LOAN DOCUMENT

PHOTOGRAPH THIS SHEET

DTIC ACCESSION NUMBER

LEVEL

INVENTORY

0

Interim Test Results Rpt. for Hurlburt . . .

DOCUMENT IDENTIFICATION

Aug 94

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

20001121 061

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

DTIC

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/2000

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 3200.12, the requested document is not supplied because:

.....

.....

.....

Print or Type Name Laura Peña

Signature Laura Peña

Telephone 210-536-1431

(For DTIC Use Only)
AQ Number M01-02-0227

Duplicate

INTERIM TEST RESULTS REPORT FOR HURLBURT FIELD FIRE TRAINING AREA (SITE FT-39) EGLIN MAIN OLD FIRE TRAINING AREA (SITE FT-28) EGLIN AFB, FLORIDA

Prepared For

Air Force Center for Environmental Excellence
Brooks AFB, Texas

and

Air Force Materiel Command
Eglin Air Force Base, Florida

Prepared By

ENGINEERING-SCIENCE, INC.
57 Executive Park South, N.E
Suite 500
Atlanta, Georgia 30329

August 1994

TABLE OF CONTENTS

TABLE OF CONTENTS
(CONTINUED)

LIST OF FIGURES

LIST OF TABLES

INTERIM TEST RESULTS REPORTS FOR HURLBURT FIELD FIRE TRAINING AREA (FT-39) EGLIN MAIN OLD FIRE TRAINING AREA (FT-28) EGLIN AFB, FLORIDA

An initial bioventing pilot test was performed at the Hurlburt Field Fire Training Area (FT-39) and the Eglin Main Old Fire Training Area (FT-28), Eglin AFB, Florida during the period of March 14, 1994 to March 24, 1994. The purpose of this Part II Report is to describe the results of the initial pilot tests and to make specific recommendations for extended testing to determine the long-term performance of bioventing in remediating site contaminants. Descriptions of the history, geology, and site contaminants are contained in the Test Work Plan (ES, 1993).

1.0 PILOT TEST ACTIVITIES

1.1 Hurlburt Field Fire Training Area (FT-39)

1.1.1 Pilot Test Design and Construction

In accordance with the Test Work Plan, one vertical air injection vent well (VW) and three multiple-depth soil vapor monitoring points (MPs) were installed the week of February 28, 1994. A 1.0-horsepower regenerative blower was installed at the VW to provide the necessary air for bioventing. Figure 1.1 depicts the locations of the VW, MPs, and blower at the FT-39 site. Figure 1.2 depicts the vertical hydrogeological cross section around FT-39. The following sections describe in more detail the final design and installation of the bioventing system.

1.1.2 Vent Well Construction

The VW was installed on March 1, 1994 in an area of documented high TPH contamination. The VW was constructed of 4-inch diameter Schedule 40 PVC with a slot size of 0.04 inches. The total depth of the VW was 8.0 feet below ground surface (bgs), with a screened interval from 8.0 to 3.0 feet bgs. The annular space between the well casing and the borehole was filled with 6-9 silica sand from the bottom of the boring to approximately 2.5 feet bgs. Granular bentonite was placed above the sand pack from 2.5 feet bgs to 1.5 feet bgs and hydrated in place with potable water. The VW was finished with 0.5 foot layer of sand upon which a 12-inch flushmount protective well cover was cemented in place with approximately 1 foot of cement/bentonite grout. A detail of the VW construction is presented on Figure 1.3.

1.1.3 Soil Vapor Monitoring Points

Three soil MPs were installed at 10, 20 and 40 feet radially away from the air injection vent well. Each MP was constructed to provide multiple depth soil gas

monitoring with two discrete sample points at 3.5 to 4 feet and 5.5 to 6 feet bgs. A small variation to this sampling interval was made at the outermost MP because of changes in elevation. Each discrete point was constructed of a six-inch long piece of 1/2-inch diameter Schedule 40 PVC well screen with 0.02 slot size. The riser of each discrete point was constructed of 1/2-inch Schedule 80 PVC, which extended to approximately six inches bgs.

Clean 6-9 silica sand was placed around each discrete point to provide a filter pack between the borehole wall and the point. Granular bentonite was placed both below and above each discrete point to provide an air tight seal between the points. The bentonite was placed in 12-inch lifts and hydrated in place to assure the proper seal. The top of each discrete point riser was fitted with a 1/4-inch quarter turn ball valve and 3/16-inch hose barb to allow for connection of appropriate monitoring instruments.

Additionally, Type K thermocouples with mini connectors were installed at the 4 feet and 6 feet bgs discrete monitoring points in the MP closest to the VW (MPA). These thermocouples will be used to measure the temperature profile at the site. The top of each MP was completed with a 12-inch flush mounted protective well cover set in a concrete base. Figure 1.4 shows the construction of the soil vapor monitoring points.

1.1.4 Blower Unit Installation

A one-horsepower GAST® regenerative blower unit was installed at FT-39 for the initial and extended pilot tests. The blower was installed in a weather resistant enclosure and electrically wired for permanent 240-volt, 30-amp service. Air from the blower is injected into the vent well via a two inch PVC line connected to the blower's exhaust port. A diagram of the blower unit and installation is presented on Figure 1.5.

1.2 Eglin Main Old Fire Training Area (FT-28)

1.2.1 Pilot Test Design and Construction

In accordance with the Test Work Plan, one vertical VW and three multiple-depth MPs were installed the week of February 28, 1994. A one-horsepower regenerative blower was installed at the VW to provide the necessary air for bioventing. Figure 1.6 depicts the locations of the VW, MPs and blower at the FT-28 site. Figure 1.7 depicts the vertical hydrogeological cross section around FT-28. The following sections describe in more detail the final design and installation of the bioventing system.

1.2.2 Vent Well Construction

The VW was installed on March 1, 1994 in an area of documented high TPH contamination. The VW was constructed of 4-inch diameter Schedule 40 PVC with a slot size of 0.04 inches. The total depth of the VW was 40 feet below ground surface (bgs), with a screened interval from 5 to 40 feet bgs. The annular space between the well casing and the borehole was filled with 6-9 silica sand from the bottom of the boring to approximately four feet bgs. Bentonite chips were then placed above the sand pack in one foot lifts to a depth of two feet bgs. Each lift of bentonite chips was hydrated in place with potable water. A 1.0 foot layer of sand was placed above the bentonite. The VW was finished with a one foot layer of cement/bentonite grout above the sand and

around a 12-inch flushmount protective well cover. The well cover was cemented in place with the cement/bentonite grout. A detail of the VW construction is presented on Figure 1.8.

1.2.3 Soil Vapor Monitoring Points

Three MPs were installed at 10, 20 and 40 feet radially away from the air injection vent well. Each MP was constructed to provide multiple depth soil gas monitoring with three discrete sample points at 4.5 to 5, 25.5 to 26 and 38.5 to 39 feet bgs. Each discrete point was constructed of a six-inch long piece of 1/4-inch diameter Schedule 40 PVC well screen with 0.02 slot size. The riser of each discrete point was constructed of 1/2-inch Schedule 80 PVC, which extended to approximately six inches bgs.

Clean 6-9 silica sand was placed around each discrete point to provide a filter pack between the borehole wall and the point. Granular bentonite was placed both below and above each discrete point to provide an air tight seal between the points. The bentonite was placed in 12-inch lifts and hydrated in place to assure the proper seal. The top of each discrete point riser was fitted with a 1/4-inch quarter turn ball valve and 3/16-inch hose barb to allow for connection of appropriate monitoring instruments.

Additionally, Type K thermocouples with mini connectors were installed at the 39 feet and 5 feet bgs discrete monitoring points in the MP closest to the VW (MPA). These thermocouples will be used to measure the temperature profile at the site. The top of each MP was completed with a 12-inch flush mounted protective well cover set in a concrete base. Figure 1.9 shows the construction of the soil vapor monitoring points.

1.2.4 Blower Unit Installation

A 1.0-horsepower GAST® regenerative blower unit was installed at FT-28 for the initial and extended pilot tests. The blower was installed in a weather resistant enclosure and electrically wired for permanent 240-volt, 30-amp service. Air from the blower is injected into the vent well via a two inch PVC line connected to the blower's exhaust port. A diagram of the blower unit and installation is presented on Figure 1.5.

Prior to departing the site, the ES engineer provided an operations and maintenance briefing, O&M checklist, and blower maintenance manual to the base point of contact.

2.0 PILOT TEST SOIL AND SOIL GAS SAMPLING RESULTS

2.1 Hurlburt Field Fire Training Area (FT-39)

2.1.1 Soil and Soil Gas Sampling Results

Soils at the FT-39 site consist of fine to medium brown sands. This soil profile was consistent throughout the unsaturated zone and to approximately five feet below the groundwater surface which was encountered at approximately 8 feet bgs.

Hydrocarbon contamination at the site appears to extend from the ground surface to the groundwater table. Contaminated soils collected by split spoons during the VW and MP installations were identified based on visual appearance, odor and photoionization detector (PID) screening. Varying degrees of hydrocarbon staining were encountered

throughout the vertical profile in the unsaturated soil zone, and light to strong hydrocarbon odors were noticed in nearly all the split spoon samples. PID readings of greater than 20,000 ppm were measured in a number of soil samples.

Soil samples for laboratory analysis were collected in brass liners inserted into stainless steel split spoons during the VW and MP installations. Procedures for soil sample collection specified in the Protocol Document (Hinchee, et. al., 1992) were followed for all sample collections. Samples were collected from the 6 to 8 feet interval from the VW, from the 3 to 5 feet interval in MPA, and from the 5 to 7 feet interval in MPB. All split spoon samples were screened for VOCs by use of the PID to determine the presence of hydrocarbon contamination and to select samples for laboratory analysis.

Soil gas samples were collected prior to performing the air permeability test in laboratory provided, evacuated Summa® canisters. Soil gas samples were collected from the VW, the 3.5 to 4 feet bgs discrete monitoring point at MPA, and from the 3.5 to 4 feet bgs discrete monitoring point in MPC. All soil gas samples were collected following procedures in the Protocol Document.

The soil samples for laboratory analysis were placed on ice and shipped via Federal Express® to the PACE Inc., Laboratory in Huntington Beach, CA. Each soil sample was analyzed for total recoverable petroleum hydrocarbons (TRPH); benzene, toluene, ethylbenzene, and total xylenes (BTEX); iron; alkalinity; total Kjeldahl nitrogen (TKN); pH; phosphates; percent moisture; and grain size distribution. Soil gas samples were placed in a shipping box (without ice), and shipped via Federal Express® to Air Toxics, Inc., in Folsom, CA for total volatile hydrocarbon (TVH) and BTEX analysis. The analytical results for these soil and soil gas samples are presented in Table 2.1.

2.1.2 Exceptions to Test Protocol Document Procedures

There were no exceptions to the Test Protocol Document procedures.

2.1.3 Field QA/QC Results

Field quality assurance/quality control (QA/QC) samples were not collected or required at this site because the ten percent collection requirement for QA/QC duplicate samples has been met at other AFCEE bioventing test sites.

2.2 Eglin Main Old Fire Training Area (FT-28)

2.2.1 Soil and Soil Gas Sampling Results

Soils at the FT-28 site consist mainly of medium to coarse tan and dark yellowish brown to reddish brown sand. This soil profile included poorly to well graded sand with trace silt and trace gravel intermittently throughout the unsaturated zone to approximately 39 feet where groundwater was encountered.

Hydrocarbon contamination at the site appears to extend from the ground surface to the groundwater table. However, at depths between 15 to 30 feet evidence of contamination was minimal. Contaminated soils collected by split spoons during the VW and MP installations were identified based on visual appearance, odor and PID screening.

Varying degrees of hydrocarbon staining were encountered throughout the vertical profile in the unsaturated soil zone, and light to strong hydrocarbon odors were noticed in nearly all the split spoon samples. PID readings of greater than 20,000 ppm were measured in a number of soil samples.

Soil samples for laboratory analysis were collected in brass liners inserted into stainless steel split spoons during the VW and MP installations. Procedures for soil sample collection specified in the Protocol Document (Hinchee, et. al., 1992) were followed for all sample collections. Samples were collected from the 3 to 5 feet interval from the VW, from the 37 to 39 feet interval in MPA, and from the 2 to 4 feet interval in MPB. All split spoon samples were screened for VOCs by use of the PID to determine the presence of hydrocarbon contamination and to select samples for laboratory analysis.

Soil gas samples were collected prior to performing the air permeability test. These samples were collected in laboratory provided, evacuated Summa® canisters. Soil gas samples were collected from the VW, the 4.5 to 5 feet bgs discrete monitoring point at MPA, and from the 38.5 to 39 feet bgs discrete monitoring point in MPC. All soil gas samples were collected following procedures in the Protocol Document.

The soil samples for laboratory analysis were placed on ice and shipped via Federal Express® to the PACE Inc., Laboratory in Huntington Beach, CA. Each soil sample was analyzed for TRPH; BTEX; iron; alkalinity; TKN; pH; phosphates; percent moisture; and grain size distribution. Soil gas samples were placed in a shipping box (without ice), and shipped via Federal Express® to Air Toxics, Inc., in Folsom, CA for TVH and BTEX analysis. The results of the soils and soil gas samples are presented in Table 2.2.

2.2.2 Exceptions to Test Protocol Document Procedures

No exceptions to the Test Protocol Document procedures were conducted during the initial pilot test at FT-28.

2.2.3 Field QA/QC Results

Field quality assurance/quality control (QA/QC) samples included collection and analysis of duplicate samples for the media sampled. Consistent with requirements of the protocol the number of QA/QC samples was ten percent of the total number of samples collected for each medium. The results of the QA/QC samples are included in Appendices A, B and C.

3.0 PILOT TEST RESULTS

3.1 Hurlburt Field Fire Training Area (FT-39)

3.1.1 Initial Soil Gas Chemistry

Prior to initiating any air injection, soil gas in the VW and all MPs were sampled for TVH, oxygen, and carbon dioxide. The VW and MPs were purged to remove stale soil gas prior to monitoring. Soil gas monitoring was accomplished using portable gas analyzers as described in the Protocol Document. The results of the initial monitoring is presented in Table 3.1.

As shown in Table 3.1, the VW and all MPs, with the exception of MPs at two shallow locations (MPA-3.5-4.0 and MPB-3.5-4.0), had completely depleted oxygen levels (0.0%), high carbon dioxide readings (greater than 7%), and TVH readings ranging from 16,000 parts per million (ppm) to greater than 20,000 ppm. These readings suggest that the indigenous microorganisms have completely depleted the naturally available oxygen supply, indicating significant biological activity. In contrast, the background monitoring point (EAFB2-1) indicated a high concentration of oxygen (approximately 13% oxygen) in the soil gas and less than 6% carbon dioxide. These measurements represent the subsurface condition at a depth of about 6 to 8 feet bgs (screen interval estimated above the water table in well EAFB2-1). TVH reading was estimated at 220 ppm.

3.1.2 Air Permeability

An air permeability test was conducted according to the Protocol Document procedures on 18 March 1994. Air was injected into the VW for three hours at a rate of approximately 13 cubic feet per minute (cfm) and an average pressure of 40 inches of water. Steady-state pressure levels were achieved at all MPs in approximately 170 minutes. Table 3.2 provides the maximum steady-state pressures at each discrete monitoring point.

Due to the gradual response and relatively lengthy time to achieve steady-state conditions, the dynamic method of determining soil permeability was selected (Hinchee et al., 1992). Using the HyperVentilate® model, an air permeability value ranging from 14 to 150 darcys was calculated for this site. The air permeability, calculated using the steady-state method, was 6.8 darcys. The radius of pressure influence is estimated to exceed 60 feet for this site as presented in the models in Appendix D (note that pressure influence was observed at MPs located at 40 feet from the vent well at this site).

3.1.3 Oxygen Influence

The depth and radius of oxygen influence in the subsurface resulting from air injection into the central VW is the primary design parameter for bioventing systems. Optimization of full-scale and multiple VW systems requires pilot testing to determine the volume of soil that can be oxygenated at a given flow rate and vent well screen configuration.

Table 3.3 presents the change in soil gas oxygen levels that occurred after approximately three days of continuous air injection. This period of air injection, at approximately 7 cfm (average), produced an increase in soil gas oxygen concentrations at least 40 feet from the VW. Based on the oxygen increase and the pressure response at the furthest monitoring point (MPC), the long-term radius of oxygen influence will exceed 40 feet when air is injected at a rate of approximately 7 cfm.

3.1.4 In-Situ Respiration Rates

In-situ respiration tests were performed at the following monitoring points and depths: MPA (5.5 to 6 feet bgs), MPB (5.5 to 6 feet bgs), and MPC (3.0 to 3.5 feet bgs). These points were chosen based on their low oxygen readings (0.0%), high carbon dioxide readings (greater than 7%), and high TVH readings (greater than 20,000 ppm).

A 2-4 percent helium in air mixture was injected into each of the three discrete monitoring points for 17 hours during the initial part of the in-situ respiration test. Oxygen, carbon dioxide, and TVH concentrations were then measured in the soil gas at each discrete monitoring point. These readings were collected for approximately 72 hours following cessation of the helium/air injection period. The measured oxygen losses were then used to calculate biological oxygen utilization rates. The results of the in-situ respiration testing for the MPs are presented in Figures 3.1 through 3.3. Table 3.4 provides a summary of the oxygen utilization rates.

Because helium is a conservative, inert gas, the change in helium concentration over time can be useful in determining the effectiveness of the bentonite seals between each discrete monitoring point in the MPs. Figures 3.1 through 3.3 compare oxygen utilization and helium retention. Helium recovery was erratic and no conclusions regarding leakage or diffusion can be drawn from these data.

Oxygen loss was linear at every interval during the respiration test. Oxygen utilization rates observed at FT-39 were very consistent and ranged from 0.0026 to 0.0034% per minute (Table 3.4). Initial respiration test data is presented in Table 3.5.

At FT-39, an estimated 1,100 milligrams (mg) of fuel per kilogram of soil can be degraded each year. This value is the average of the fuel consumption rates calculated for every point at which a respiration test was conducted. The interval-specific fuel consumption rates were calculated using observed oxygen utilization rates, estimated air-filled porosites, and a conservative ratio of 3.5 mg of oxygen consumed for every 1 mg of fuel biodegraded. The air-filled porosity calculated for each sampling point ranged from 0.17 to 0.18 liters of air per kilogram of soil.

3.1.5 Potential Air Emissions

The long-term potential for air emissions from full-scale bioventing operations at FT-39 are considered to be low because of the age and type of the site contaminants (greater than five years, and primarily JP4 jet fuel). Additionally, health and safety monitoring conducted during the permeability test using a PID sensitive to 1 ppm barely exceeded background levels. Because the potential for air emissions is highest during the initial air injection period, and very little emissions were detected, the long-term emission potential is considered low. Finally, the site is very isolated at the Hurlburt field, and is several hundred feet from any permanently occupied building.

3.2 Eglin Main Old Fire Training Area (FT-28)

3.2.1 Initial Soil Gas Chemistry

Prior to initiating any air injection, soil gas in the VW and all MPs were sampled for TVH, oxygen, and carbon dioxide. The VW and MPs were purged to remove stale soil gas prior to monitoring. Soil gas monitoring was accomplished using portable gas analyzers as described in the Protocol Document. The results of the initial monitoring is presented in Table 3.6.

As shown in Table 3.6, the VW and all MPs had completely depleted oxygen levels (0.0%), high carbon dioxide readings (greater than 10%), and TVH readings exceeding

20,000 ppm. These readings suggest that the indigenous microorganisms have completely depleted the naturally available oxygen supply, indicating significant biological activity. In contrast, the background monitoring point (EAFB1-1) indicated near atmospheric conditions in the soil gas (i.e. greater than 20% oxygen and less than 0.5% carbon dioxide) to a depth of at least 35 feet bgs.

