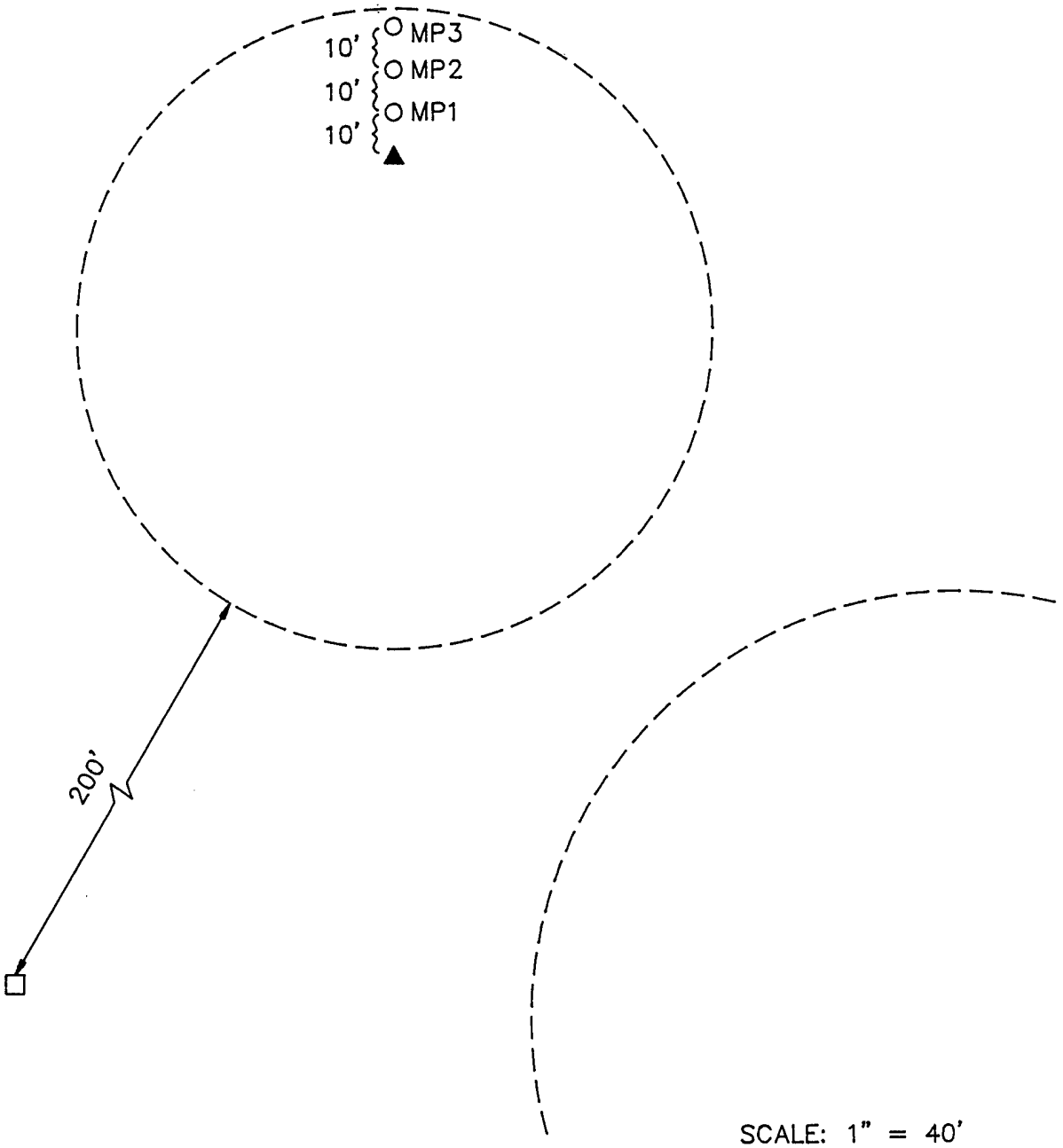
test activities will be confined to unsaturated soils remediation. Existing monitoring wells will not be used as primary air injection or extraction wells. However, monitoring wells which have a portion of their screened interval above the water table may be used as vapor monitoring points or to measure the composition of background soil gas.

3.1 Fire Training Pit 1

A general description of criteria for siting a central venting well and vapor monitoring points are included in the attached protocol. Figure 3.1 illustrates the proposed locations of the central vent well and monitoring points at this site. The final location of these wells may vary slightly from the proposed location if significant fuel contamination is not observed in the boring for the central vent well. Based on site investigation data, the central vent well should be located in a line extending north of the center of the small bermed fire training pit. This area is expected to have an average TPH concentration exceeding 4000 mg/kg. Soils in this area are expected to be oxygen depleted (< 2%) and increased biological activity should be stimulated by oxygen-rich soil gas ventilation during full-scale operations.