3.2.2 Air Permeability

An air permeability test was conducted according to the Protocol Document procedures on 23 March 1994. Air was injected into the VW for two and one-half hours at a rate of approximately 92 cubic feet per minute (cfm) and an average pressure of four inches of water. Steady-state pressure levels were achieved at all MPs in less than approximately 150 minutes. Table 3.7 provides the maximum steady-state pressures at each discrete monitoring point.

Due to the gradual response and relatively lengthy time to achieve steady-state conditions, the dynamic method of determining soil permeability was selected (Hinchee et al., 1992). Using the HyperVentilate® model, an air permeability value ranging from 77 to 305 darcys was calculated for this site. The air permeability, calculated using the steady-state method, was 70.4 darcys. The radius of pressure influence is estimated to exceed 60 feet for this site as presented in the models in Appendix D (note that pressure influence was observed at MPs located at 40 feet from the vent well at this site).

3.2.3 Oxygen Influence

The depth and radius of oxygen influence in the subsurface resulting from air injection into the central VW is the primary design parameter for bioventing systems. Optimization of full-scale and multiple VW systems requires pilot testing to determine the volume of soil that can be oxygenated at a given flow rate and vent well screen configuration.

Table 3.8 presents the change in soil gas oxygen levels that occurred after 17 hours of continuous air injection. This period of air injection, at approximately 92 cfm, produced an increase in soil gas oxygen concentrations at least 40 feet from the VW. Based on the oxygen increase and the pressure response at the furthest monitoring point (MPC), the long-term radius of oxygen influence will exceed 40 feet when air is injected at a rate of approximately 92 cfm.

3.2.4 In-Situ Respiration Rates

In-situ respiration tests were performed at the following monitoring points and depths: MPA (4.5 to 5 feet bgs), MPB (25.5 to 26 feet bgs), and MPC (38.5 to 39 feet bgs). These points were chosen based on their low oxygen readings (0.0%), high carbon dioxide readings (greater than 10%), and high TVH readings (greater than 20,000 ppm). A 2-4 percent helium in air mixture was injected into each of the three discrete monitoring points of MPA for 27 hours during the initial part of the in-situ respiration test. Oxygen, carbon dioxide, and TVH concentrations were then measured in the soil gas at each discrete monitoring point. These readings were collected for approximately 74 hours following cessation of the helium/air injection period. The measured oxygen losses were then used to calculate biological oxygen utilization rates. The results of the

in-situ respiration testing for the points are presented in Figures 3.4 through 3.6. Table 3.9 provides a summary of the oxygen utilization rates.

Because helium is a conservative, inert gas, the change in helium concentration over time can be useful in determining the effectiveness of the bentonite seals between each discrete monitoring point in the MPs. Figures 3.4 through 3.6 compare oxygen utilization and helium retention. Helium recovery was erratic and no conclusions regarding leakage or diffusion can be drawn from these data.

Oxygen loss was linear at every interval during the respiration test. Oxygen utilization rates observed at FT-28 were very consistent and ranged from 0.001 to 0.004% per min (Table 3.9). Initial respiration test data is presented in Table 3.10.

At FT-28, an estimated 860 mg of fuel per kilogram of soil can be degraded each year. This value is the average of the fuel consumption rates calculated for every point at which a respiration test was conducted. The interval-specific fuel consumption rates were calculated using observed oxygen utilization rates, estimated air-filled porosites, and a conservative ratio of 3.5 mg of oxygen consumed for every 1 mg of fuel biodegraded. The air-filled porosity calculated for each sampling point ranged from 0.09 to 0.17 liters of air per kilogram of soil.

3.2.5 Potential Air Emissions

The long-term potential for air emissions from full-scale bioventing operations at FT-28 are considered to be low because of the age and type of the site contaminants (greater than ten years, and primarily JP4 jet fuel). The site history and contaminants at FT-39 are very similar to FT-28. Health and safety monitoring conducted during the permeability test using a PID sensitive to 1 ppm did not detect any hydrocarbons above background levels in the breathing zone or at the ground surface. Because the potential for air emissions is highest during the initial air injection period, and no emissions were detected, the long-term emission potential is considered low. The site is very isolated on Eglin AFB, and is several thousand feet from any permanently occupied building.

4.0 RECOMMENDATIONS

Initial bioventing test at FT-39 and FT-28 indicate that naturally occurring oxygen has been depleted in the contaminated soils, and that air injection will be an effective method of increasing aerobic fuel biodegradation. AFCEE has recommended that air injection begin at both sites to determine the long-term radius of oxygen influence and the effects of time, available nutrients and changing temperatures on fuel biodegradation rates.

A one horsepower regenerative blower has been installed at FT-39 and at FT-28 to inject air at a rate of up to 8 cfm at FT-39 and 88 cfm at FT-28. This size blower was installed to allow for expansion of the bioventing system to include multiple air injection vent wells to impact an even larger area if necessary in the future. Extended (one-year) testing began at Hurlburt Field Site FT-39 on March 20, 1994. Due to a delay in power installation the extended test at Eglin Site FT-28 did not begin until July 6, 1994. ES will return to the base at six months and one year to analyze the soil gas and conduct

follow-up in-situ respiration tests. Additionally, at the one year point, ES will collect soil samples from both sites to determine the soil contamination levels after one year of in-situ treatment.

Based on the results of the first year of pilot-scale bioventing, AFCEE will recommend one of three options for these sites:

1. Upgrade, if necessary, and continue operation of the bioventing systems.
2. If the one year soil samples indicate that significant contamination removal has occurred, AFCEE may recommend additional soil sampling to confirm that the cleanup criteria has been achieved.
3. If significant difficulties or poor results are encountered during the bioventing pilot test, AFCEE may recommend removal of the blower system and proper abandonment of the VW and MPs.

5.0 REFERENCES

Engineering-Science, Inc. 1993. *Draft Bioventing Test Work Plan for A-20 Radar (SS-01) Hurlburt Field Fire Training Area (Site FT-39), Eglin Main Old Fire Training Area (FT-28). December.*

Hinchee, R.E., Ong, S.K., Miller, R.N., Downey, D.C., Frandt, R. 1992. *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing.* Columbus, Ohio. January.

G/DE268-3/CD/DSS/1093

SITE LAYOUT MAP
HURLBURT FIELD FTA - (FT-39)
EGLIN AFB, FLORIDA

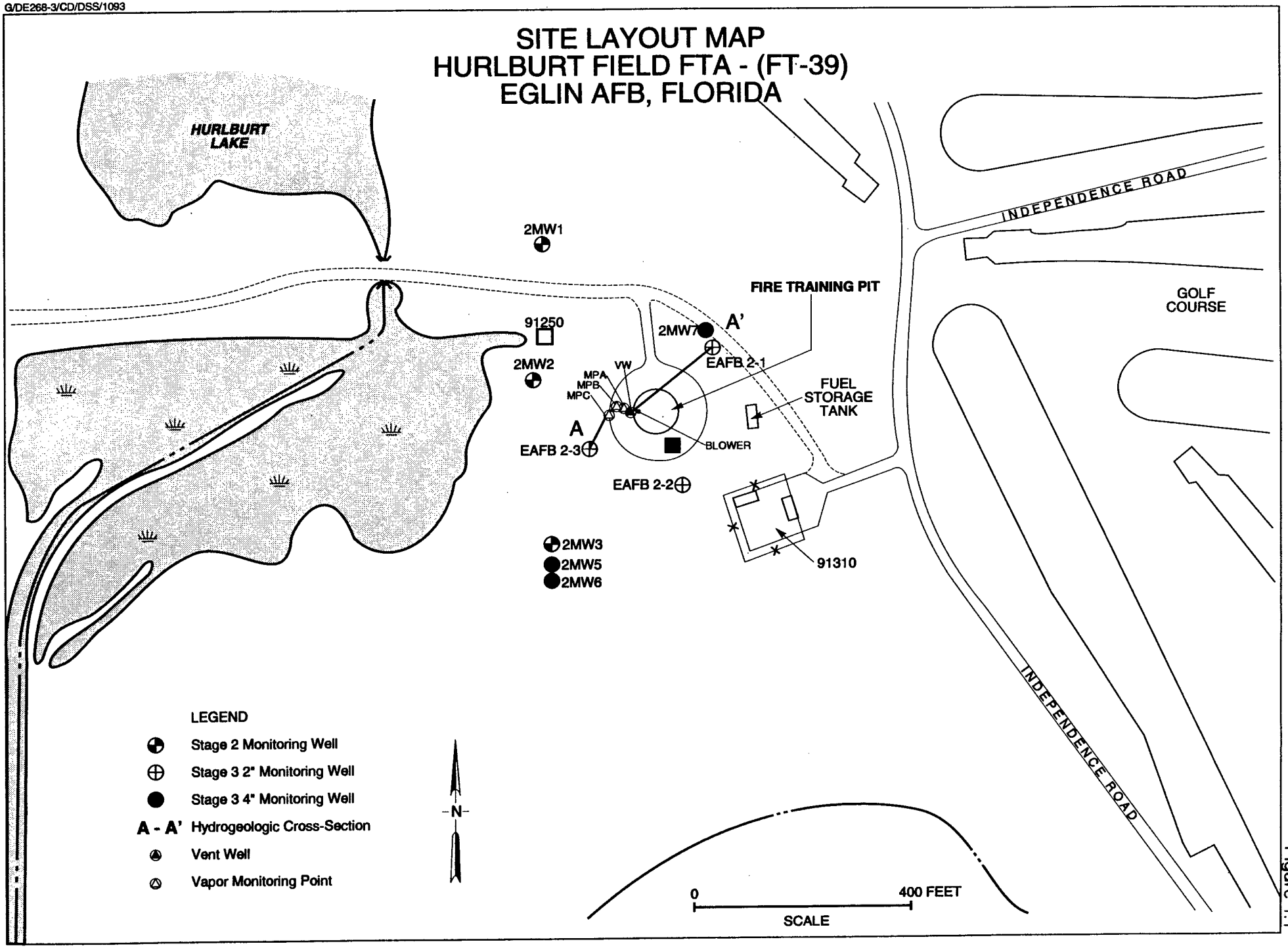
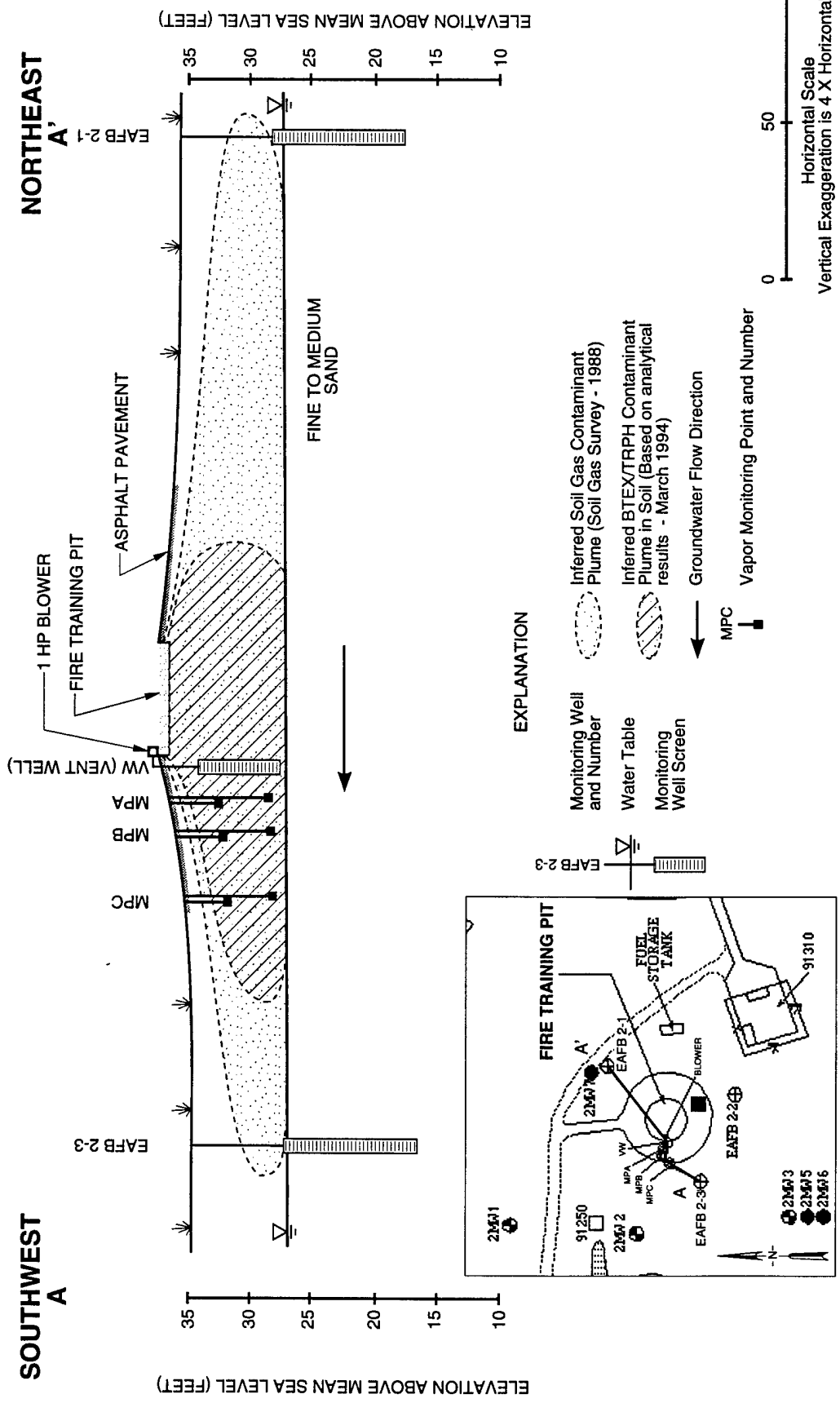