Due to the relatively shallow depth of contamination at this site and the potential for low permeability soils, the radius of venting influence around the central air injection well is expected to be only 30 to 40 feet. Three vapor monitoring points will be located within a 30-foot radius of the central vent well. A fourth vapor monitoring point will be located approximately 200 feet south of the site and will be used to measure background levels of oxygen and carbon dioxide and to determine if natural carbon sources are contributing to oxygen uptake during the in situ respiration test. Upgradient monitoring well No. 86 could be used for a background monitoring point if the screened interval extends several feet above the water table. Additional details on the in situ respiration test are found in Section 5.7 of the attached protocol document.

The vent well will be constructed of 4-inch ID Schedule 40 PVC, with a five foot interval of 0.04 slotted screen set at 4 to 9 feet below ground surface. Flush-threaded PVC casing and screen will be used with no organic solvents or glues. The filter pack will be clean, well-rounded silica sand with a 6-9 grain size and will be



SCALE: 1" = 40'

LEGEND

MP3 O MONITORING POINTS

▲ CENTRAL VENT WELL (AIR INJECTION)

□ BACKGROUND MONITORING POINT

FIGURE 3.1

PROPOSED VENT WELL/VAPOR MONITORING POINT LOCATIONS

FIRE TRAINING PIT 1

F.E. WARREN A.F.B., Wyoming

ENGINEERING–SCIENCE, INC.
Denver, Colorado

ES

26802–01, 05/04/92 at 13:00

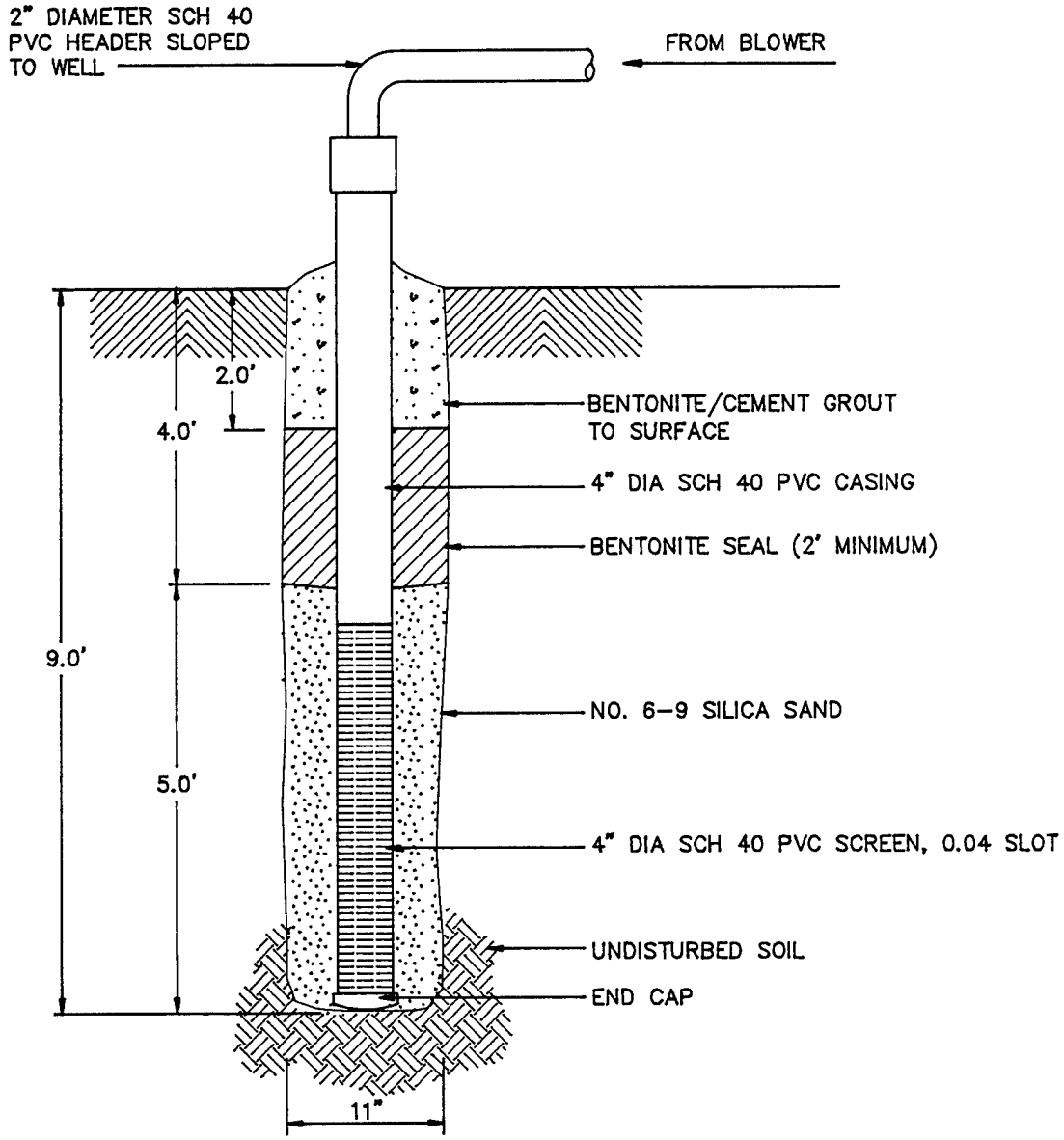
placed in the annular space of the screened interval. A 2-foot layer of bentonite will be placed directly over the filter pack. The first 6 inches of bentonite will consist of bentonite pellets hydrated in place with potable water. This layer of pellets will prevent the addition of bentonite slurry from saturating the filter pack. The remaining 18 inches of bentonite will be fully hydrated and mixed aboveground and the slurry tremied into the annular space to produce an air tight seal above the screened interval. A complete seal is critical to prevent injected air from short-circuiting to the surface during the bioventing test. Figure 3.2 illustrates the proposed central vent well construction for this site.

A typical multi-depth vapor monitoring point installation for this site is shown in Figure 3.3. Soil gas oxygen and carbon dioxide concentrations will be monitored at depth intervals of 3 - 4 feet and 7 - 8 feet at each location. Multi-depth monitoring will confirm that the entire soil profile is receiving oxygen and be used to measure fuel biodegradation rates at both depths. The annular space between these two monitoring points will be sealed with bentonite to isolate the monitoring intervals. As with the central vent well, several inches of bentonite pellets will be used to shield the filter pack from rapid infiltration of bentonite slurry additions. Additional details on vent well and monitoring point construction are found in Section 4 of the protocol document.

3.2 Spill Site 1

Figure 3.4 illustrates the proposed locations of the central vent well and monitoring points at this site. The primary test area has been located just downgradient of the former underground waste oil tank east of Building 400. An alternated area is located north of Building 400 in the vicinity of the gasoline spill which occurred in 1973. If the recent USGS survey indicates that significantly higher TPH levels(> 1000 mg/kg) are located above the capillary fringe in the gasoline spill, the alternate test area will be used. The final location of these wells may vary slightly from the proposed location if significant fuel contamination is not observed in the boring for the central vent well.

Due to the slightly greater depth of contamination at this site, the radius of venting influence around the central air injection well is expected to be 35 to 40 feet. Three