Figure 1.1

ES ENGINEERING-SCIENCE

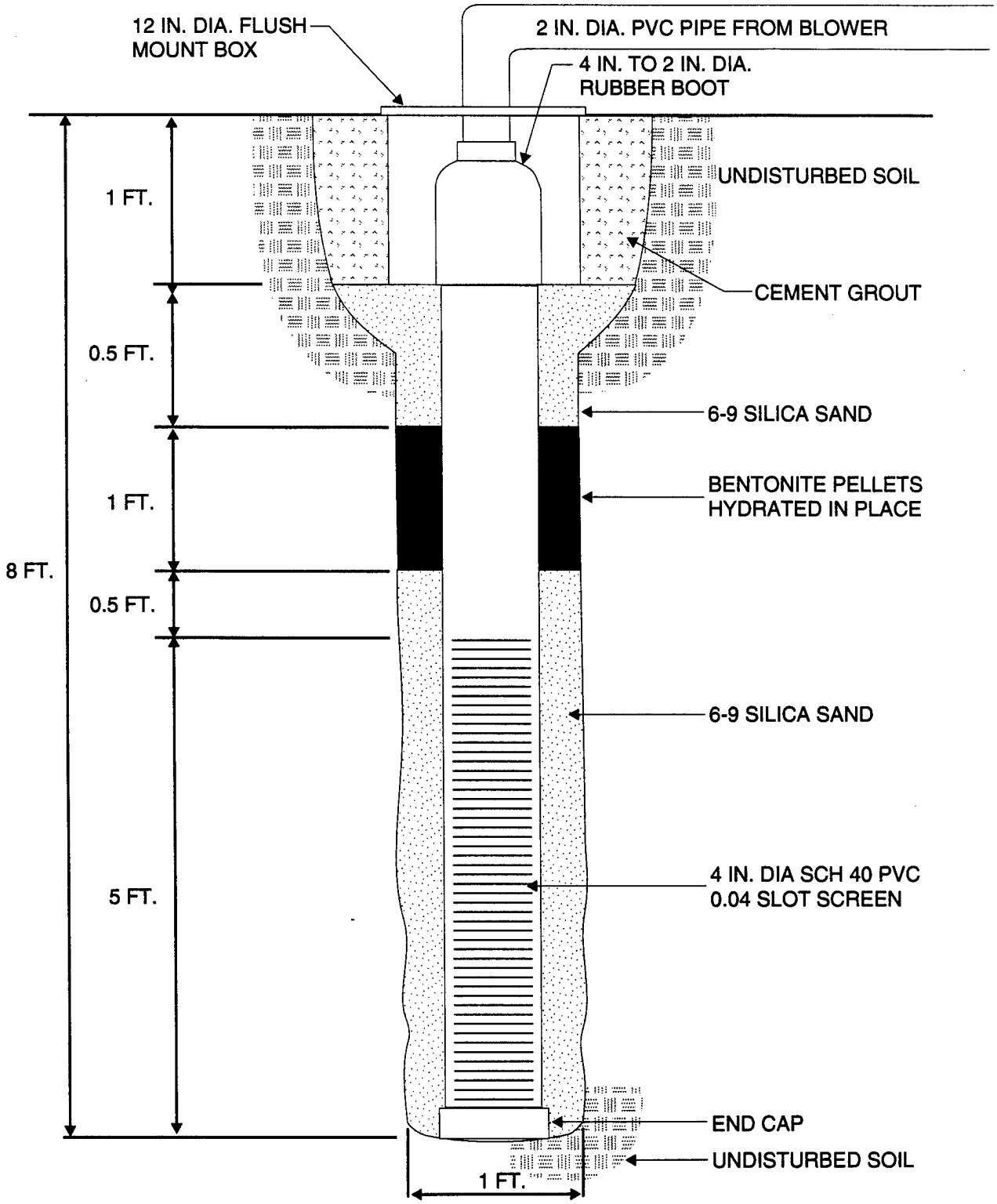
Figure 1.2

HYDROGEOLOGIC CROSS-SECTION A - A'
HURLBURT FIELD FIRE TRAINING AREA (FT-39)
EGLIN AFB, FLORIDA



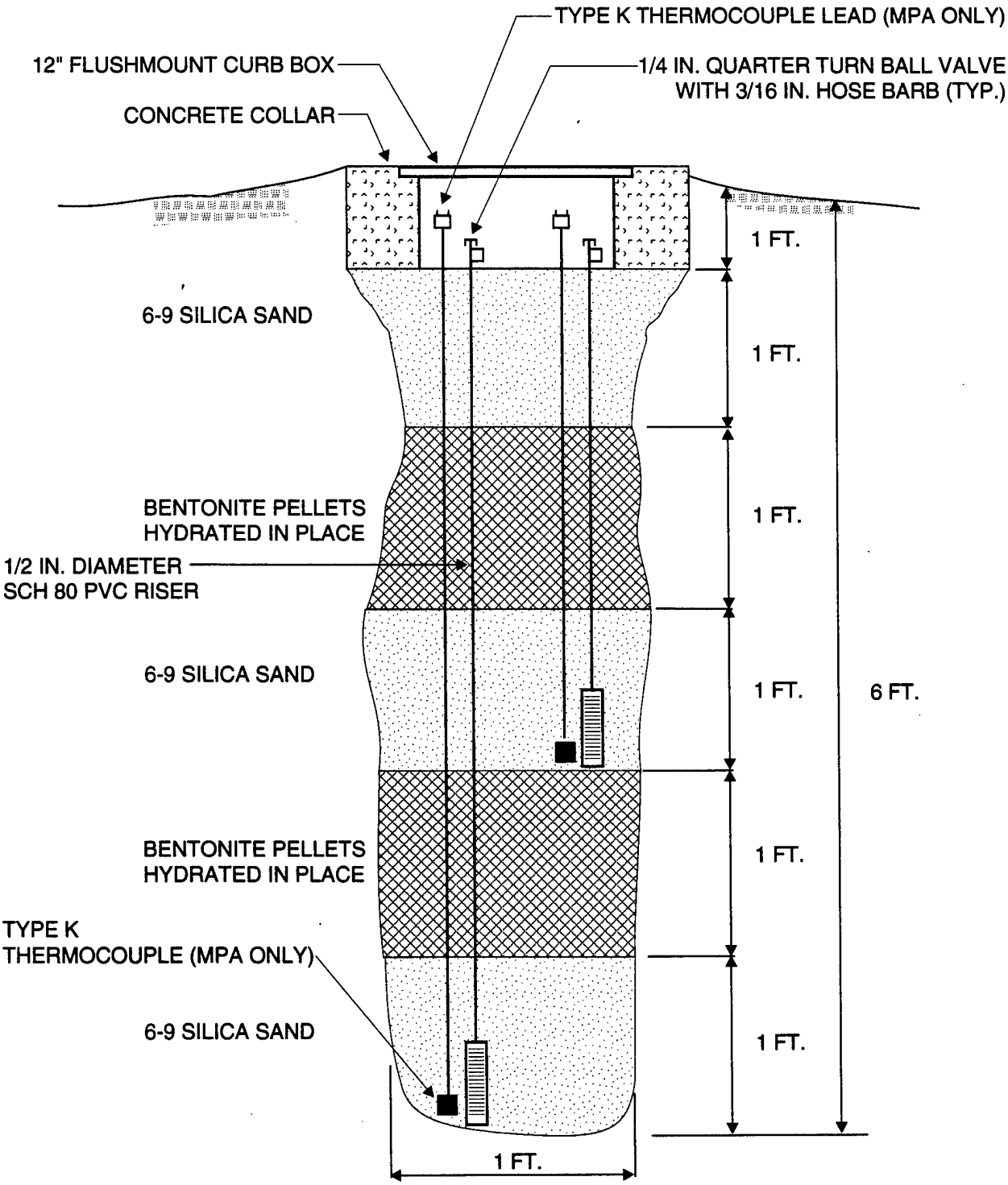
Water Level as of March 3, 1994

INJECTION VENT WELL CONSTRUCTION DETAIL
HURLBURT FIELD FTA - (FT - 39)
EGLIN AFB, FLORIDA

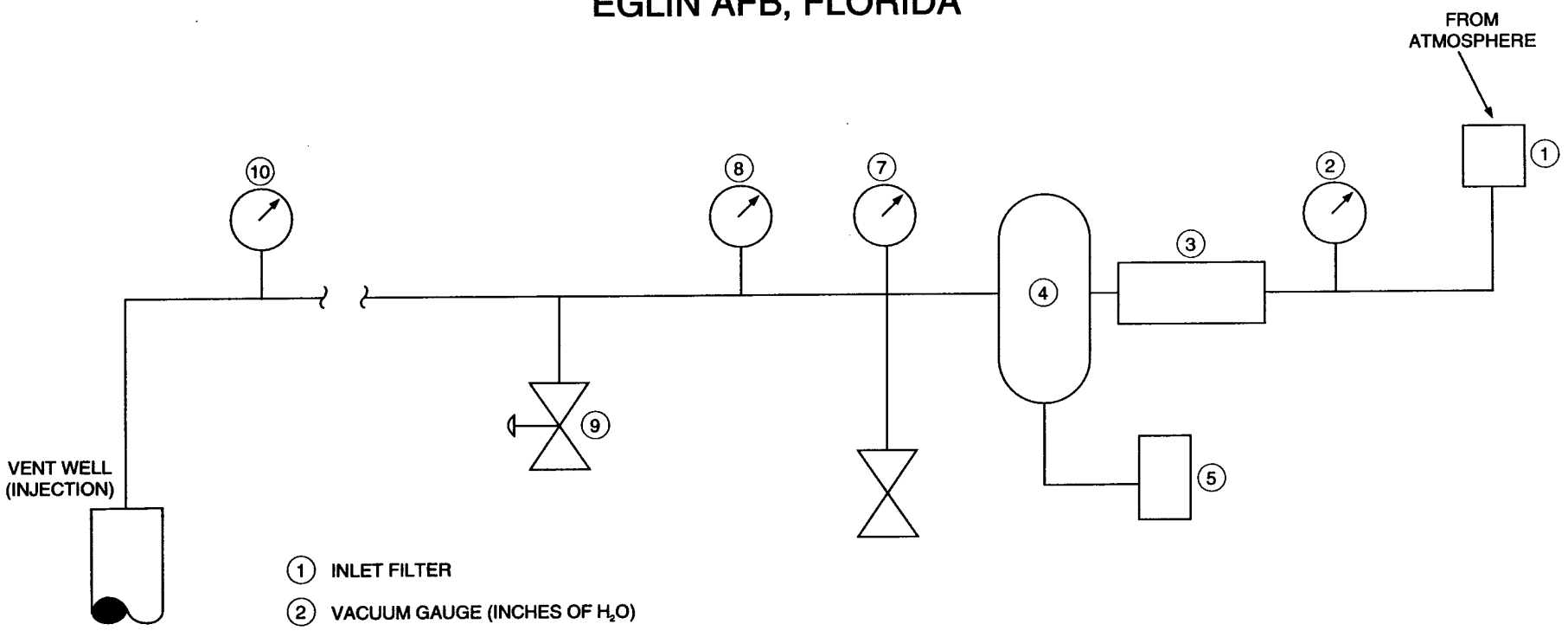


NOT TO SCALE

TYPICAL MONITORING POINT
HURLBURT FIELD FTA - (FT-39)
EGLIN AFB, FLORIDA



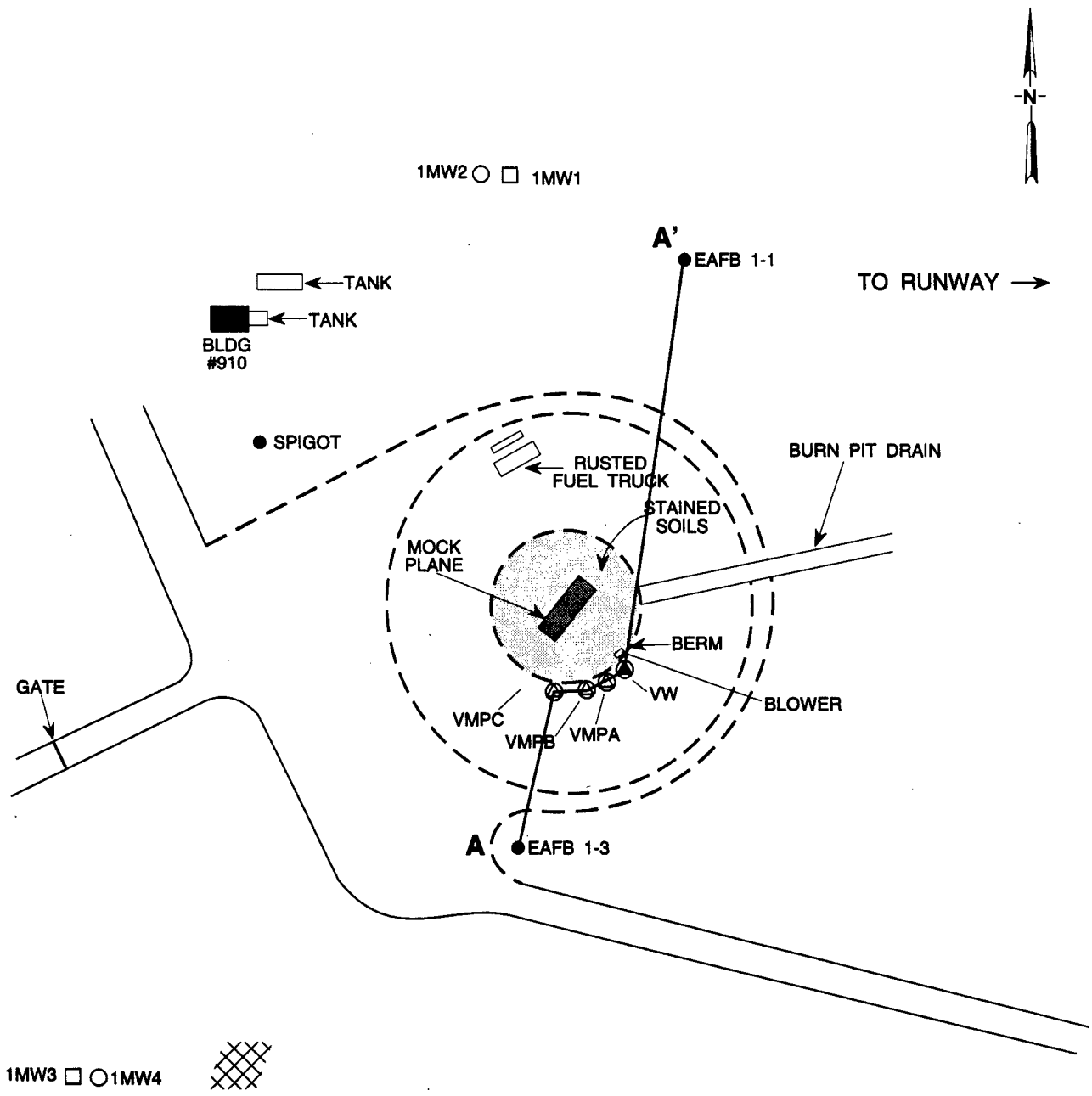
SCHEMATIC OF BLOWER SYSTEM FOR AIR INJECTION EGLIN AFB, FLORIDA



1. INLET FILTER
2. VACUUM GAUGE (INCHES OF H_2O)
3. DRIVE MOTOR
   1 HP / 3450 RPM @ 60 Hz / 230v / SINGLE PHASE / 15 A
4. BLOWER - GAST R4110-2 / REGENERATIVE
   70 SCFM @ 20 INCHES H_2O
5. POWER SWITCH
6. AUTOMATIC PRESSURE RELIEF VALVE - SET @ 42 INCHES H_2O
7. PRESSURE GAUGE (INCHES OF H_2O)
8. THERMOMETER (FARENHEIT)
9. MANUAL PRESSURE RELIEF (BLEED) VALVE - 1 1/2" BALL
10. AIR VELOCITY MEASUREMENT PORT

Figure 1.5

VENT WELL AND VAPOR MONITORING POINTS
EGLIN MAIN BASE OLD FTA - (FT-28)
EGLIN AFB



LEGEND

- VENT WELL
- VAPOR MONITORING POINT
- PATCHES OF ASPHALT, GLASS AND DEBRIS
- BOUNDARY OF FTA
- A - A' HYDROGEOLOGIC CROSS-SECTION
- STAGE 3 2" MONITORING WELL
- STAGE 3 4" MONITORING WELL

EARTHEN BERM

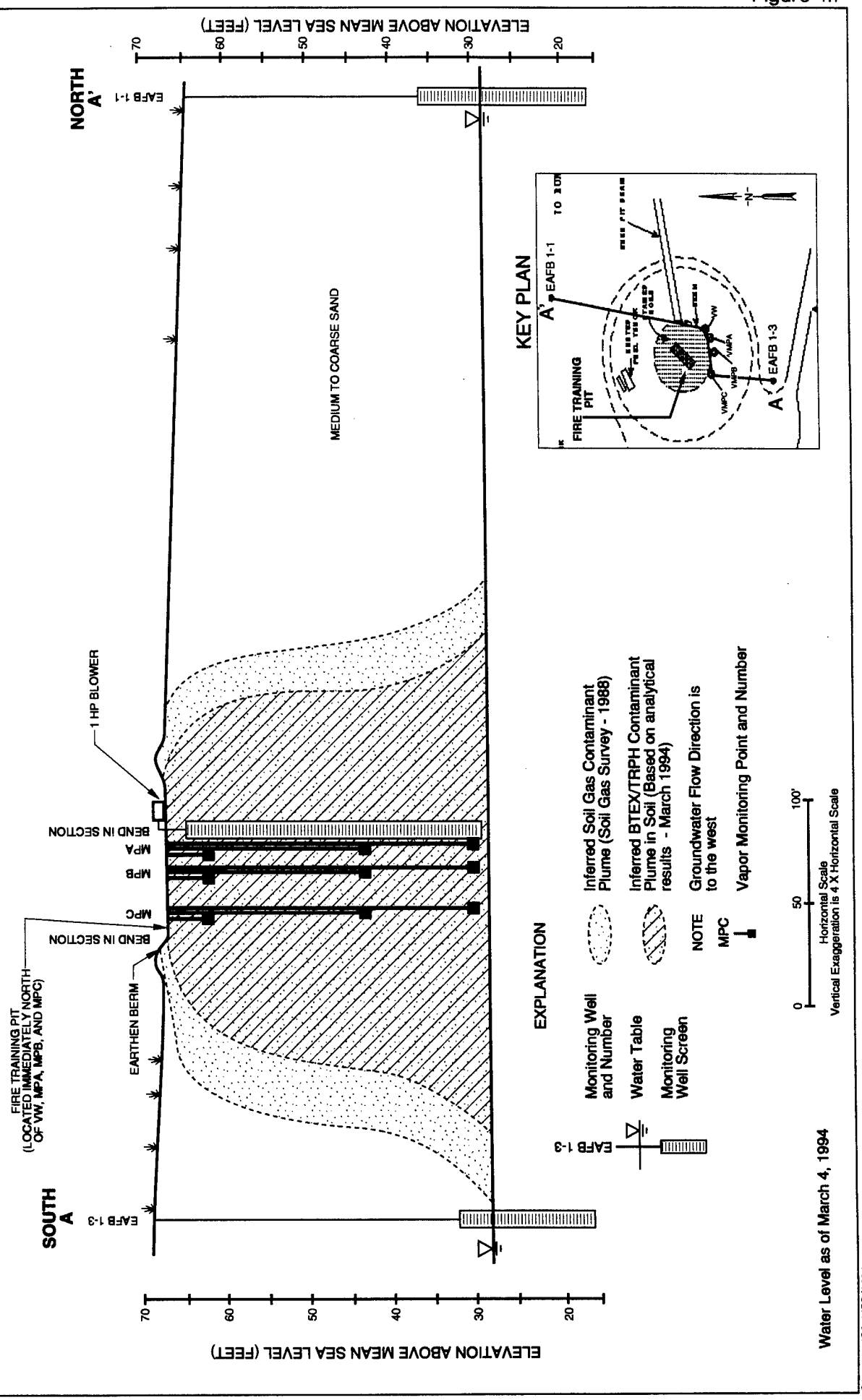
LOCATION OF OLD FUEL STORAGE TANK (REMOVED)