NOT TO SCALE

FIGURE 3.2

FIRE TRAINING PIT 1
INJECTION VENTING WELL
CONSTRUCTION

F.E. WARREN A.F.B., WYOMING

ENGINEERING-SCIENCE, INC.
Denver, Colorado

26802-04, 05/14/92 at 10:49

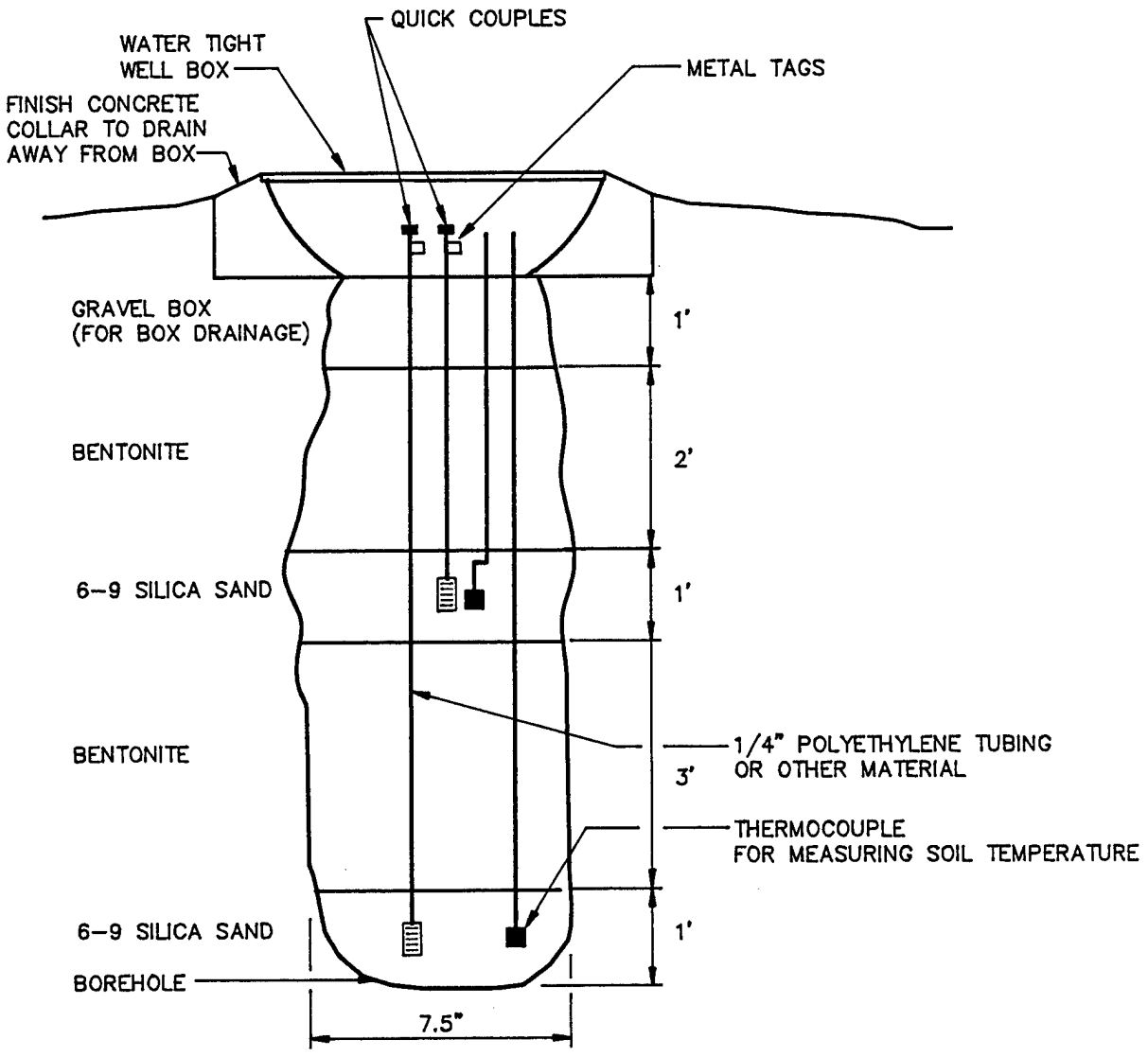


FIGURE 3.3

FIRE TRAINING PIT 1
MONITORING POINT
CONSTRUCTION DETAIL

F.E. WARREN A.F.B., WYOMING

ENGINEERING–SCIENCE, INC.
Denver, Colorado

26802–03, 05/14/92 at 11:18

vapor monitoring points will be located within a 35 feet radius of the central vent well. A fourth vapor monitoring point will be located approximately 200 feet south of the site and will be used to measure background levels of oxygen and carbon dioxide and to determine if natural carbon sources are contributing to oxygen uptake during the in situ respiration test. Additional details on the in situ respiration test are found in Section 5.7 of the attached protocol document.

The vent well will be constructed of 4-inch ID Schedule 40 PVC, with a five foot interval of 0.04 slotted screen set at 6 to 11 feet below ground surface. Flush-threaded PVC casing and screen will be used with no organic solvents or glues. The filter pack will be clean, well-rounded silica sand with a 6-9 grain size and will be placed in the annular space of the screened interval. A 3-foot layer of bentonite will be placed directly over the filter pack. The first 6 inches of bentonite will consist of bentonite pellets hydrated in place with potable water. This layer of pellets will prevent the rapid addition of bentonite slurry from saturating the upper portion of the filter pack. The remaining 30 inches of bentonite will be fully hydrated and mixed aboveground and then tremied into the annular space to produce an air tight seal above the screened interval. A complete seal is critical to prevent injected air from short-circuiting to the surface during the bioventing test. Figure 3.5 illustrates the proposed central vent well construction for this site.

A typical multi-depth vapor monitoring point installation for this site is shown in Figure 3.6. Soil gas oxygen and carbon dioxide concentrations will be monitored at depth intervals of 3-4 feet, 6.5 to 7.5 feet, and 10 to 11 feet at each location. Multi-depth monitoring will confirm that the entire soil profile is receiving oxygen and be used to measure fuel biodegradation rates at both depths. The annular space between these two monitoring points will be sealed with bentonite to isolate the monitoring intervals. As with the central vent well, several inches of bentonite pellets will be used to shield the filter pack from rapid infiltration of bentonite slurry additions. Additional details on vent well and monitoring point construction are found in Section 4 of the protocol document.

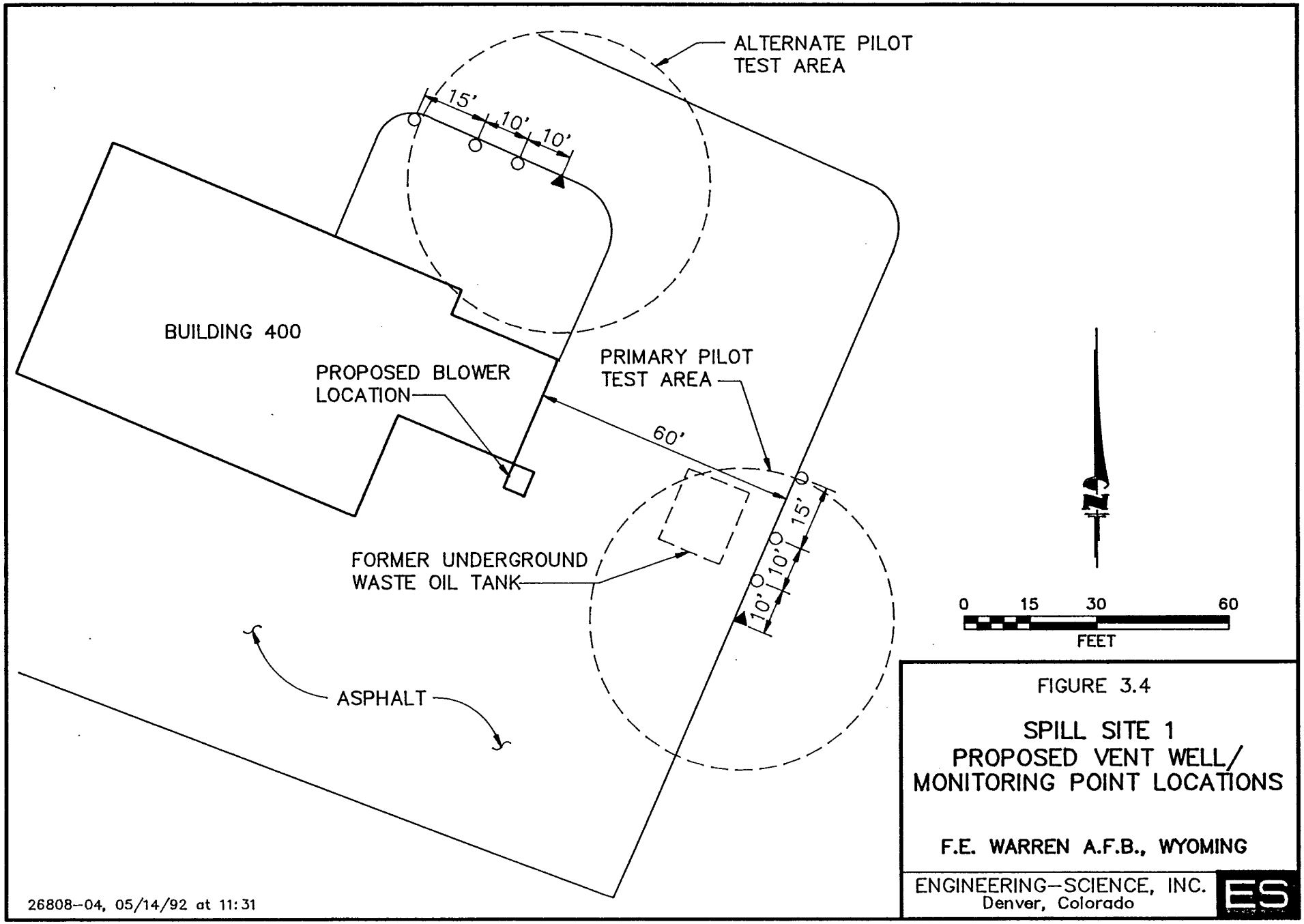