0 200 FEET

APPROXIMATE SCALE

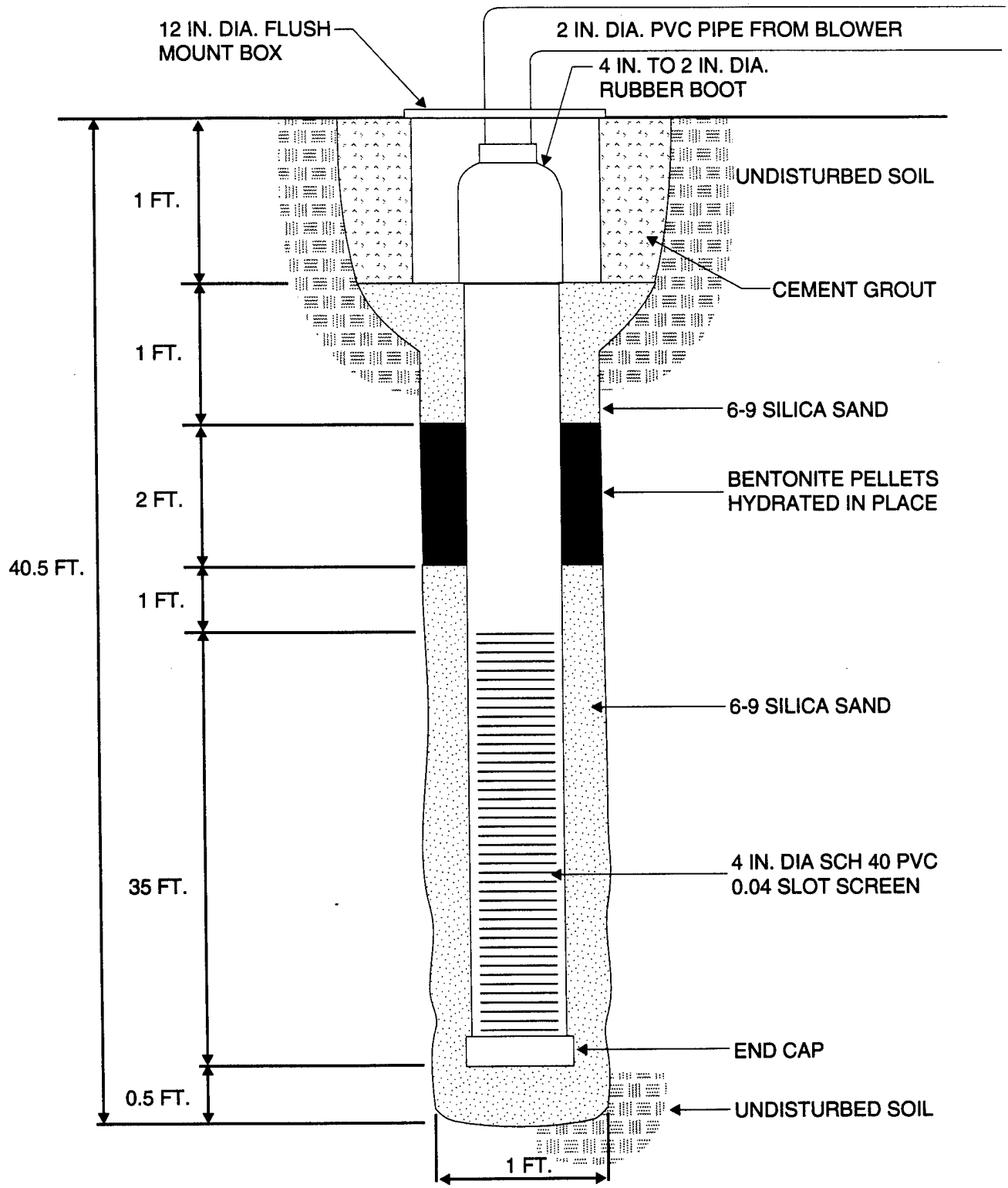
Figure 1.7

HYDROGEOLOGIC CROSS-SECTION A - A'
EGLIN MAIN OLD FIRE TRAINING AREA (FT-28)
EGLIN AFB, FLORIDA



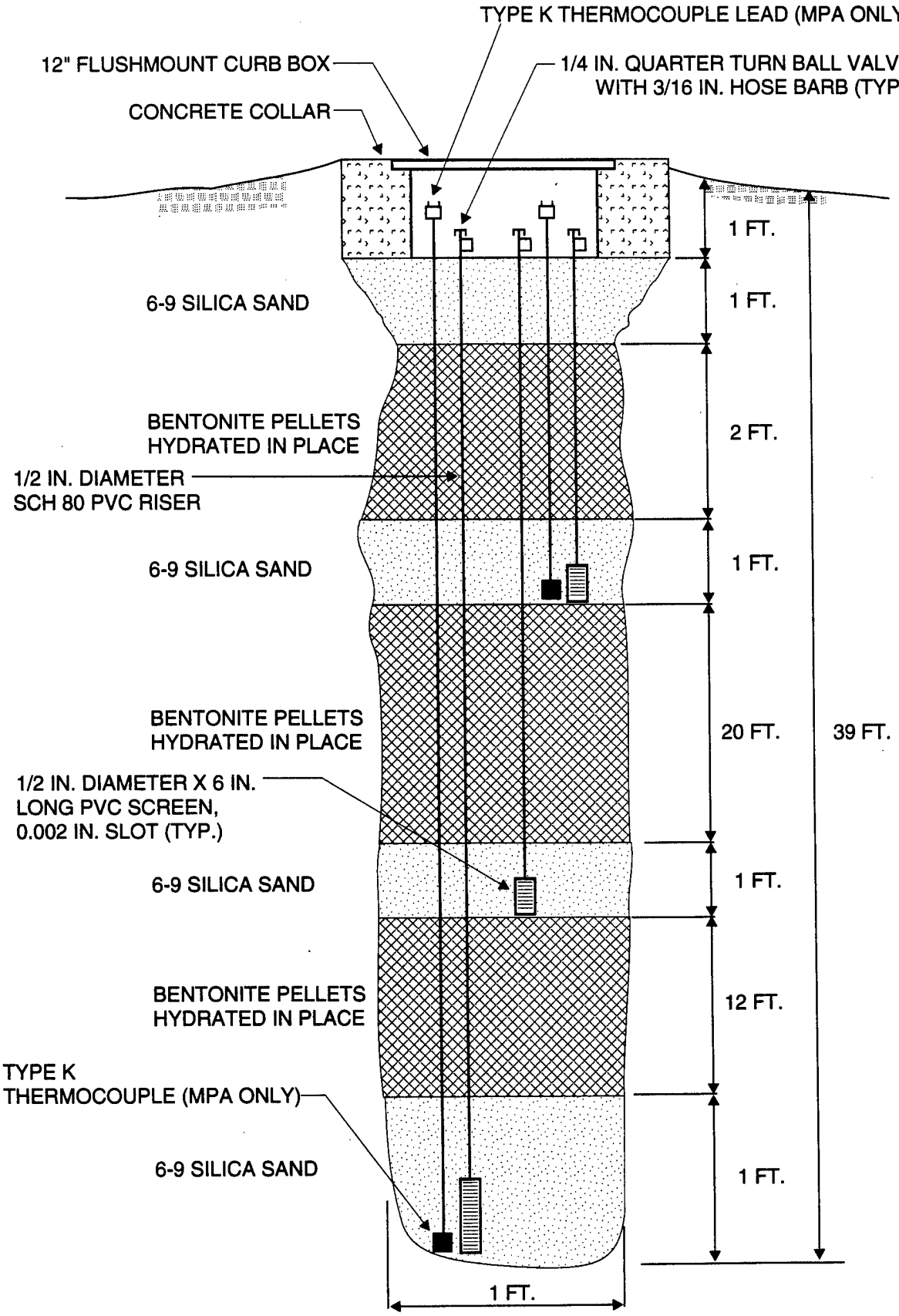
G/722409/CS-2/CD/0594

INJECTION VENT WELL CONSTRUCTION DETAIL
EGLIN MAIN BASE OLD FTA - (FT - 28)
EGLIN AFB, FLORIDA

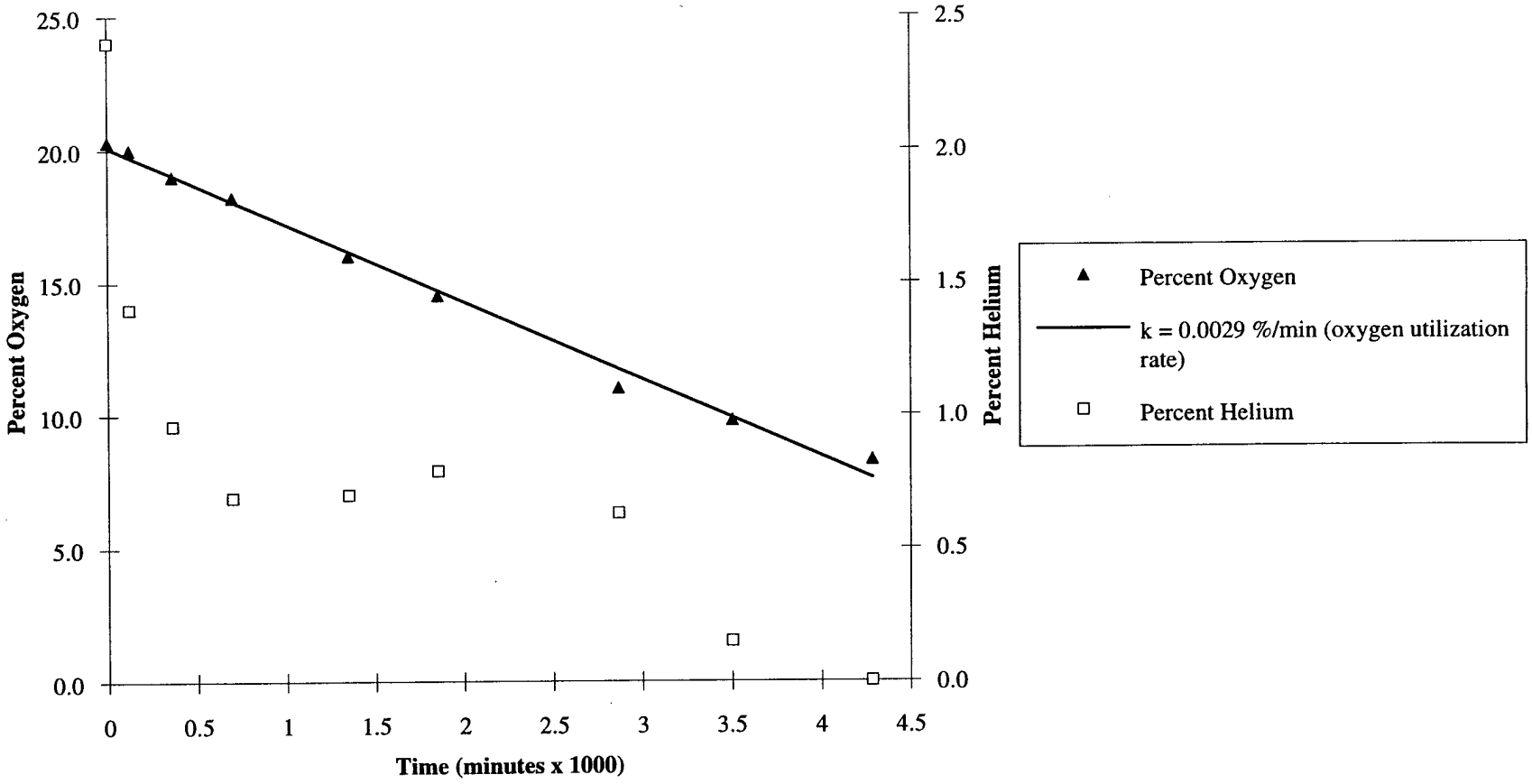


NOT TO SCALE

TYPICAL MONITORING POINT
EGLIN MAIN BASE OLD FTA - (SITE FT-28)
EGLIN AFB, FLORIDA



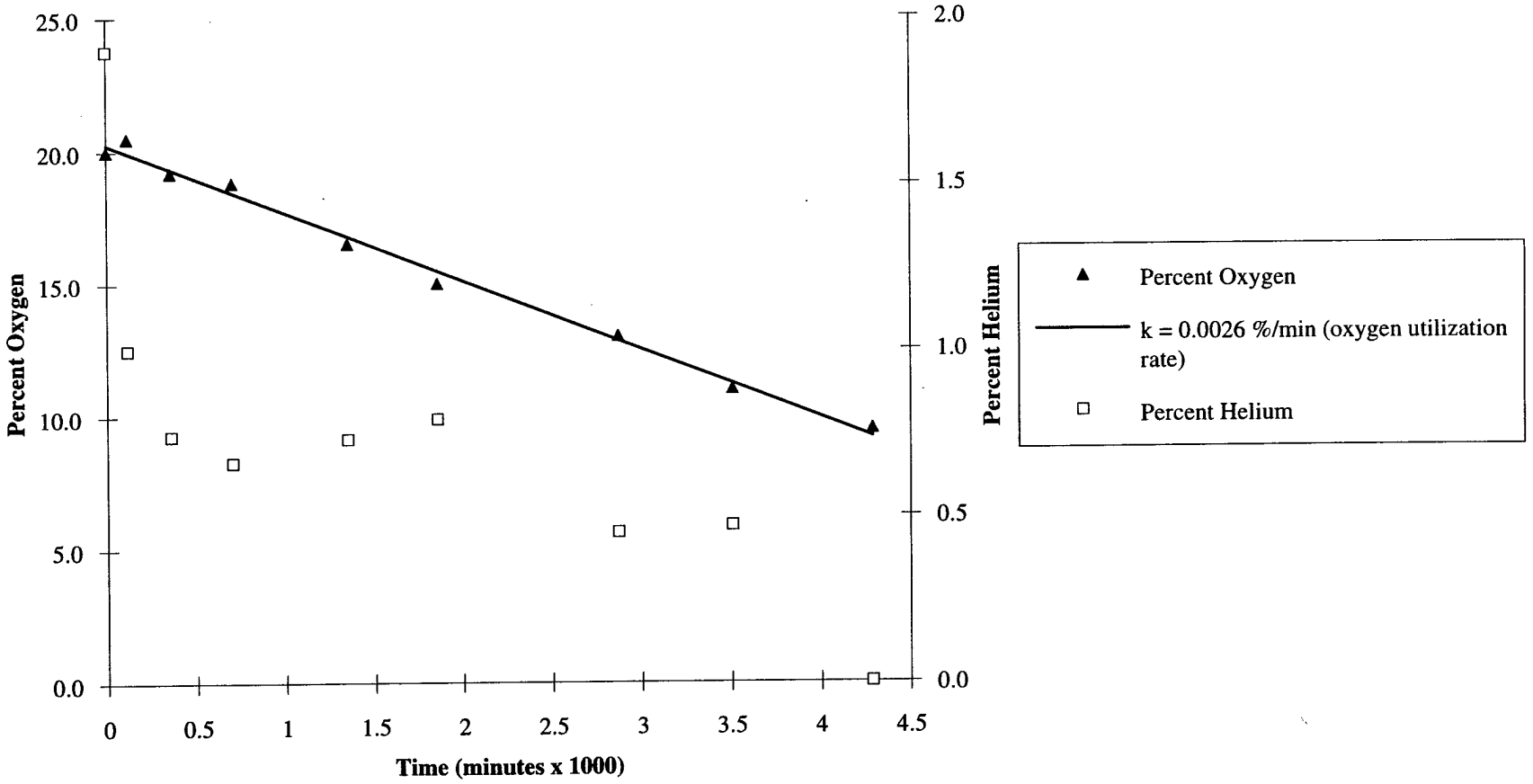
Initial Respiration Test
Oxygen and Helium Concentrations
Hurlburt FTA, MPA-Deep
Eglin AFB, Florida



H:\722409\9311J102\MPADEEP.XLS Chart 1

Figure 3.1

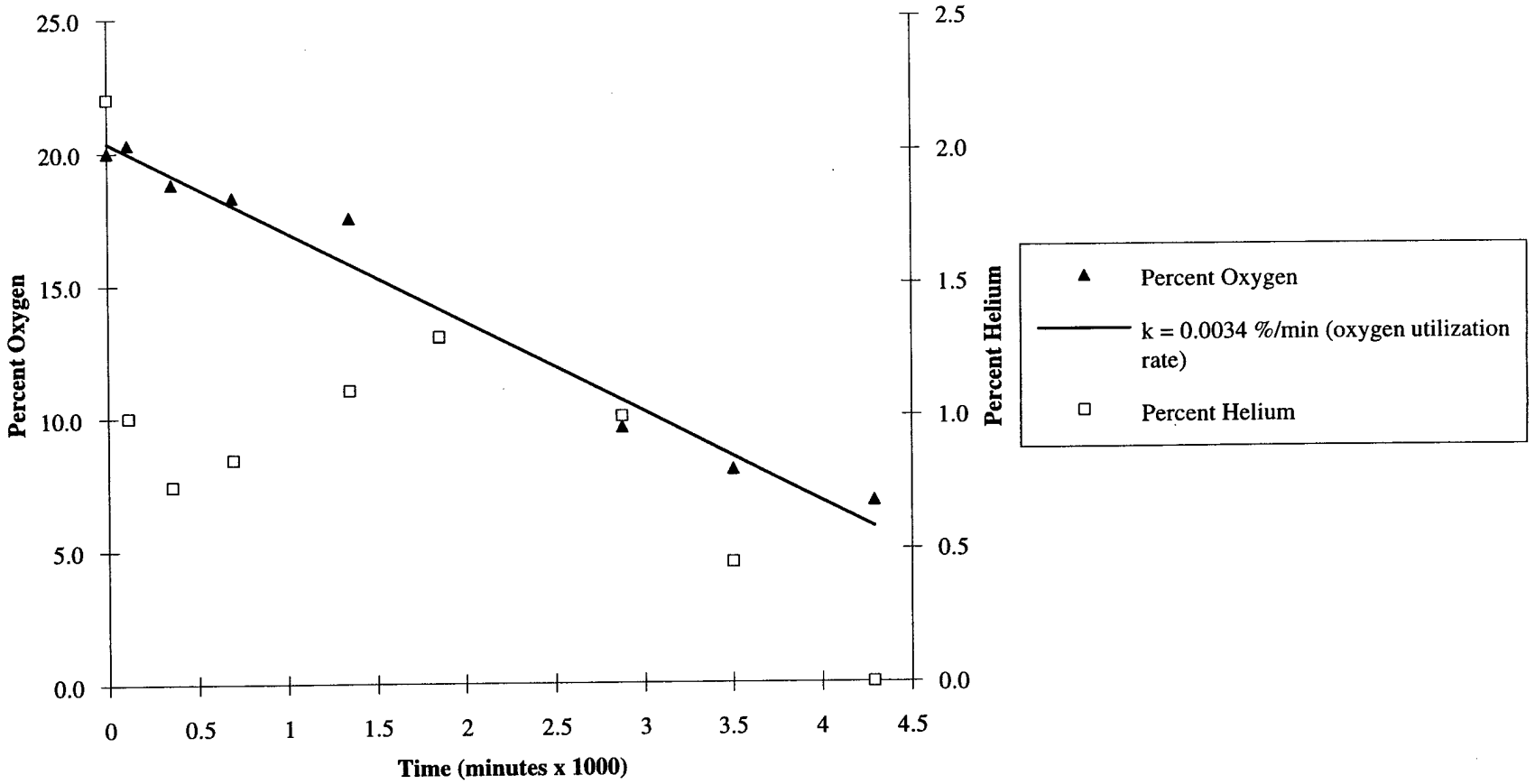
Initial Respiration Test
Oxygen and Helium Concentrations
Hurlburt FTA, MPB-Deep
Eglin AFB, Florida



H:\722409\9311J102\MPBDEEP.XLS Chart 1

Figure 3.2

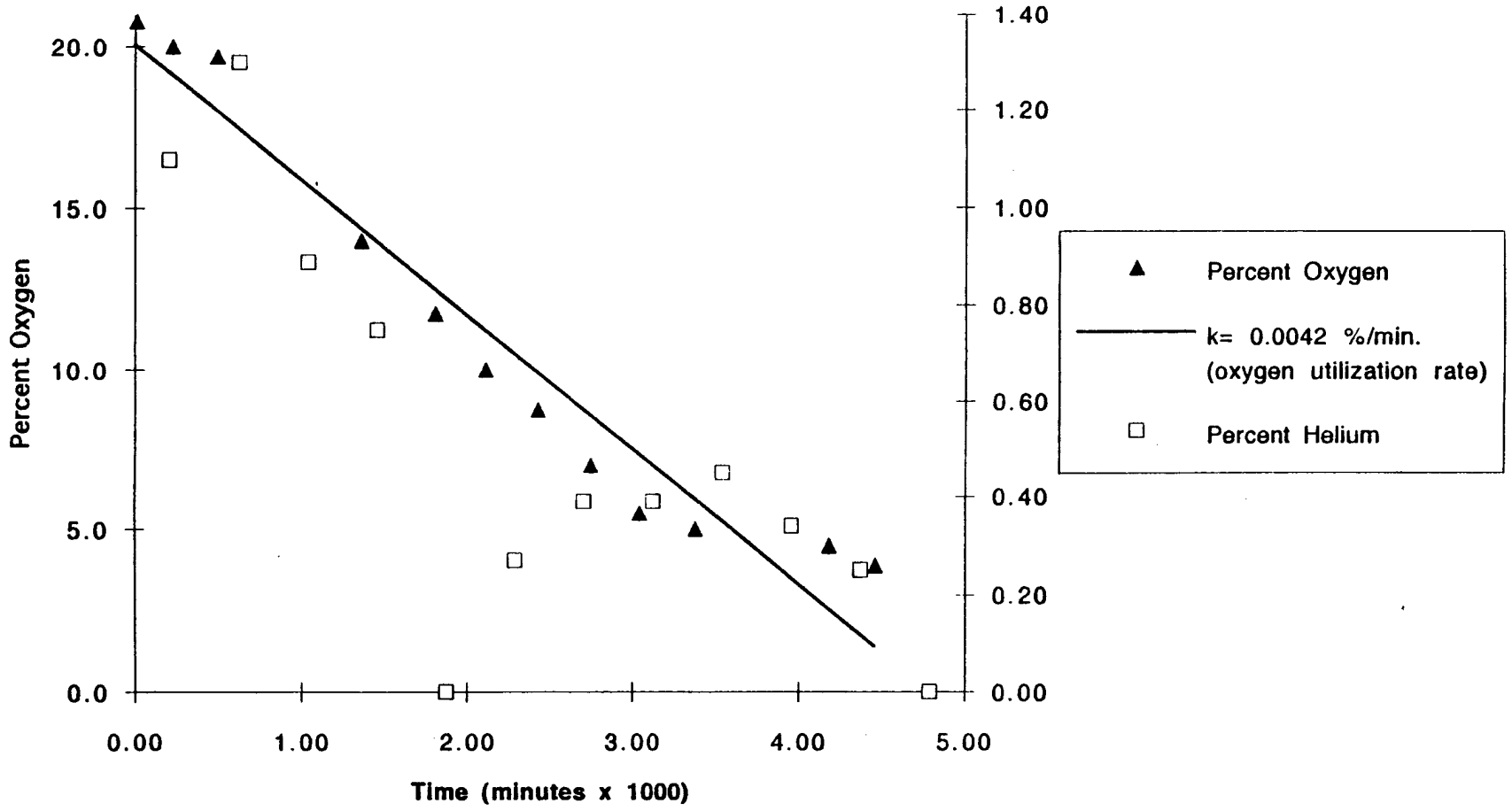
Initial Respiration Test
Oxygen and Helium Concentrations
Hurlburt FTA, MPC-Shallow
Eglin AFB, Florida



H:\722409\9311J102\MPCSHALL.XLS Chart 1

Figure 3.3

Initial Respiration Test
Oxygen and Helium Concentrations
Eglin FTA (EG2), MPA-Shallow
Eglin AFB, Florida

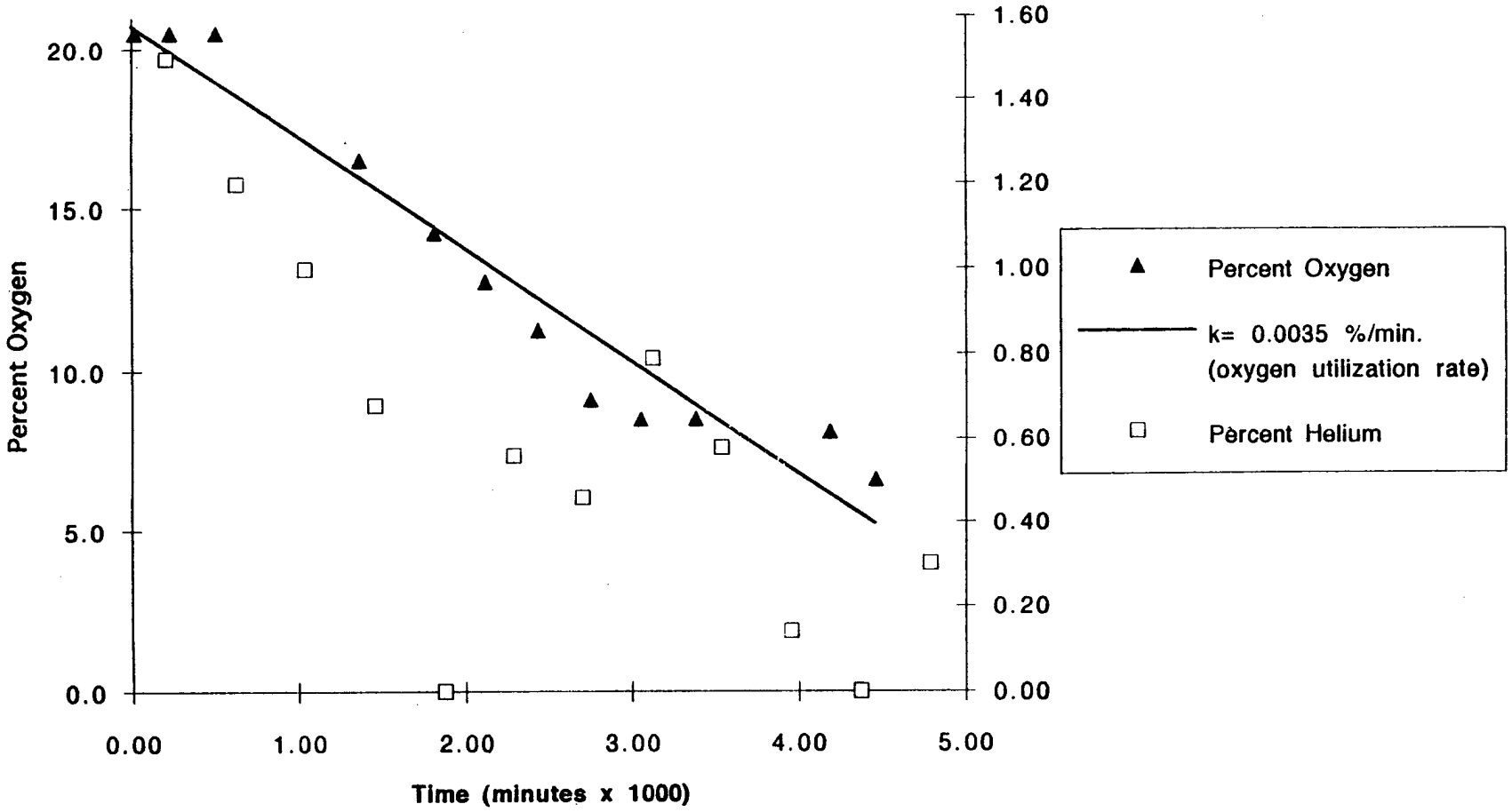


B:\EGLIN\KO\MPA-Shallow.xls\rms

6/7/94

Figure 3.4

Initial Respiration Test
Oxygen and Helium Concentrations
Eglin FTA (EG2), MPB-Medium
Eglin AFB, Florida

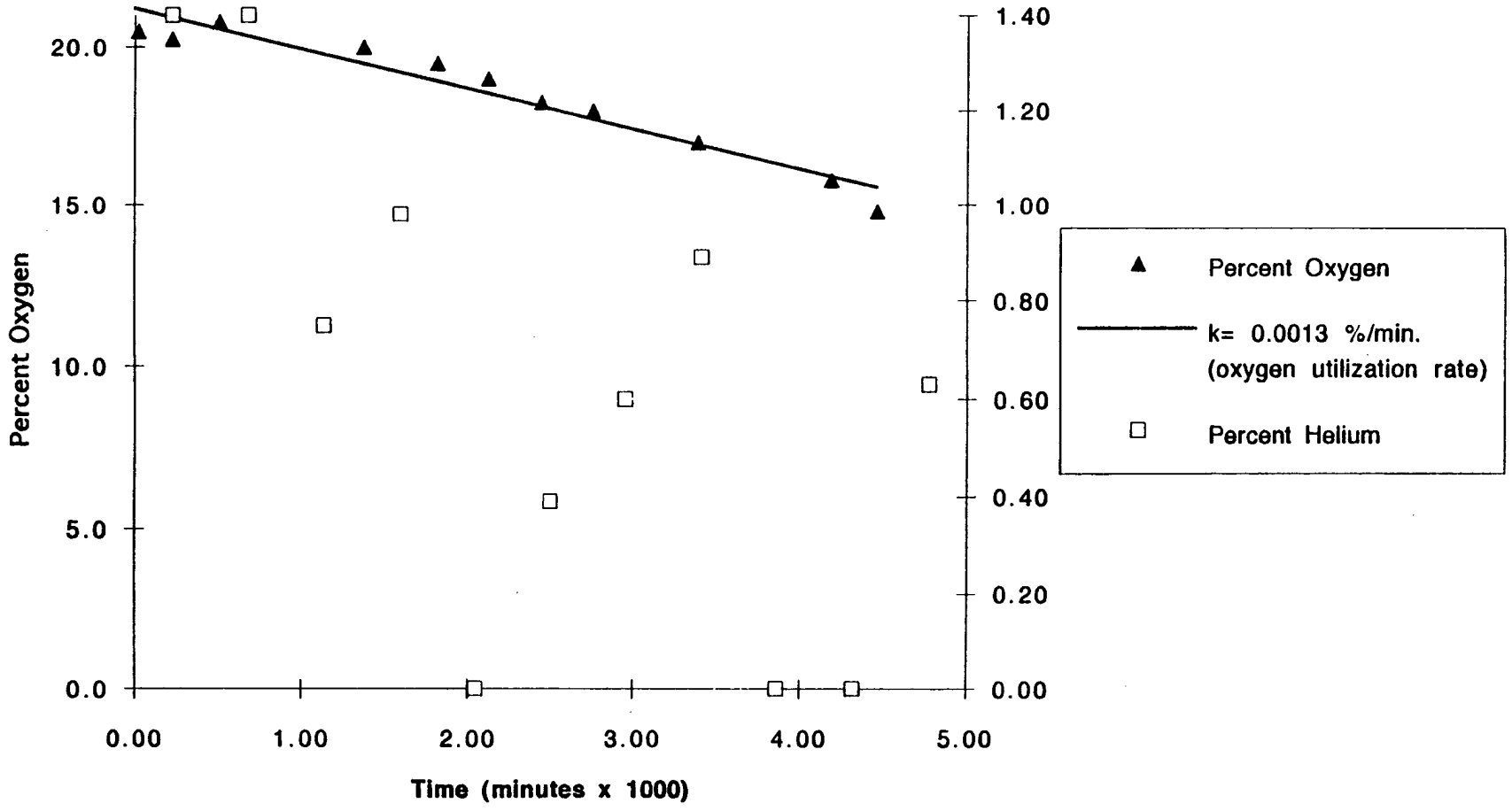


B:\EGLIN\KO\MPB-Medium.xls\rms

6/7/94

Figure 3.5

Initial Respiration Test
Oxygen and Helium Concentrations
Eglin FTA (EG2), MPC-Deep
Eglin AFB, Florida



B:\EGLIN\KO\MPC-Deep.xls\rms

6/7/94

Figure 3.6

TABLE 2.1
SOIL AND SOIL GAS LABORATORY ANALYTICAL RESULTS
Fire Training Pit 1 - Hurlburt Field Fire Training Area (FT-39)
Eglin AFB, Florida

Analyte (Units)a	Sample Location - Depth (feet below ground surface)		
Soil Gas Hydrocarbons	EG3-VW	EG3-MPA-3.5-4'	EG3-MPC-3.0-3.5'
TPH (ppmv)	14000	13000	26000
Benzene (ppmv)	32	24	53
Toluene (ppmv)	20	19	100
Ethylbenzene (ppmv)	8.5	6.8	21
Xylenes (ppmv)	35	30	170
Soil Hydrocarbons	EG3-VW-6-8'	EG3-MPA-3-5'	EG3-MPB-5'
TRPH (mg/kg)	15,800	12,100	848
Benzene (mg/kg)	ND(0.54)	ND(2.6)	ND(2.7)
Toluene (mg/kg)	15	22	5.1
Ethylbenzene (mg/kg)	3.3	14	4.5
Xylenes (mg/kg)	26	88	29
Soil Inorganics			
Iron (mg/kg)	240	620	1,160
Alkalinity (mg/kg as CaCO3)	331	253	321
pH (units)	8.1	8.3	8.2
TKN (mg/kg)	ND (40)	120	83
Phosphates (mg/kg)	35	18	46
Soil Physical Parameters			
Moisture (% wt.)	6.9	5.8	7.1
Gravel (%)	0	0	0
Sand (%)	95.5	88.3	90
Silt (%)	1.9	6.5	4.8
Clay (%)	2.6	5.2	5.2
Soil Temperature	EG3-MPA-3.5-4'		EG3-MPA-5.5-6'
	63°F		63.4°F

a - TRPH = total recoverable petroleum hydrocarbons; TPH = total petroleum hydrocarbons; mg/kg - milligrams per kilogram; ppmv = parts per million by volume; CaCO3 = carbonate; TKN = total kjeldhal nitrogen.

ND - Not detected.

NS - Not sampled.

TABLE 2.2
SOIL AND SOIL GAS LABORATORY ANALYTICAL RESULTS
Eglin Main Old Fire Training Area (FT-28)
Eglin AFB, Florida

Analyte (Units)a	Sample Location - Depth (feet below ground surface)		
Soil Gas Hydrocarbons	EG2-VW	EG2-MPA-4.5-5'	EG2-MPC-38.5-39'
TPH (ppmv)	11,000	11,000	26,000
Benzene (ppmv)	94	93	250
Toluene (ppmv)	52	24	460
Ethylbenzene (ppmv)	20	20	47
Xylenes (ppmv)	76	64	220
Soil Hydrocarbons	EG2-VW-3-5'	EG2-MPA-37-39'	EG2-MPB-2-4'
TRPH (mg/kg)	2,210	3,370	6,610
Benzene (mg/kg)	10	0.15	ND (2.7)
Toluene (mg/kg)	21	0.19	ND (2.7)
Ethylbenzene (mg/kg)	24	0.4	9.9
Xylenes (mg/kg)	72	2.5	22
Soil Inorganics			
Iron (mg/kg)	2,560	135	2,100
Alkalinity (mg/kg as CaCO3)	354	ND (42)	128
pH (units)	8.2	6.6	7.8
TKN (mg/kg dry weight)	ND (43)	ND (43)	ND (43)
Phosphorus (mg/kg dry weight)	28	29	15
Soil Physical Parameters			
Moisture (% wt.)	6	7	7.6
Gravel (%)	0.1	0	0
Sand (%)	91.8	92.5	92.2
Silt (%)	2.1	4.0	1.8
Clay (%)	6	3.5	6.1
Soil Temperature	EG2-MPA-4.5-5'		EG2-MPA-38.5-39'
	58.7°F		70.3°F

a - TRPH = total recoverable petroleum hydrocarbons; TPH = total petroleum hydrocarbons; mg/kg - milligrams per kilogram; ppmv = parts per million by volume; CaCO3 = carbonate; TKN = total kjeldhal nitrogen.

ND - Not detected- Detection limit in parenthesis.

NS - Not sampled.

TABLE 3.1
INITIAL SOIL GAS CHEMISTRY
Hurlburt Fire Training Area (FT-39)
Eglin AFB, Florida

MP Depth (ft)	O2 (%)	CO2 (%)	TVH (ppm)
EG3-VW-3-8	0.0	9	20,000+
EG3-MPA-3.5-4.0	1.2	7	20,000+
EG3-MPA-5.5-6.0	0.0	8.5	20,000+
EG3-MPB-3.5-4.0	3.5	5.25	16,000
EG3-MPB-5.5-6.0	0.0	7.5	20,000+
EG3-MPC-3.0-3.5	0.0	9	20,000+
EG3-MPC-5.0-5.5	0.0	9	20,000+

TABLE 3.2
MAXIMUM PRESSURE RESPONSE
AIR PERMEABILITY TEST
Hurlburt Fire Training Area (FT-39)
Eglin AFB, Florida

	Distance from injection well (EG3-VW)					
	10' (MPA)		20' (MPB)		40' (MPC)	
Depth (feet)	3.5-4.0	5.5-6.0	3.5-4.0	5.5-6.0	3.0-3.5	5.0-5.5
Time (minutes)	170	170	170	170	170	170
Max Pressure (inches H2O)	11.6	12.2	5.98	7.45	3.09	3.2

TABLE 3.3
INFLUENCE OF AIR INJECTION AT VENT WELL
ON MONITORING POINT OXYGEN LEVELS
Hurlburt Fire Training Area (FT-39)
Eglin AFB, Florida

MP	Distance from VW (ft)	Screen Depth (ft)	Initial O2 (%)	Final O2 (%) End of Permeability Test	O2 After 3 Days of Injection
EG3-MPA-Shallow	10	3.5-4.0	1.2	19.0	20.0
EG3-MPA-Deep	10	5.5-6.0	0	20.4	20.0
EG3-MPB-Shallow	20	3.5-4.0	3.5	20.0	20.5
EG3-MPB-Deep	20	5.5-6.0	0	20.0	20.9
EG3-MPC-Shallow	40	3.0-3.5	0	0.0	19.4
EG3-MPC-Deep	40	5.0-5.5	0	0.0	20.0

TABLE 3.4
SUMMARY OF OXYGEN UTILIZATION RATES
Hurlburt Fire Training Area (FT-39)
Eglin AFB, Florida

Monitoring Point	Oxygen Utilization Rate (%/minute)
EG3-MPA-5.5-6.0	0.0029
EG3-MPB-5.5-6.0	0.0026
EG3-MPC-3.0-3.5	0.0034

TABLE 3.5
Initial Respiration Test
Huriburt FTA
Eglin AFB, Florida

Monitoring Point	Date	Days Elapsed (frac. days)	Time	Hrs elapsed (fractional days)	Days Elapsed	Elapsed Time (min. x 1000)	O2%	CO2%	Total Hydro-carbon	Helium	Comments	Trend of O2/ Time	New x-values	k
MPA-Deep	03/15/94	0.00	10:00	0.00	0.00	0.00	20.3	0.20	110	2.40		20.101453	0	0.002922
MPA-Deep	03/15/94	0.00	12:00	0.08	0.08	0.12	20.0	0.30	290	1.40		7.5656199	4.29	
MPA-Deep	03/15/94	0.00	16:00	0.25	0.25	0.36	19.0	0.50	500	0.96	Temperature = 62.8 degrees F			
MPA-Deep	03/15/94	0.00	21:40	0.49	0.49	0.70	18.2	0.50	780	0.69				
MPA-Deep	03/16/94	1.00	08:30	-0.06	0.94	1.35	16.0	0.60	1,000	0.70	Temperature = 63.4 degrees F			
MPA-Deep	03/16/94	1.00	16:55	0.29	1.29	1.86	14.5	0.80	1,100	0.79				
MPA-Deep	03/17/94	2.00	09:50	-0.01	1.99	2.87	11.0	1.25	1,100	0.63				
MPA-Deep	03/17/94	2.00	20:25	0.43	2.43	3.51	9.8	1.50	1,200	0.15				
MPA-Deep	03/18/94	3.00	09:25	-0.02	2.98	4.29	8.3	1.60	1,400	0.00				
MPB-Deep	03/15/94	0.00	10:02	0.00	0.00	0.00	20.0	0.20	32	1.90		20.252725	0	0.002577
MPB-Deep	03/15/94	0.00	11:57	0.08	0.08	0.12	20.5	0.20	48	1.00		9.1990212	4.29	
MPB-Deep	03/15/94	0.00	16:00	0.25	0.25	0.36	19.2	0.50	160	0.74				
MPB-Deep	03/15/94	0.00	21:46	0.49	0.49	0.71	18.8	0.60	280	0.66				
MPB-Deep	03/16/94	1.00	08:32	-0.05	0.94	1.35	16.5	0.70	540	0.73				
MPB-Deep	03/16/94	1.00	16:58	0.29	1.29	1.86	15.0	0.80	640	0.79				
MPB-Deep	03/17/94	2.00	09:55	0.00	2.00	2.88	13.0	1.00	700	0.45				
MPB-Deep	03/17/94	2.00	20:28	0.44	2.44	3.51	11.0	1.50	940	0.47				
MPB-Deep	03/18/94	3.00	09:30	-0.02	2.98	4.29	9.5	1.50	1,000	0.00				
MPC-Shallow	03/15/94	0.00	10:05	0.00	0.00	0.00	20.0	0.20	84	2.20		20.359211	0	0.003387
MPC-Shallow	03/15/94	0.00	11:55	0.08	0.08	0.12	20.3	0.40	220	1.00		5.7940976	4.3	
MPC-Shallow	03/15/94	0.00	16:00	0.25	0.25	0.36	18.8	0.50	280	0.74				
MPC-Shallow	03/15/94	0.00	21:40	0.49	0.49	0.70	18.3	0.50	640	0.84				
MPC-Shallow	03/16/94	1.00	08:34	-0.05	0.94	1.35	17.5	0.60	1,000	1.10				
MPC-Shallow	03/16/94	1.00	17:00	0.29	1.29	1.86	13.0	1.00	1,200	1.30				
MPC-Shallow	03/17/94	2.00	10:00	0.00	2.00	2.88	9.6	1.90	2,000	1.00				
MPC-Shallow	03/17/94	2.00	20:30	0.44	2.44	3.51	8.0	2.10	3,200	0.45				
MPC-Shallow	03/18/94	3.00	09:37	-0.02	2.98	4.30	6.8	2.50	3,600	0.00				

TABLE 3.6
INITIAL SOIL GAS CHEMISTRY
Eglin Main Old Fire Training Area (FT-28)
Eglin AFB, Florida

MP Depth (ft)	O2 (%)	CO2 (%)	TVH (ppm)
EG2-VW-5-40	0.0	10.5	20,000+
EG2-MPA-4.5-5	0.0	10.25	20,000+
EG2-MPA-25.5-26	0.0	10.25	20,000+
EG2-MPA-38.5-39	NM	NM	NM
EG2-MPB-4-4.5	0.0	10.25	20,000+
EG2-MPB-25.5-26	0.0	10.25	20,000+
EG2-MPB-38-38.5	0.0	10.5	20,000+
EG2-MPC-4-4.5	0.0	10.75	20,000+
EG2-MPC-25.5-26	0.0	10.5	20,000+
EG2-MPC-38-38.5	0.0	11	20,000+

NM-Not Measured (unable to draw sample)

TABLE 3.7
MAXIMUM PRESSURE RESPONSE
AIR PERMEABILITY TEST
Eglin Main Old Fire Training Area (FT-28)
Eglin AFB, Florida

	Distance from injection well (EG2-VW)								
	10' (MPA)			20' (MPB)			40' (MPC)		
Depth (feet)	4.5	25.5	38.5	4.5	25.5	38.5	4.5	25.5	38.5
Time (minutes)	150	150	-	125	125	-	150	150	150
Max Pressure (inches H2O)	2.15	2.6	-	1.8	1.77	-	1.4	1.5	1.5

Note: water table may have risen above the screen at the deep monitoring points at MPA and MPB. Readings could not be obtained at these points as shown in Table 3.7.