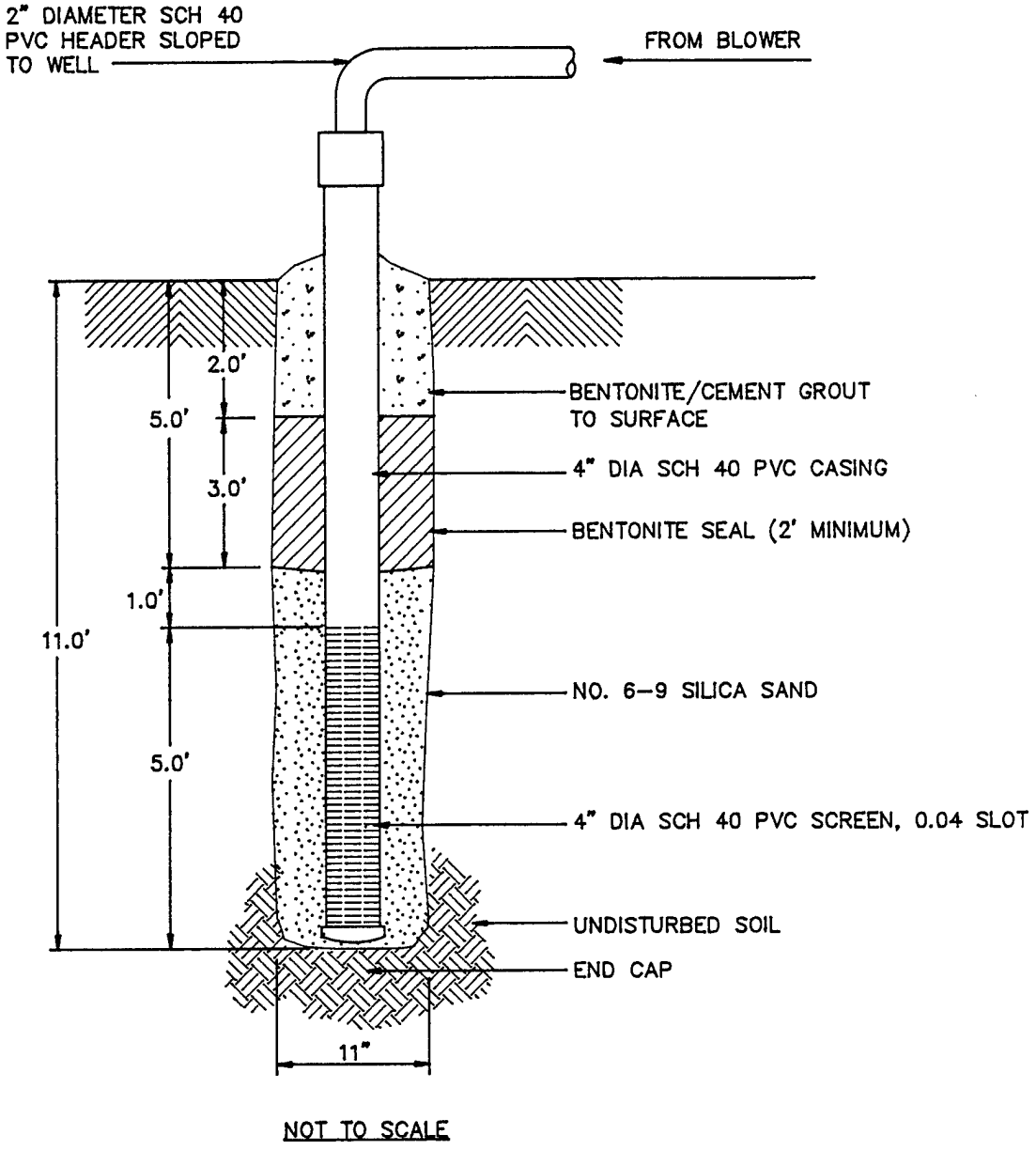