TABLE 3.8
INFLUENCE OF AIR INJECTION AT VENT WELL
ON MONITORING POINT OXYGEN LEVELS
Eglin Main Old Fire Training Area (FT-28)
Eglin AFB, Florida

MP	Distance from VW (ft)	Screen Depth (ft)	Initial O2 (%)	Final O2 (%) End of Permeability Test	O2 After 17 Hours of Injection
EG2-MPA-Shallow	10	4.5-5.0	0	19.75	19.5
EG2-MPA-Mid depth	10	25.5-26.0	0	20.5	20.8
EG2-MPA-Deep	10	38.5-39	NM	NM	NM
EG2-MPB-Shallow	20	4.5-5.0	0	11.25	17.0
EG2-MPB-Mid depth	20	25.5-26.0	0	5.5	20.8
EG2-MPB-Deep	20	38.5-39	0	NM	NM
EG2-MPC-Shallow	40	4.5-5.0	0	0	0
EG2-MPC-Mid depth	40	25.5-26.0	0	0	0
EG2-MPC-Deep	40	38.5-39	0	11	19.5

NM- Not Measured (unable to draw sample-suspected a clogged screen or screen in water table)

TABLE 3.9
SUMMARY OF OXYGEN UTILIZATION RATES
Eglin Main Old Fire Training Area (FT-28)
Eglin AFB, Florida

Monitoring Point	Oxygen Utilization Rate (%/minute)
EG2-MPA-4.5-5.0'	0.0042
EG2-MPB-25.5-26'	0.0035
EG2-MPC-38.5-39'	0.0013

TABLE 5.10

Initial Respiration Test
Eglin FTA (EG2)
Eglin AFB, Florida

Monitoring Point	Date	Days Elapsed (frac. days)	Time	Hrs elapsed (fractional days)	Days Elapsed	Elapsed Time (min. x 1000)	O2%	CO2%	Total Hydro-carbon	Helium	Comments	Trend of O2/ Time	New x-values	k
MPA-Shallow	03/18/94	0.00	11:25	0.01	0.01	0.01	20.8	0.50	NS	1.10	Temperature = 58.7 degrees F.	20.058575	0	0.004181
MPA-Shallow	03/18/94	0.00	15:00	0.16	0.16	0.23	20.0	0.60	NS	1.30		1.4103543	4.46	
MPA-Shallow	03/18/94	0.00	19:33	0.35	0.35	0.50	19.7	0.70	NS	0.89				
MPA-Shallow	03/19/94	1.00	09:53	-0.06	0.94	1.36	14.0	0.90	3,200	0.75				
MPA-Shallow	03/19/94	1.00	17:20	0.25	1.25	1.81	11.8	1.70	5,800	NS				
MPA-Shallow	03/19/94	1.00	22:25	0.47	1.47	2.11	10.0	2.00	7,200	0.27				
MPA-Shallow	03/20/94	2.00	03:40	-0.31	1.69	2.43	8.8	2.60	9,000	0.39				
MPA-Shallow	03/20/94	2.00	09:00	-0.09	1.91	2.75	7.0	2.00	>10,000	0.39				
MPA-Shallow	03/20/94	2.00	13:57	0.11	2.11	3.04	5.5	2.30	>10,000	0.45				
MPA-Shallow	03/20/94	2.00	19:33	0.35	2.35	3.38	5.0	3.80	>10,000	0.34				
MPA-Shallow	03/21/94	3.00	08:57	-0.09	2.91	4.18	4.5	4.80	>10,000	0.25				
MPA-Shallow	03/21/94	3.00	13:34	0.10	3.10	4.46	3.9	5.00	>10,000	NS				
MPB-Medium	03/18/94	0.00	11:30	0.01	0.01	0.02	20.5	0.50	NS	1.50		20.708051	0	0.003476
MPB-Medium	03/18/94	0.00	15:01	0.16	0.16	0.23	20.5	0.50	NS	1.20		5.204501	4.46	
MPB-Medium	03/18/94	0.00	19:36	0.35	0.35	0.50	20.5	0.60	NS	1.00				
MPB-Medium	03/19/94	1.00	09:58	-0.05	0.95	1.37	16.5	0.80	4,800	0.68				
MPB-Medium	03/19/94	1.00	17:22	0.26	1.26	1.81	14.3	1.30	7,500	NS				
MPB-Medium	03/19/94	1.00	22:30	0.47	1.47	2.12	12.8	1.90	9,200	0.56				
MPB-Medium	03/20/94	2.00	03:50	-0.31	1.69	2.44	11.3	2.50	10,000	0.46				
MPB-Medium	03/20/94	2.00	09:04	-0.09	1.91	2.75	9.1	3.00	>10,000	0.79				
MPB-Medium	03/20/94	2.00	14:02	0.12	2.12	3.05	8.5	3.50	>10,000	0.58				
MPB-Medium	03/20/94	2.00	19:36	0.35	2.35	3.38	8.5	3.80	>10,000	0.14	Helium meter not working correctly.			
MPB-Medium	03/21/94	3.00	08:59	-0.09	2.91	4.19	8.1	4.90	>10,000	NS				
MPB-Medium	03/21/94	3.00	13:35	0.10	3.10	4.46	6.6	5.10	>10,000	0.30				
MPC-Deep	03/18/94	0.00	11:34	0.01	0.01	0.02	20.5	0.50	NS	1.40		21.210732	0	0.001263
MPC-Deep	03/18/94	0.00	15:02	0.16	0.16	0.23	20.3	0.50	NS	1.40		15.57601	4.46	
MPC-Deep	03/18/94	0.00	19:40	0.35	0.35	0.51	20.8	0.60	NS	0.75	Helium meter needs charged			
MPC-Deep	03/19/94	1.00	10:02	-0.05	0.95	1.37	20.0	0.60	1,200	0.98				
MPC-Deep	03/19/94	1.00	17:24	0.26	1.26	1.81	19.5	0.60	2,200	NS				
MPC-Deep	03/19/94	1.00	22:32	0.47	1.47	2.12	19.0	0.60	3,000	0.39				
MPC-Deep	03/20/94	2.00	03:53	-0.31	1.69	2.44	18.3	0.60	3,800	0.60				
MPC-Deep	03/20/94	2.00	09:07	-0.09	1.91	2.75	18.0	0.70	4,300	0.89	Got 0.77 on check for repeatability			
MPC-Deep	03/20/94	2.00	19:38	0.35	2.35	3.39	17.0	0.70	NS	NS				
MPC-Deep	03/21/94	3.00	09:00	-0.09	2.91	4.19	15.8	0.80	8,400	NS				
MPC-Deep	03/21/94	3.00	13:36	0.10	3.10	4.46	14.8	0.90	>10,000	0.63				

APPENDIX A

ANALYTICAL DATA FOR AIR SAMPLES AT FT-39

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9403129

Work Order Summary

CLIENT: Ms. Diana Schenfeld
Engineering Science
1700 Broadway, Suite 900
Denver, CO 80290

BILL TO: Same

PHONE: 303-831-8100
FAX: 303-831-8208
DATE RECEIVED: 3/16/94
DATE COMPLETED: 3/24/94

INVOICE # 3240
P.O. # DE268.43.040
PROJECT # DE268.43.040 Eglin AFB
AMOUNT$: $462.87

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	PRICE
01A	EG3-VW	TO-3	1.5 "Hg	$120.00
02A	EG3-MPA Shallow	TO-3	3.0 "Hg	$120.00
02B	EG3-MPA Shallow Duplicate	TO-3	3.0 "Hg	NC
03A	EG3-MPC Shallow	TO-3	2.0 "Hg	$120.00
04A	Method Spike	TO-3	NA	NC
05A	Lab Blank	TO-3	NA	NC

Misc. Charges	1 Liter SUMMA Canister Preparation (3) @ $10.00 each.	$30.00
	Shipping (2/28/94)	$72.87

CERTIFIED BY: Linda L. Fuerman
Laboratory Director

DATE: 3/24/94

180 BLUE RAVINE ROAD, SUITE B • FOLSOM, CA 95630
(916) 985-1000 • FAX (916) 985-1020

AIR TOXICS LTD.

SAMPLE NAME: EG3-VW
ID#: 9403129-01A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name: 6031707 **Date of Collection: 3/14/94**
Dil. Factor: 270 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.27	0.88	32	100
Toluene	0.27	1.0	20	77
Ethyl Benzene	0.27	1.2	8.5	38
Total Xylenes	0.27	1.2	35	150

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name: 6031707 **Date of Collection: 3/14/94**
Dil. Factor: 270 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	2.7	18	14000	91000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: EG3-MPA Shallow
ID#: 9403129-02A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	**6031708**	**Date of Collection: 3/14/94**	
Dil. Factor:	**220**	**Date of Analysis: 3/17/94**	

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.22	0.71	24	78
Toluene	0.22	0.84	19	73
Ethyl Benzene	0.22	0.97	6.8	30
Total Xylenes	0.22	0.97	30	130

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	**6031708**	**Date of Collection: 3/14/94**	
Dil. Factor:	**220**	**Date of Analysis: 3/17/94**	

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	2.2	14	13000	84000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: EG3-MPA Shallow Duplicate
ID#: 9403129-02B

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6031709	Date of Collection: 3/14/94
Dil. Factor:	220	Date of Analysis: 3/17/94

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.22	0.71	23	75
Toluene	0.22	0.84	18	69
Ethyl Benzene	0.22	0.97	6.7	30
Total Xylenes	0.22	0.97	29	130

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031709	Date of Collection: 3/14/94
Dil. Factor:	220	Date of Analysis: 3/17/94

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	2.2	14	12000	78000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: EG3-MPC Shallow
ID#: 9403129-03A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	**6031710**	**Date of Collection: 3/14/94**	
Dil. Factor:	**270**	**Date of Analysis: 3/17/94**	

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.27	0.88	53	170
Toluene	0.27	1.0	100	380
Ethyl Benzene	0.27	1.2	21	93
Total Xylenes	0.27	1.2	170	750

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	**6031710**	**Date of Collection: 3/14/94**	
Dil. Factor:	**270**	**Date of Analysis: 3/17/94**	

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	2.7	18	26000	170000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Method Spike
ID#: 9403129-04A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name: 6031701 **Date of Collection: NA**
Dil. Factor: 1.0 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	% Recovery
Benzene	0.001	0.003	108
Toluene	0.001	0.004	106
Ethyl Benzene	0.001	0.004	103
Total Xylenes	0.001	0.004	104

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name: 6031703 **Date of Collection: NA**
Dil. Factor: 1.0 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	% Recovery
TPH*	0.010	0.065	109

*TPH referenced to Jet Fuel (MW=156)

Container Type: NA

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank
ID#: 9403129-05A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name: 6031705 **Date of Collection: NA**
Dil. Factor: 1.0 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.001	0.003	Not Detected	Not Detected
Toluene	0.001	0.004	Not Detected	Not Detected
Ethyl Benzene	0.001	0.004	Not Detected	Not Detected
Total Xylenes	0.001	0.004	Not Detected	Not Detected

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name: 6031705 **Date of Collection: NA**
Dil. Factor: 1.0 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	0.010	0.065	Not Detected	Not Detected

*TPH referenced to Jet Fuel (MW=156)

Container Type: NA

9403129

FIGURE B.3

CHAIN OF CUSTODY RECORD

Page 1 of 1

ENGINEERING-SCIENCE, INC.
[illegible] BROADWAY, SUITE 900
DENVER, COLORADO 80290
[illegible]-831-8100

AFCEE BIOVENTING PILOT TESTS

Base: EGLIN AFB, FT. WALTON FLORIDA

Site: HURLBURT FTA (EG3)

E Job No.
E268.43-04008

Sampler(s): (Signature)
OLA AWOSIKA
STEVE RATZLAFF
ED GLAZA

Preservative: 1 NONE

Analysis Required: TO-3(EPA) | BTEX & TPH

Ship To:
Air Toxics Ltd.
180 Blue Ravine Rd.
Suite B
Folsom California 95630
Attn: Alexis Merydith

Date	Time	Sample Description	Lab I.D.	No. of Cntrs	Sample Type	Matrix	Remarks
3/14/94	1536	EG3 - VW		1	G C	AIR	1.5 "Hg O1A
3/14/94	1543	EG3 - MPA SHALLOW		1	G C	AIR	3.0 "Hg O2A/B
3/14/94	1550	EG3 - MPC SHALLOW		1	G C	AIR	2.0 "Hg O3A
					G C	AIR	
					G C	AIR	
					G C	AIR	
					G C	AIR	
					G C	AIR	
					G C	AIR	
					G C	AIR	
					G C	AIR	
					G C	AIR	
					G C	AIR	
					G C	AIR	
					G C	AIR	

Relinquished by: (Signature)
OLA AWOSIKA

Date / Time
3/15/94 1700

Received for Laboratory by: (Signature)
Cynthia A Wright ATL

Date / Time
3/14/94 9:45

Remarks:
Custody seals not present
-Samples rec'd at Room temp in cold condition GW 3/16/94

Relinquished by: (Signature)

Date / Time

Received for Laboratory by: (Signature)

Date / Time

G - Grab Sample, C - Composite Sample

Distribution: Original Accompanies Shipment, Copies to: Coordinator Field Files

Federal Express Number: 7397135653

ENGINEERING-SCIENCE, INC.
1700 Broadway, Suite 900 - Denver, Colorado
(303) 831-8100

AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9403252

Work Order Summary

CLIENT: Ms. Diana Schenfeld
Engineering Science
1700 Broadway, Suite 900
Denver, CO 80290

BILL TO: Same

PHONE: 303-831-8100
FAX: 303-831-8208
DATE RECEIVED: 3/30/94
DATE COMPLETED: 4/5/94

INVOICE # 3335
P.O. # 722409.43040
PROJECT # 722409.43040 Eglin AFB
AMOUNT$: $140.00

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	PRICE
01A	EG3-EAFB2-1	ASTM D-1945	1.5 "Hg	$140.00
02A	Lab Blank	ASTM D-1945	NA	NC

CERTIFIED BY: Linda D. Fuoco
Laboratory Director

DATE: 4/6/94

180 BLUE RAVINE ROAD, SUITE B • FOLSOM, CA 95630
(916) 985-1000 • FAX (916) 985-1020

AIR TOXICS LTD.

SAMPLE NAME: EG3-EAFB2-1
ID#: 9403252-01A

NATURAL GAS ANALYSIS by ASTM D-1945
GC/TCD/FID

File Name:	**3033106**	**Date of Collection:**	**3/21/94**
Dil. Factor:	**2.1**	**Date of Analysis:**	**3/31/94**

Compound	Det. Limit (%)	Amount (%)
Methane	0.002	Not Detected
Ethane	0.002	Not Detected
Propane	0.002	Not Detected
Isobutane	0.002	Not Detected
Butane	0.002	Not Detected
Neopentane	0.002	Not Detected
Isopentane	0.002	Not Detected
n-Pentane	0.002	Not Detected

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank
ID#: 9403252-02A

NATURAL GAS ANALYSIS by ASTM D-1945
GC/TCD/FID

File Name:	**3033105**	**Date of Collection:**	**NA**
Dil. Factor:	**1.0**	**Date of Analysis:**	**3/31/94**

Compound	Det. Limit (%)	Amount (%)
Methane	0.001	Not Detected
Ethane	0.001	Not Detected
Propane	0.001	Not Detected
Isobutane	0.001	Not Detected
Butane	0.001	Not Detected
Neopentane	0.001	Not Detected
Isopentane	0.001	Not Detected
n-Pentane	0.001	Not Detected

Container Type: NA

ENGINEERING SCIENCE
CHAIN OF CUSTODY RECORD

~~9403215~~ 0292
9403252

ES JOB NO.	PROJECT NAME/LOCATION
722409.4304	EGLIN AFB, HURLBURT FTA (EG3)

SAMPLER(S): (Signature)
STEVE RATZLAFF

SHIP TO:
AIR TOXICS LTD.
180 BLUE RAVINE RD. STE. B
FOLSOM, CA 95630
ATTN: ALEXIS MERYDITH

PRESERVATIVE REQUIRED

ANALYSES REQUIRED

	DATE	TIME	SAMPLE DESCRIPTION	NUMBER OF CONTAINERS	TO-3 (EPA)	BTEX & TPH	C1-C5	SAMPLE TYPE	MATRIX	REMARKS
01A	3/21/94	1725	EG3-EAFB2-1	1	X	X	X	(G) C	AIR	1.5 Hg
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		

Relinquished by: (Signature)	Date/Time	Recieved for Laboratory by:	Date/Time	Remarks:
Steve A. Ratzlaff	3/23/94 9:10	ATL	3/24/94 9:30	Custody seals not present - samples rec'd at room temp in good condition GJW 3/24/94

Airbill #: 8935551623

G-Grab
C-Composite

Distribution Original Accompanies Shipment. Yellow Copy Returned With Report.
Pink Retained by Laboratory. Gold Retained by Sender.

File 722409.43F

9403205 Engineering Science

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

copy to
Jim Awosika
ES - Atlanta

WORK ORDER #: 9403205

Work Order Summary

CLIENT: Ms. Diana Schenfeld
Engineering Science
1700 Broadway, Suite 900
Denver, CO 80290

BILL TO: Same

PHONE: 303-831-8100
FAX: 303-831-8208
DATE RECEIVED: 3/24/94
DATE COMPLETED: 3/30/94

INVOICE # 3286
P.O. # 722409.43040
PROJECT # 722409.43040 Eglin AFB
AMOUNT$: $130.00

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	PRICE
01A	EG3-EAFB2-1	TO-3	1.5 "Hg	$120.00
02A	Lab Blank	TO-3	NA	NC

Misc. Charges	1 Liter SUMMA Canister Preparation (1) @ $10.00 each.	$10.00

CERTIFIED BY: Linda J. Fruman
Laboratory Director

DATE: 3/30/94

180 BLUE RAVINE ROAD, SUITE B • FOLSOM, CA 95630
(916) 985-1000 • FAX (916) 985-1020

AIR TOXICS LTD.

SAMPLE NAME: EG3-EAFB2-1
ID#: 9403205-01A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	**6032422**	**Date of Collection:**	**3/21/94**
Dil. Factor:	**2.1**	**Date of Analysis:**	**3/24/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.002	0.007	Not Detected	Not Detected
Toluene	0.002	0.008	Not Detected	Not Detected
Ethyl Benzene	0.002	0.009	Not Detected	Not Detected
Total Xylenes	0.002	0.009	0.027	0.12

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	**6032422**	**Date of Collection:**	**3/21/94**
Dil. Factor:	**2.1**	**Date of Analysis:**	**3/24/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	0.021	0.14	2.0	13
C2 - C4** Hydrocarbons	0.021	0.038	Not Detected	Not Detected

*TPH referenced to Jet Fuel (MW=156)
**C2 - C4 Hydrocarbons referenced to Propane (MW=44)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank
ID#: 9403205-02A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6032406	Date of Collection: NA
Dil. Factor:	1.0	Date of Analysis: 3/24/94

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.001	0.003	Not Detected	Not Detected
Toluene	0.001	0.004	Not Detected	Not Detected
Ethyl Benzene	0.001	0.004	Not Detected	Not Detected
Total Xylenes	0.001	0.004	Not Detected	Not Detected

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6032406	Date of Collection: NA
Dil. Factor:	1.0	Date of Analysis: 3/24/94

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	0.010	0.065	Not Detected	Not Detected
C2 - C4** Hydrocarbons	0.010	0.018	Not Detected	Not Detected

*TPH referenced to Jet Fuel (MW=156)
**C2 - C4 Hydrocarbons referenced to Propane (MW=44)

Container Type: NA

ENGINEERING SCIENCE
CHAIN OF CUSTODY RECORD

9403205
0292

ES JOB NO.	PROJECT NAME/LOCATION
722409.43040	EGLIN AFB, HURLBURT FTA (EG3)

SAMPLER(S): (Signature)
STEVE RATZLAFF

SHIP TO:
AIR TOXICS LTD.
180 BLUE RAVINE RD. STE. B
FOLSOM, CA 95630
ATTN: ALEXIS MERYDITH

PRESERVATIVE REQUIRED

ANALYSES REQUIRED

	DATE	TIME	SAMPLE DESCRIPTION	NUMBER OF CONTAINERS	TO-3 (EPA)	BTEX & TPH	CA-CS	SAMPLE TYPE	MATRIX	REMARKS
01A	3/21/94	1725	EG3-EAFB2-1	1	X	X	X	G C	AIR	1.5 L/M
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		
								G C		

Relinquished by: (Signature)	Date/Time	Recieved for Laboratory by:	Date/Time	Remarks:
Steve A. Ratzlaff	3/23/94 9:10	ATL	3/24/94 9:30	Custody seals not present - samples rec'd at room temp in good condition GJW 3/24/94

Airbill #: 8935551623

Distribution Original Accompanies Shipment. Yellow Copy Returned With Report.
Pink Retained by Laboratory. Gold Retained by Sender.