FIGURE 3.4

SPILL SITE 1
PROPOSED VENT WELL/
MONITORING POINT LOCATIONS

F.E. WARREN A.F.B., WYOMING

ENGINEERING-SCIENCE, INC.
Denver, Colorado
ES



NOT TO SCALE

FIGURE 3.5

SPILL SITE 1
INJECTION VENTING WELL
CONSTRUCTION

F.E. WARREN A.F.B., WYOMING

ENGINEERING-SCIENCE, INC.
Denver, Colorado

26808-01, 05/14/92 at 11:00

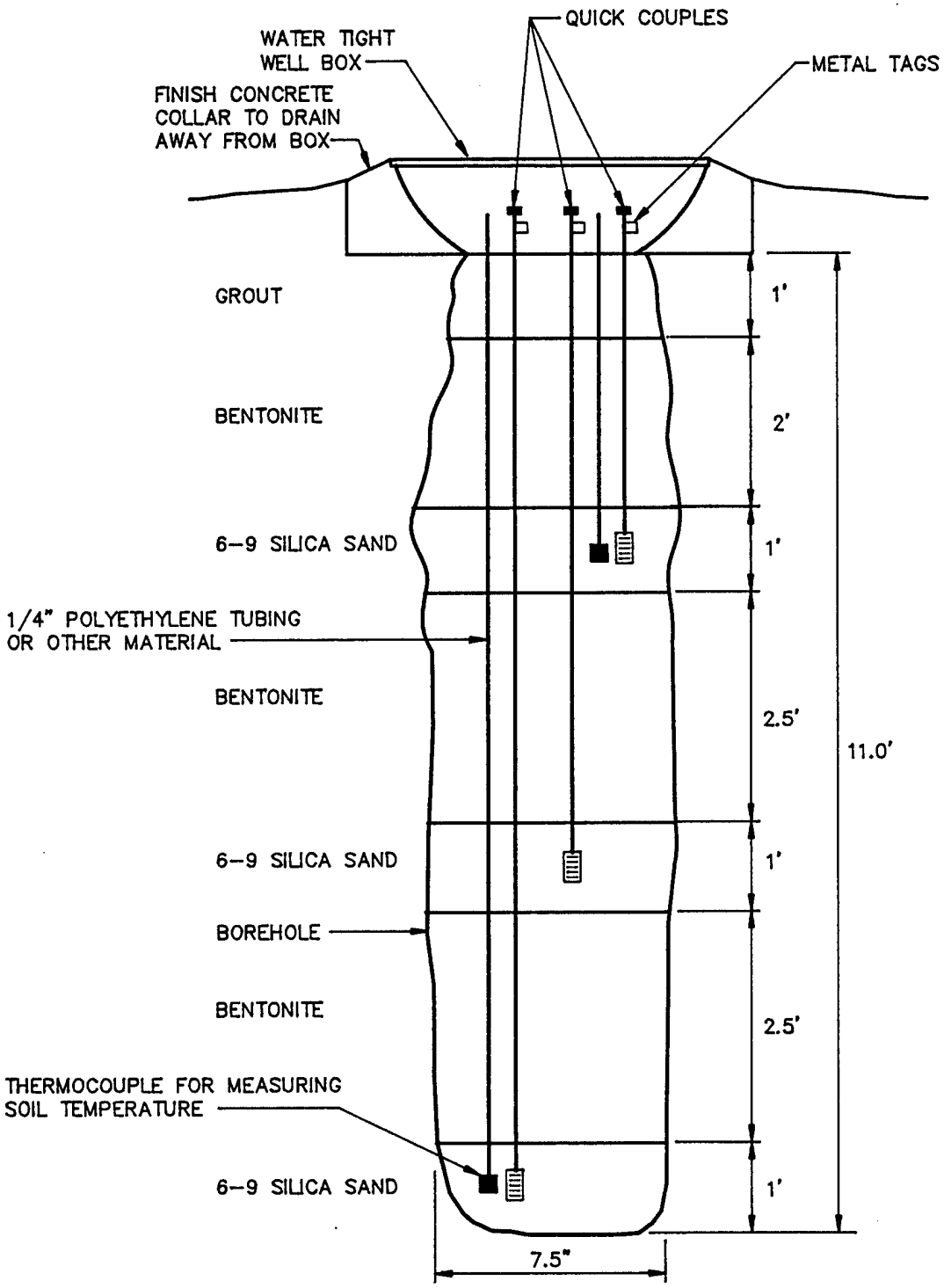


FIGURE 3.6

SPILL SITE 1
MONITORING POINT
CONSTRUCTION DETAIL

F.E. WARREN A.F.B., WYOMING

ENGINEERING-SCIENCE, INC.
Denver, Colorado

26808-02, 05/14/92 at 11:11

3.3 Handling of Drill Cuttings

Drill cuttings from all borings will be collected in a DOT approved container, the containers labelled and then placed in the F.E. Warren AFB hazardous material storage area. These drill cuttings will become the responsibility of F.E. Warren AFB and will be analyzed, handled, and disposed of in accordance with the current procedures for ongoing remedial investigations. This project is expected to generate only one and a half 55 gallon barrels of cuttings per site.

3.4 Soil Sampling

Three soil samples will be collected from the each pilot test area during the installation of the vent well and monitoring points. Sampling procedures will follow those outlined in the approved sampling and analysis plan for F.E. Warren AFB site investigations. One sample will be collected from the most contaminated interval of each central vent well boring, one sample will be collected from the interval of highest apparent contamination in each of the borings for the two inner monitoring points at each site. Soil samples will be analyzed for TPH, BTEX, soil moisture, pH, particle sizing, alkalinity, total iron and nutrients. At Fire Training Area 1, split samples could be provided to the USGS for additional analysis under the remedial investigation program. This is an option available to USGS and the base.

Samples will be collected using a split-spoon sampler containing brass tube liners. A photoionization detector or total hydrocarbon vapor analyzer (see protocol Section 4.5.2) will be used to insure that breathing zone levels of volatiles do not exceed 1 ppmv during drilling and to screen split spoon samples for intervals of high fuel contamination. Soil samples collected in the brass tubes will be immediately trimmed and aluminum foil and a plastic cap placed over the ends. Soil samples will be labelled following the nomenclature specified in the protocol document(Section 5.5), wrapped in plastic, and placed in an ice chest for shipment. A chain of custody form will be filled out and the ice chest shipped to the Engineering Science laboratory in Berkeley, California for analysis. This laboratory has been audited by the U.S. Air Force and meets all quality assurance/quality control and certification requirements for the State of California.

3.5 Blower System

A 3-HP rotary lobe blower capable of injecting 30 scfm at 12 psi will be used to conduct the initial air permeability test at these sites. This blower provides a wide range of flowrates and should develop sufficient pressure to move air through low permeability soils. Air injection will be used to provide oxygen to soil bacteria and to minimize emissions of volatiles to the atmosphere. If initial testing indicates that less pressure is required to supply oxygen throughout the test volume, a smaller blower will be installed for extended testing at Spill Site 1.

At this time, an extended pilot test will not be performed at FTP 1 because the USGS remedial investigation has not been completed. Following the remedial investigation at this site, and if initial pilot testing is positive, an extended bioventing test will be initiated following regulatory approval. Figure 3.7 is a schematic of a typical air injection system that will be used for pilot testing at these sites.

The maximum power requirement anticipated for this pilot test is a 230-Volt, Single-Phase, 30 Amp service. Additional details on power supply requirements are described in Section 5.0, Base Support Requirements.

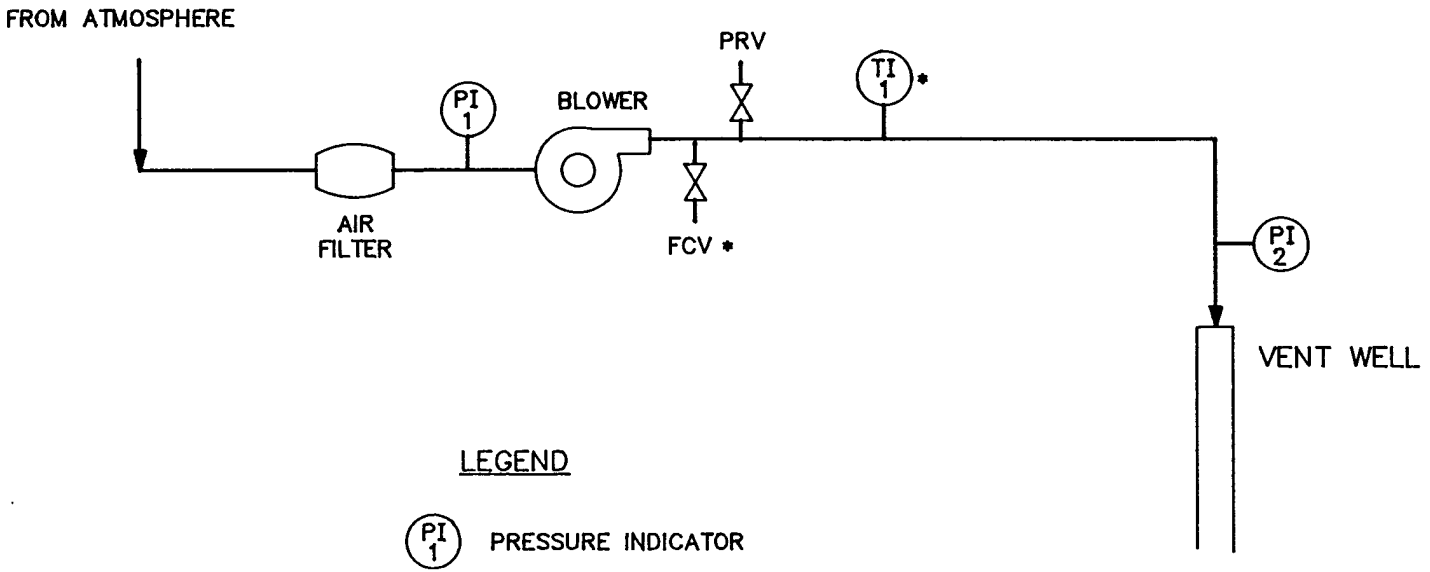
4.0 EXCEPTIONS TO PROTOCOL PROCEDURES

The procedures that will be used to measure the air permeability of the soil and in situ respiration rates are described in Sections 4 and 5 of the attached protocol document. One exceptions to this protocol should be noted. Groundwater levels in monitoring wells in the test areas will be gauged before and during the pilot test to determine the impact of air injection on localized groundwater elevation and flow.

5.0 BASE SUPPORT REQUIREMENTS

5.1 Test Preparation

The following base support is needed prior to the arrival of a driller and the Engineering-Science test team:



LEGEND

PI 1	PRESSURE INDICATOR
TI 1	TEMPERATURE INDICATOR
FCV	FLOW CONTROL VALVE
PRV	PRESSURE RELIEF VALVE
*	OPTIONAL

FIGURE 3.7

BLOWER SYSTEM INSTRUMENTATION DIAGRAM FOR AIR INJECTION

F.E. WARREN A.F.B., WYOMING

ENGINEERING–SCIENCE, INC.
Denver, Colorado

ES

26802–05, 05/14/92 at 11:23

- Name and phone number of base point of contact provided to the Engineering-Science project manager.

- Confirmation of regulatory approval for the pilot test.

- Assistance in obtaining a digging permit at each site.

- A breaker box within 100 feet of the site which can supply 240 Volt, Single-Phase 30 Amp service for the initial and extended pilot test.

- Provide any paperwork required to obtain gate passes and security badges for approximately four Engineering Science employees and two drillers. Vehicle passes will be needed for two trucks and a drill rig.

During the initial three week pilot test the following base support is needed:

- Twelve square feet of desk space and a telephone in a building located as near to the site as practical.

- A decontamination pad where the driller can clean augers between borings.

- Accept responsibility for drill cuttings from vent well and monitoring point borings including any drum sampling to determine hazardous waste status.

- The use of a fax machine for transmitting 15 to 20 pages of test results.

During the one year extended pilot test on Spill Site 1:

- Check the blower system at Spill Site 1 once a week to ensure that it is operating and to record the air injection pressure. Engineering-Science will provide a brief training session on this procedure.

- Notify Mr Doug Downey or Ms Gail Saxton, Engineering-Science Inc Denver (303) 831-8100, or Mr. Jim Williams of the AFCEE, (800) 821-4528, ext 293 if the blower or motor stop working.

- Arrange site access for an Engineering-Science technician to conduct in situ respiration tests approximately six months and one year after the initial pilot test.

6.0 PROJECT SCHEDULE

The following schedule is contingent upon timely approval of this pilot test work plan.

Event	Date
Draft Test Work Plan to AFCEE	5 May 1992
Submit Test Plan for Regulatory Approval	18 May 1992
Regulatory Approval To Proceed	28 May 1992
Begin Pilot Test	8 Jun 1992
Complete Initial Pilot Test	24 Jun 1992
Interim Results Report	9 Jul 1992
Respiration Test (Spill Site 1 Only)	Nov 1992
Final Respiration Test (Spill Site 1 Only)	Jun 1993

For Spill Site 1:

After a period of one year, a decision will be made by AFCEE and the base to either remove the system or to expand the system for full-scale remediation at Spill Site 1.

For FTP 1:

If the results of the pilot test are favorable, a full-scale demonstration system will be installed by the AFCESA contractor in the fall of 1992 following the remedial investigation of the site and with regulatory approval.

7.0 POINTS OF CONTACT

Mr Barry C. Mountain
90 SPTG/DEVR
F.E. Warren AFB, WY 82005-5000
(307) 775 - 4154

Major Ross Miller/Mr. Jim Williams
AFCEE/ESR
Brooks AFB, TX 78235-5000
(800) 821-4528 ext. 282, 293

Mr Doug Downey
Engineering-Science, Inc
1700 Broadway, Suite 900
Denver, CO 80290
(303) 831-8100