G-Grab
C-Composite

APPENDIX B

ANALYTICAL DATA FOR AIR SAMPLES AT FT-28

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9403143

Work Order Summary

CLIENT: Ms. Diana Schenfeld
Engineering Science
1700 Broadway, Suite 900
Denver, CO 80290

BILL TO: Same

PHONE: 303-831-8100
FAX: 303-831-8208
DATE RECEIVED: 3/17/94
DATE COMPLETED: 3/24/94

INVOICE # 3239
P.O. # DE268.43.04
PROJECT # DE268.43.04 Eglin AFB
AMOUNT$: $390.00

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	PRICE
01A	EG2-VW	TO-3	1.0 "Hg	$120.00
02A	EG2-MPA-Shallow	TO-3	1.0 "Hg	$120.00
03A	EG2-MPC-Deep	TO-3	1.5 "Hg	$120.00
04A	Lab Blank	TO-3	NA	NC

Misc. Charges	1 Liter SUMMA Canister Preparation (3) @ $10.00 each.	$30.00

CERTIFIED BY: Linda D. Furman
Laboratory Director

DATE: 3/24/94

180 BLUE RAVINE ROAD, SUITE B • FOLSOM, CA 95630
(916) 985-1000 • FAX (916) 985-1020

AIR TOXICS LTD.

SAMPLE NAME: EG2-VW
ID#: 9403143-01A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name: 6031711 **Date of Collection: 3/16/94**
Dil. Factor: 260 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.26	0.84	94	300
Toluene	0.26	1.0	52	200
Ethyl Benzene	0.26	1.1	20	88
Total Xylenes	0.26	1.1	76	340

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name: 6031711 **Date of Collection: 3/16/94**
Dil. Factor: 260 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	2.6	17	11000	71000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: EG2-MPA-Shallow
ID#: 9403143-02A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name: 6031712 **Date of Collection: 3/16/94**
Dil. Factor: 260 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.26	0.84	93	300
Toluene	0.26	1.0	24	92
Ethyl Benzene	0.26	1.1	20	88
Total Xylenes	0.26	1.1	64	280

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name: 6031712 **Date of Collection: 3/16/94**
Dil. Factor: 260 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	2.6	17	11000	71000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: EG2-MPC-Deep
ID#: 9403143-03A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6031713	Date of Collection: 3/16/94
Dil. Factor:	530	Date of Analysis: 3/17/94

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.53	1.7	250	810
Toluene	0.53	2.0	460	1800
Ethyl Benzene	0.53	2.3	47	210
Total Xylenes	0.53	2.3	220	970

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031713	Date of Collection: 3/16/94
Dil. Factor:	530	Date of Analysis: 3/17/94

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	5.3	34	26000	170000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank
ID#: 9403143-04A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name: 6031705 **Date of Collection: NA**
Dil. Factor: 1.0 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.001	0.003	Not Detected	Not Detected
Toluene	0.001	0.004	Not Detected	Not Detected
Ethyl Benzene	0.001	0.004	Not Detected	Not Detected
Total Xylenes	0.001	0.004	Not Detected	Not Detected

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name: 6031705 **Date of Collection: NA**
Dil. Factor: 1.0 **Date of Analysis: 3/17/94**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	0.010	0.065	Not Detected	Not Detected

*TPH referenced to Jet Fuel (MW=156)

Container Type: NA

9403143

FIGURE B.3

CHAIN OF CUSTODY RECORD

Page 1 of 1

ENGINEERING-SCIENCE, INC.
1700 BROADWAY, SUITE 900
DENVER, COLORADO 80290
831-8100

AFCEE BIOVENTING PILOT TESTS

Base: EGLIN AFB

Site: OLD EGLIN FTA

Job No.
268.43.04 ##

Sampler(s): (Signature)
OLA AWOSIKA
STEVE RATCLIFF

Preservative: NONE

Analysis Required: TO-3(EPA) | BTEX & TPH

Ship To:
Air Toxics Ltd.
180 Blue Ravine Rd.
Suite B
Folsom California 95630
Attn: Alexis Merydith

Date	Time	Sample Description	Lab I.D.	No. of Containers	TO-3(EPA)	BTEX & TPH	Sample Type	Matrix	Remarks
6/94	1000	EG2 - VW		1	X	X	@ C	AIR	1" Hg
6/94	1020	EG2 - MPA - SHALLOW		1	X	X	@ C	AIR	1" Hg
6/94	1015	EG2 - MPC - DEEP		1	X	X	@ C	AIR	1.5" Hg
							@ C	AIR	
							@ C	AIR	
							@ C	AIR	
							@ C	AIR	
							@ C	AIR	
							@ C	AIR	
							@ C	AIR	
							@ C	AIR	
							@ C	AIR	
							@ C	AIR	
							@ C	AIR	
							@ C	AIR	
							@ C	AIR	

01A
02A
03A

Relinquished by: (Signature) — Date / Time: 3/14/94 1645 — Received for Laboratory by: (Signature) ATC — Date / Time: 3/17/94 9:45

Relinquished by: (Signature) — Date / Time — Received for Laboratory by: (Signature)

Remarks: Custody seals not present ##

G - Grab Sample, C - Composite Sample

Distribution: Original Accompanies Shipment. Copies to: Coordinator Field Files

Federal Express Number:

ENGINEERING-SCIENCE, INC.
1700 Broadway, Suite 900 - Denver, Colorado
(303) 831-8100

[redacted]

APPENDIX C

ANALYTICAL DATA FOR SOILS AT FT-28 AND FT-39

SOIL

0100001

FINAL REPORT FOR SAMPLES RECEIVED: 03/07/94

FOR

EGLIN AFB
SITE: OLD EGLIN FTA

PACE PROJECT NUMBER: 730307502

copy for
① Ola Awosika
ES - Atlanta
② Battelle - Lisa
③ Original to Document Control

PREPARED FOR:

ENGINEERING SCIENCE, INC.
1700 BROADWAY
SUITE 900
DENVER, COLORADO 80290

APRIL, 1994

PREPARED BY:

PACE INCORPORATED
5702 BOLSA AVENUE
HUNTINGTON BEACH, CALIFORNIA 92649

CONTRACT NO. DE-268.19.06.08

TABLE OF CONTENTS

SECTION I

COVER LETTER

pace®
INCORPORATED
THE ASSURANCE OF QUALITY

April 7, 1994

Mr. Doug Downey
ENGINEERING SCIENCE - DENVER
1700 Broadway, Suite 900
Denver, Colorado 80290

Re: **PACE Project No. 740307.502**
Client Reference: AFCEE-EGLIN AFB

Dear Mr. Downey:

Enclosed is the report of laboratory analysis for three (3) soil samples received on March 7, 1994. These samples were delivered by Federal Express and received by PACE-Huntington Beach. The Chain of Custody indicated these samples to be analyzed for pH, alkalinity, iron, moisture content, BTEX, and TRPH using methods SW9045, A403(M), SW7380, D2216, SW8020, and E418.1, respectively. Total Kjedahl Nitrogen, phosphate and soil classification were subcontracted out to Sequoia Analytical in Redwood City, CA. All results are reported on a dry-weight basis.

A glossary of acronyms and symbols are found in Section VI.

If you have any questions regarding this report, please feel free to contact us.

Sincerely,

Melanie R. Concepcion

Melanie R. Concepcion
Project Manager
PACE-Southern California

THESE DATA HAVE BEEN REVIEWED AND ARE APPROVED FOR RELEASE.

for

Kenneth D. Faust
Regional Director
PACE-Southern California

740307.502

5702 Bolsa Avenue
Huntington Beach, CA 92649
TEL: 714-892-2565
FAX: 714-890-4032

SECTION II

CHAIN OF CUSTODY

730307.502

FIGURE B.2

CHAIN OF CUSTODY RECORD

ENGINEERING-SCIENCE, INC.
1700 BROADWAY, SUITE 900
DENVER, COLORADO 80290
303-831-8100

AFCEE BIOVENTING PILOT TESTS

Base: EGLIN AFB

Site: OLD EGLIN FTA (EG2)

ES Job No.: DE268.43.08

Sampler(s): (Signature)

OLA A. AWOSIKA

Preservative: NONE | HOLD AT 4C | NONE

Analysis Required

Ship To:
ATTENTION: MS. MELANIE BALCERZONE
PACE LABORATORY
~~11 Digital Drive~~ 5782 BOLSA AV.
~~Novato, California 94949~~ HUNTINGTON BEACH
~~Attn: Stacy Hoek~~
~~(415) 883-6100~~
(714) 892-2565

Date	Time	Sample Description	Lab I.D.	No. of Contrs.	ISW 8015 (PH)	EA 420 (ALKA)	ISW 7380 (IRON)	ISW 846 (MOIST)	ISW 8020 (BTEX)	E 418.1 (TRPH)	E 351.2 (TKN)	E 365.3 (PHOS)	IUCM (CLASS)	Sample Type	Matrix	Remarks
3/3/94	1400	EG2 - VW - 3'		3			✓			✓		✓		@ C	SOIL	
		"												G C	SOIL	
3/4/94	1030	EG2 - VMPA - 39'		3			✓			✓		✓		@ C	SOIL	
														G C	SOIL	
3/4/94	1300	EG2 - VMPB - 2-4'		3			✓			*✓		✓		@ C	SOIL	*✓ ANALYZE PER
														G C	SOIL	OLA A. 'S REQUEST
														G C	SOIL	MC 3/30/94
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	

Relinquished by: (Signature)

Date / Time: 3/4/94 1800

Received for Laboratory by: (Signature) VIA FED EX

Date / Time: 3-4

Relinquished by: (Signature) FED EX

Date / Time: 3-7 0956

Received for Laboratory by: (Signature) (PACE)

Date / Time: 3-7 0956

Remarks: RECD @ 4.3°C GW 3-7-94

C - Grab Sample, C - Composite Sample

Distribution: Original Accompanies Shipment. Copies to: Coordinator Field Files

Federal Express Number: 7290988110

Airbill Number: 7290988110

ENGINEERING-SCIENCE, INC.
1700 Broadway, Suite 900 • Denver, Colorado
(303) 831-8100

OCRBOIL

7290988110

0100106

SECTION III

CROSS REFERENCE TABLE

FIELD/LABORATORY IDENTIFIER CROSS-REFERENCE TABLE

PACE PROJECT NUMBER: 740307502

DATE COLLECTED	DATE RECEIVED	PACE SAMPLE IDENTIFIER	FIELD SAMPLE IDENTIFIER
03/03/94	03/07/94	750031647	EG2-VW-3'
03/04/94	03/07/94	750031655	EG2-VMPA-39'
03/04/94	03/07/94	750031663	EG2-VMPB-2-4'

SECTION IV

INORGANIC SECTION

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

DATA PACKAGE

REPORT OF LABORATORY ANALYSIS

EPA Method:	E418.1	AFIID:	EGLIN
Ext/Prep Method:	SW3550	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031647	Contract/Donum:	NA
Batch ID:	7511962		
Client Sample ID:	EG2-VW-3'		
Date Collected:	03-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	12-Mar-94	SACODE:	N1
Date Analyzed:	14-Mar-94		
		Percent Moisture:	6.0
Matrix:	Soil	Dilution Factor:	25

Compound	(MG/KG) Result		PQL
Total Petroleum Hydrocarbons	2210		133
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	E418.1	AFIID:	EGLIN
Ext/Prep Method:	SW3550	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031655	Contract/Donum:	NA
Batch ID:	7511962		
Client Sample ID:	EG2-VMPA-39'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	12-Mar-94	SACODE:	N1
Date Analyzed:	14-Mar-94		
		Percent Moisture:	7.0
Matrix:	Soil	Dilution Factor:	25

Compound	(MG/KG) Result		PQL
Total Petroleum Hydrocarbons	3370		134
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	E418.1	AFIID:	EGLIN
Ext/Prep Method:	SW3550	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031663	Contract/Donum:	NA
Batch ID:	7511962		
Client Sample ID:	EG2-VMPB-2-4'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	12-Mar-94	SACODE:	N1
Date Analyzed:	14-Mar-94		
		Percent Moisture:	7.6
Matrix:	Soil	Dilution Factor:	50

Compound	(MG/KG) Result		PQL
Total Petroleum Hydrocarbons	6610		270
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	E418.1	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	LABQC
		Project:	QC
PACE Sample ID:	758270217	Contract/Donum:	NA
Batch ID:	7511962		
Client Sample ID:	Method Blank		
Date Collected:	NA	SBD:	0
Date Received:	NA	SED:	0
Date Ext/Prep:	12-Mar-94	SACODE:	LB1
Date Analyzed:	14-Mar-94		
		Percent Moisture:	0
Matrix:	Soil/Solid Quality Control Matrix	Dilution Factor:	1

Compound	(MG/KG) Result		PQL
Total Petroleum Hydrocarbons	ND		5
End Of Results For Method			

LAB Q.C. BATCH/FIELD I.D.

CROSS-REFERENCE TABLE

PACE Project Number: 740307502

QC BATCH IDENTIFIER	DATE ANALYZED	ANALYTICAL METHOD	PACE SAMPLE IDENTIFIER	FIELD SAMPLE IDENTIFIER
7511962	14-MAR-94	E418.1	750031655	EG2-VMPA-39'
7511962	14-MAR-94	E418.1	750031663	EG2-VMPB-2-4'
7511962	14-MAR-94	E418.1	750031647	EG2-VW-3'

QUALITY CONTROL REPORT

Solid X
Water _

Analytical Method: E418.1
Analytical Batch ID: 7511962
Date of Analysis: 03/14/94
Instrument ID: IR #1
Calibration Reference #: 02/18/94

Field Sample ID: EG2-VW-3' | EG2-VMPA-39' | EG2-VMPB-2-4'

Quality Control Samples	Target Concentrations (MG/KG)	Recovery (%)			RPD (%)		Corrective Action
		Spike	Spike Duplicate	Control Limits	Results	Control Limits	
Laboratory Control Sample List Of Analytes							
Total Petroleum Hydrocarbons	208	88	91	75-125	3	50	

IRON DATA PACKAGE

REPORT OF LABORATORY ANALYSIS

EPA Method:	SW7380	AFIID:	EGLIN
Ext/Prep Method:	SW3050	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031647	Contract/Donum:	NA
Batch ID:	7512062		
Client Sample ID:	EG2-VW-3'		
Date Collected:	03-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	16-Mar-94	SACODE:	N1
Date Analyzed:	21-Mar-94		
		Percent Moisture:	6.0
Matrix:	Soil	Dilution Factor:	10

Compound	(MG/KG) Result		PQL
Iron	2560		200
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	SW7380	AFIID:	EGLIN
Ext/Prep Method:	SW3050	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031655	Contract/Donum:	NA
Batch ID:	7512062		
Client Sample ID:	EG2-VMPA-39'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	16-Mar-94	SACODE:	N1
Date Analyzed:	21-Mar-94		
		Percent Moisture:	7.0
Matrix:	Soil	Dilution Factor:	1

Compound	(MG/KG) Result		PQL
Iron	135		20
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	SW7380	AFIID:	EGLIN
Ext/Prep Method:	SW3050	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031663	Contract/Donum:	NA
Batch ID:	7512062		
Client Sample ID:	EG2-VMPB-2-4'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	16-Mar-94	SACODE:	N1
Date Analyzed:	21-Mar-94		
		Percent Moisture:	7.6
Matrix:	Soil	Dilution Factor:	8

Compound	(MG/KG) Result		PQL
Iron	2100		170
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

000021

EPA Method:	SW7380	AFIID:	EGLIN
Ext/Prep Method:	SW3050	LOCID:	LABQC
		Project:	QC
PACE Sample ID:	758272821	Contract/Donum:	NA
Batch ID:	7512062		
Client Sample ID:	Method Blank		
Date Collected:	NA	SBD:	0
Date Received:	NA	SED:	0
Date Ext/Prep:	21-Mar-94	SACODE:	LB1
Date Analyzed:	21-Mar-94		
		Percent Moisture:	0
Matrix:	Soil/Solid Quality Control Matrix	Dilution Factor:	1

Compound	(MG/KG) Result		PQL
Iron	ND		20
End Of Results For Method			

LAB Q.C. BATCH/FIELD I.D.

CROSS-REFERENCE TABLE

PACE Project Number: 740307502

QC BATCH IDENTIFIER	DATE ANALYZED	ANALYTICAL METHOD	PACE SAMPLE IDENTIFIER	FIELD SAMPLE IDENTIFIER
7512062	21-MAR-94	SW7380	750031655	EG2-VMPA-39'
7512062	21-MAR-94	SW7380	750031663	EG2-VMPB-2-4'
7512062	21-MAR-94	SW7380	750031647	EG2-VW-3'

QUALITY CONTROL REPORT

Solid X
Water _

Analytical Method: SW7380
Analytical Batch ID: 7512062
Date of Analysis: 03/21/94
Instrument ID: FAA #1
Calibration Reference #: 03/21/94

Field Sample ID: EG2-VW-3' | EG2-VMPA-39' | EG2-VMPB-2-4'

Quality Control Samples	Target Concentrations (MG/KG)	Recovery (%)			RPD (%)		Corrective Action
		Spike	Spike Duplicate	Control Limits	Results	Control Limits	
Laboratory Control Sample List Of Analytes							
Iron	500	105	107	80-120	2	50	

0010123

WET CHEMISTRY DATA PACKAGE

REPORT OF LABORATORY ANALYSIS

EPA Method:	SM403(M)	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031647	Contract/Donum:	NA
Batch ID:	7512016		
Client Sample ID:	EG2-VW-3'		
Date Collected:	03-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	16-Mar-94	SACODE:	N1
Date Analyzed:	16-Mar-94		
		Percent Moisture:	6.0
Matrix:	Soil	Dilution Factor:	1

Compound	(MG/KG) Result		PQL
Alkalinity, Total (As CaCO3)	354		42
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	SM403(M)	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031655	Contract/Donum:	NA
Batch ID:	7512016		
Client Sample ID:	EG2-VMPA-39'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	16-Mar-94	SACODE:	N1
Date Analyzed:	16-Mar-94		
		Percent Moisture:	7.0
Matrix:	Soil	Dilution Factor:	1

Compound	(MG/KG) Result		PQL
Alkalinity, Total (As CaCO3)	ND		42
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	SM403(M)	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031663	Contract/Donum:	NA
Batch ID:	7512016		
Client Sample ID:	EG2-VMPB-2-4'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	16-Mar-94	SACODE:	N1
Date Analyzed:	16-Mar-94		
		Percent Moisture:	7.6
Matrix:	Soil	Dilution Factor:	1

Compound	(MG/KG) Result		PQL
Alkalinity, Total (As CaCO3)	128		43
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	SM403(M)	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	LABQC
		Project:	QC
PACE Sample ID:	758271744	Contract/Donum:	NA
Batch ID:	7512016		
Client Sample ID:	Method Blank		
Date Collected:	NA	SBD:	0
Date Received:	NA	SED:	0
Date Ext/Prep:	16-Mar-94	SACODE:	LB1
Date Analyzed:	16-Mar-94		
		Percent Moisture:	0
Matrix:	Soil/Solid Quality Control Matrix	Dilution Factor:	1

Compound	(MG/KG) Result		PQL
Alkalinity, Total (As CaCO3)	ND		40
End Of Results For Method			

LAB Q.C. BATCH/FIELD I.D.

CROSS-REFERENCE TABLE

PACE Project Number: 740307502

QC BATCH IDENTIFIER	DATE ANALYZED	ANALYTICAL METHOD	PACE SAMPLE IDENTIFIER	FIELD SAMPLE IDENTIFIER
7512016	16-MAR-94	SM403(M)	750031655	EG2-VMPA-39'
7512016	16-MAR-94	SM403(M)	750031663	EG2-VMPB-2-4'
7512016	16-MAR-94	SM403(M)	750031647	EG2-VW-3'

QUALITY CONTROL REPORT

Analytical Method: SM403(M)
Analytical Batch ID: 7512016
Date of Analysis: 03/16/94
Instrument ID: NA
Calibration Reference #: 03/16/94

Solid X
Water _

Field Sample ID: EG2-VW-3' | EG2-VMPA-39' | EG2-VMPB-2-4'

Quality Control Samples	Target Concentrations (MG/KG)	Recovery (%)			RPD (%)		Corrective Action
		Spike	Spike Duplicate	Control Limits	Results	Control Limits	
Laboratory Control Sample List Of Analytes							
Alkalinity, Total (As CaCO3)	1760	97	95	75-125	2	50	

REPORT OF LABORATORY ANALYSIS

EPA Method:	D2216	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031647	Contract/Donum:	NA
Batch ID:	7511886		
Client Sample ID:	EG2-VW-3'		
Date Collected:	03-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	09-Mar-94	SACODE:	N1
Date Analyzed:	09-Mar-94		
		Percent Moisture:	6.0
Matrix:	Soil	Dilution Factor:	1

Compound	(PERCENT) Result		PQL
Moisture, Percent	6		NA
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	D2216	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031655	Contract/Donum:	NA
Batch ID:	7511886		
Client Sample ID:	EG2-VMPA-39'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	09-Mar-94	SACODE:	N1
Date Analyzed:	09-Mar-94		
		Percent Moisture:	7.0
Matrix:	Soil	Dilution Factor:	1

Compound	(PERCENT) Result		PQL
Moisture, Percent	7		NA
End Of Results For Method			

Table 4.1(8)

REPORT OF LABORATORY ANALYSIS

0010033

EPA Method:	D2216	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031663	Contract/Donum:	NA
Batch ID:	7511886		
Client Sample ID:	EG2-VMPB-2-4'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	09-Mar-94	SACODE:	N1
Date Analyzed:	09-Mar-94		
		Percent Moisture:	7.6
Matrix:	Soil	Dilution Factor:	1

Compound	(PERCENT) Result		PQL
Moisture, Percent	7.6		NA
End Of Results For Method			

Table 4.1(9)

REPORT OF LABORATORY ANALYSIS

EPA Method:	D2216	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	LABQC
		Project:	QC
PACE Sample ID:	758268646	Contract/Donum:	NA
Batch ID:	7511886		
Client Sample ID:	Method Blank		
Date Collected:	NA	SBD:	0
Date Received:	NA	SED:	0
Date Ext/Prep:	09-Mar-94	SACODE:	LB1
Date Analyzed:	09-Mar-94		
		Percent Moisture:	0
Matrix:	Soil/Solid Quality Control Matrix	Dilution Factor:	1

Compound	(PERCENT) Result		PQL
Moisture, Percent	ND		NA
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	SW9045	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031647	Contract/Donum:	NA
Batch ID:	7511924		
Client Sample ID:	EG2-VW-3'		
Date Collected:	03-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	10-Mar-94	SACODE:	N1
Date Analyzed:	10-Mar-94		
		Percent Moisture:	6.0
Matrix:	Soil	Dilution Factor:	1

Compound	(PH UNITS) Result		PQL
pH	8.2		NA
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	SW9045	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031655	Contract/Donum:	NA
Batch ID:	7511924		
Client Sample ID:	EG2-VMPA-39'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	10-Mar-94	SACODE:	N1
Date Analyzed:	10-Mar-94		
		Percent Moisture:	7.0
Matrix:	Soil	Dilution Factor:	1

Compound	(PH UNITS) Result		PQL
pH	6.6		NA
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	SW9045	AFIID:	EGLIN
Ext/Prep Method:	METHOD	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031663	Contract/Donum:	NA
Batch ID:	7511924		
Client Sample ID:	EG2-VMPB-2-4'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	10-Mar-94	SACODE:	N1
Date Analyzed:	10-Mar-94		
		Percent Moisture:	7.6
Matrix:	Soil	Dilution Factor:	1

Compound	(PH UNITS) Result		PQL
pH	7.8		NA
End Of Results For Method			

SECTION V

ORGANICS SECTION

SW8020 (BTEX) DATA PACKAGE

REPORT OF LABORATORY ANALYSIS

EPA Method:	SW8020	AFIID:	EGLIN
Ext/Prep Method:	SW5030	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031647	Contract/Donum:	NA
Batch ID:	7511968		
Client Sample ID:	EG2-VW-3'		
Date Collected:	03-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	08-Mar-94	SACODE:	N1
Date Analyzed:	08-Mar-94		
		Percent Moisture:	6
Matrix:	Soil	Dilution Factor:	10000

Compound	(MG/KG) Result		PQL
Benzene	10		5.3
Toluene	21		5.3
Ethylbenzene	24		5.3
Xylenes, Total	72		7.4
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	SW8020	AFIID:	EGLIN
Ext/Prep Method:	SW5030	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031655	Contract/Donum:	NA
Batch ID:	7511968		
Client Sample ID:	EG2-VMPA-39'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	08-Mar-94	SACODE:	N1
Date Analyzed:	08-Mar-94		
		Percent Moisture:	7
Matrix:	Soil	Dilution Factor:	125

Compound	(MG/KG) Result		PQL
Benzene	0.15		0.067
Toluene	0.19		0.067
Ethylbenzene	0.4		0.067
Xylenes, Total	2.5		0.094
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	SW8020	AFIID:	EGLIN
Ext/Prep Method:	SW5030	LOCID:	NA
		Project:	740307502
PACE Sample ID:	750031663	Contract/Donum:	NA
Batch ID:	7511968		
Client Sample ID:	EG2-VMPB-2-4'		
Date Collected:	04-Mar-94	SBD:	0
Date Received:	07-Mar-94	SED:	0
Date Ext/Prep:	08-Mar-94	SACODE:	N1
Date Analyzed:	08-Mar-94		
		Percent Moisture:	7.6
Matrix:	Soil	Dilution Factor:	5000

Compound	(MG/KG) Result		PQL
Benzene	ND		2.7
Toluene	ND		2.7
Ethylbenzene	9.9		2.7
Xylenes, Total	22		3.8
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

EPA Method:	SW8020	AFIID:	EGLIN
Ext/Prep Method:	SW5030	LOCID:	LABQC
		Project:	QC
PACE Sample ID:	758270500	Contract/Donum:	NA
Batch ID:	7511968		
Client Sample ID:	Method Blank		
Date Collected:	NA	SBD:	0
Date Received:	NA	SED:	0
Date Ext/Prep:	07-Mar-94	SACODE:	LB1
Date Analyzed:	07-Mar-94		
		Percent Moisture:	0
Matrix:	Soil/Solid Quality Control Matrix	Dilution Factor:	1

Compound	(MG/KG) Result		PQL
Benzene	ND		0.0005
Toluene	ND		0.0005
Ethylbenzene	ND		0.0005
Xylenes, Total	ND		0.0007
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS
SURROGATE PERCENT RECOVERY REPORT

EPA Method: SW8020
Matrix: Soil
Batch ID: 7511968

AFB: VNBRG
Project: 740307502

Client Sample ID	PACE Sample No.	S1	Out of Limits
EG2-VW-3'	750031647	94	0
EG2-VMPA-39'	750031655	79	0
EGS-VMPB-2-4'	750031663	92	0
Method Blank	758270500	100	0
Laboaratory Control	758270535	102	0
LCS Duplicate	758270543	100	0

QC LIMITS

S1 = a,a,a-Trifluorotoluene 60-140

* = Values outside of Q.C. Limits
D = Surrogate diluted out

LAB Q.C. BATCH/FIELD I.D.

CROSS-REFERENCE TABLE

PACE Project Number: 740307502

QC BATCH IDENTIFIER	DATE ANALYZED	ANALYTICAL METHOD	PACE SAMPLE IDENTIFIER	FIELD SAMPLE IDENTIFIER
7511968	08-MAR-94	SW8020	750031655	EG2-VMPA-39'
7511968	08-MAR-94	SW8020	750031663	EG2-VMPB-2-4'
7511968	08-MAR-94	SW8020	750031647	EG2-VW-3'

QUALITY CONTROL REPORT

Solid X
Water _

Analytical Method: SW8020
Analytical Batch ID: 7511968
Date of Analysis: 03/07/94
Instrument ID: GC #4
Calibration Reference #: 03/01/94

Field Sample ID: EG2-VW-3' | EG2-VMPA-39' | EG2-VMPB-2-4'

Quality Control Samples	Target Concentrations (MG/KG)	Recovery (%) Spike	Spike Duplicate	Control Limits	RPD (%) Results	Control Limits	Corrective Action
Laboratory Control Sample List Of Analytes							
Benzene	0.02	103	94	73-125	9	18	
Toluene	0.02	105	96	77-123	9	17	
Ethylbenzene	0.02	107	99	72-125	8	15	
Xylenes, Total	0.06	108	100	76-123	8	16	

010046

PACE Project: 740307.502

Table 4.4.4

SECTION VI

GLOSSARY OF ACRONYMS AND SYMBOLS

GLOSSARY OF ACRONYMS AND SYMBOLS

ACRONYM/SYMBOL	DEFINITION
MDL	Method Detection Limit
NA	Not applicable.
NC	Not calculated.
ND	Not Detected
RPD	Relative Percent Difference.
D	Detectable.
J	Detected but below the PQL; therefore, result is an estimated concentration.
X	Please see NCR Ref. No.:___.

SECTION VII

SUBCONTRACTED ANALYSIS

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
1900 Bates Avenue, Suite L, Concord, CA 94520, (510) 686-9600, FAX (510) 686-9689
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Pace	Client Project ID:	EGLIN AFB	Sampled:	Mar 7, 1994
5702 Bolsa Ave.	Sample Descript:	Soil	Received:	Mar 8, 1994
Huntington Beach, CA 92649	Analysis for:	Total Kjeldahl Nitrogen		
Attention: Melanie Concepcion	First Sample #:	4C62601	Analyzed:	Mar 16, 1994
			Reported:	Mar 23, 1994

LABORATORY ANALYSIS FOR: Total Kjeldahl Nitrogen

Sample Number	Sample Description	Detection Limit mg/kg	Sample Result mg/kg
4C62601	EG2-VW-3'(3-3)	43	N.D.
4C62602	EG2-VMPA-39'(3-4)	43	N.D.
4C62603	EG2-VMPB-2-4'(3-4)	43	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Tom Fowler
Project Manager

Please Note:
Sample results are reported on a dry weight basis. % moistures faxed by client 3-22-94.

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
1900 Bates Avenue, Suite L, Concord, CA 94520, (510) 686-9600, FAX (510) 686-9689
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Pace	Client Project ID:	EGLIN AFB	Sampled:	Mar 7, 1994
5702 Bolsa Ave.	Sample Descript:	Soil	Received:	Mar 8, 1994
Huntington Beach, CA 92649	Analysis for:	Phosphorus		
Attention: Melanie Concepcion	First Sample #:	4C62601	Analyzed:	Mar 17, 1994
			Reported:	Mar 23, 1994

LABORATORY ANALYSIS FOR: Phosphorus

Sample Number	Sample Description	Detection Limit mg/kg	Sample Result mg/kg
4C62601	EG2-VW-3'(3-3)	1.1	28
4C62602	EG2-VMPA-39'(3-4)	1.1	29
4C62603	EG2-VMPB-2-4'(3-4)	1.1	15

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Tom Fowler
Project Manager

Please Note:
Sample results are reported on a dry weight basis. % moisture faxed by client 3-22-94.
Samples were analyzed by 365.2.

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
1900 Bates Avenue, Suite L, Concord, CA 94520, (510) 686-9600, FAX (510) 686-9689
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Pace
5702 Bolsa Ave.
Huntington Beach, CA 92649
Attention: Melanie Concepcion

Client Project ID: EGLIN AFB
Matrix: Solid

QC Sample Group: 4C62601-03

Reported: Mar 23, 1994

QUALITY CONTROL DATA REPORT

ANALYTE	Total Kjeldahl Nitrogen	Phosphorous
Method:	EPA 351.4	EPA 365.2
Analyst:	S. Flynn	K. Newberry
MS/MSD Batch#:	4034751	4C27305
Date Prepared:	3/16/94	3/15/94
Date Analyzed:	3/16/94	3/15/94
Instrument I.D.#:	N/A	-
Conc. Spiked:	4000 mg/kg	100 mg/kg
Matrix Spike % Recovery:	109	90
Matrix Spike Duplicate % Recovery:	109	100
Relative % Difference:	0.0	11

LCS Batch#:		LCS031794
Date Prepared:		3/17/94
Date Analyzed:		3/17/94
Instrument I.D.#:		-
LCS % Recovery:		99
% Recovery Control Limits:	60-140	60-140

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

SEQUOIA ANALYTICAL

Tom Fowler
Project Manager

000053

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: **ASTM D422-63**
Analyzed: 3/16/94
Lab ID: 9403626-01
Client ID: EG2-VW-3'
Sample Description: SOIL

SIEVE TEST

A. Total weight of sample:	212.91	g
B. Weight retained in No.10 sieve:	2.35	g
C. % passing No.10 sieve:	98.90	%

Sieve test for weight retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.26	0.12	0.12	99.88
No. 10	2.09	0.98	1.10	98.90
No. 200	193.33	90.80	91.91	8.09

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE DIAM. in mm (S)	% SUSPENDED (P)
2	20	15	11	14.5	0.0368	9.5
5	20	14	10	14.7	0.0234	8.6
10	20	13	9	14.8	0.0166	7.7
15	20	13	9	14.8	0.0136	7.7
25	20	12	8	15	0.0106	6.9
40	20	12	8	15	0.0084	6.9
60	20	12	8	15	0.0068	6.9
90	20	12	8	15	0.0056	6.9
120	20	11	7	15.2	0.0049	6.0
1440	20	10	6	15.3	0.0014	5.2

Weight of soil used in hydrometer test (D):	115	g
Hydroscopic moisture correction factor (G):	1	
Specific gravity (Assumed):	2.65	
Dispersing agent correction factor (E):	3	
Meniscus correction factor (F):	1	
Temp./Spec. gravity dependant constant (K):	0.01365	

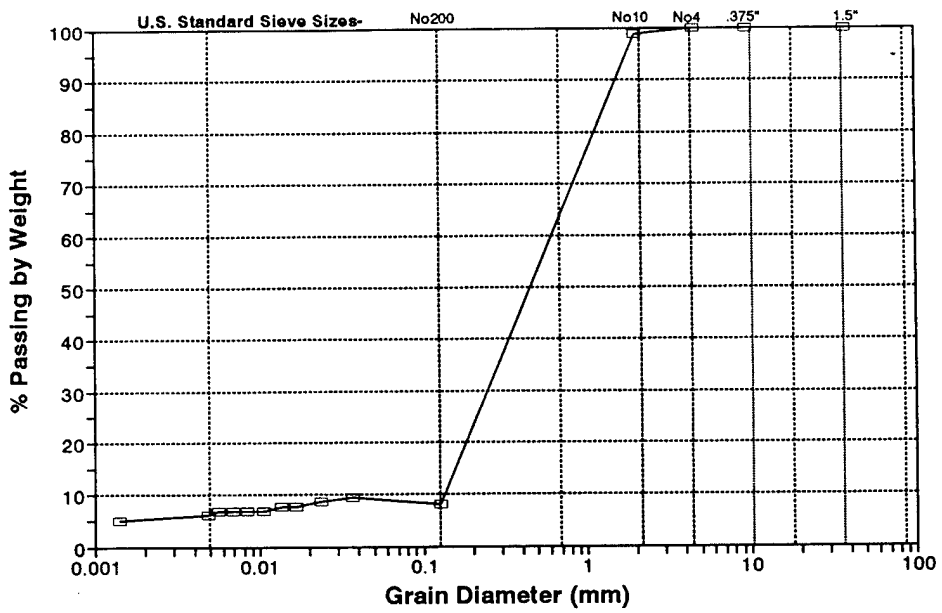
Formulas:

R = H - E - F
S = K[SQRT(L/T)]
P = (R/W)100
W = (J x 100)/C
J = D x G

000054

Method: **ASTM D422-63**
Analyzed: 3/16/94
Lab ID: 9403626-01

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coars	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	99.88
2	98.90
0.127	8.09
0.0368	9.46
0.0234	8.60
0.0166	7.74
0.0136	7.74
0.0106	6.88
0.0084	6.88
0.0068	6.88
0.0056	6.88
0.0049	6.02
0.0014	5.16

Sample Composition:

(1) Gravel, passing 3-in. and retained on No. 4 sieve	0.1 %
(2) Sand, passing No. 4 sieve and retained on No. 200 sieve	91.8 %
(3) Silt size, 0.074 to 0.005 mm	2.1 %
(4) Clay size, smaller than 0.005 mm	6.0 %

0100055

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: **ASTM D422-63**
Analyzed: 3/16/94
Lab ID: 9403626-02
Client ID: EG2-VMPA-39'
Sample Description: SOIL

SIEVE TEST

A. Total weight of sample:	239.58	g
B. Weight retained in No.10 sieve:	0.09	g
C. % passing No.10 sieve:	99.96	%

Sieve test for weight retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	0.09	0.04	0.04	99.96
No. 200	221.56	92.48	92.52	7.48

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE DIAM. in mm (S)	% SUSPENDED (P)
2	20	14	10	14.7	0.0370	8.7
5	20	9	5	15.5	0.0240	4.3
10	20	9	5	15.5	0.0170	4.3
15	20	9	5	15.5	0.0139	4.3
25	20	9	5	15.5	0.0107	4.3
40	20	9	5	15.5	0.0085	4.3
60	20	8	4	15.6	0.0070	3.5
90	20	8	4	15.6	0.0057	3.5
120	20	8	4	15.6	0.0049	3.5
1440	20	7	3	15.8	0.0014	2.6

Weight of soil used in hydrometer test (D):	115	g
Hydroscopic moisture correction factor (G):	1	
Specific gravity (Assumed):	2.65	
Dispersing agent correction factor (E):	3	
Meniscus correction factor (F):	1	
Temp./Spec. gravity dependant constant (K):	0.01365	

Formulas:

R = H - E - F

S = K[SQRT(L/T)]

P = (R/W)100

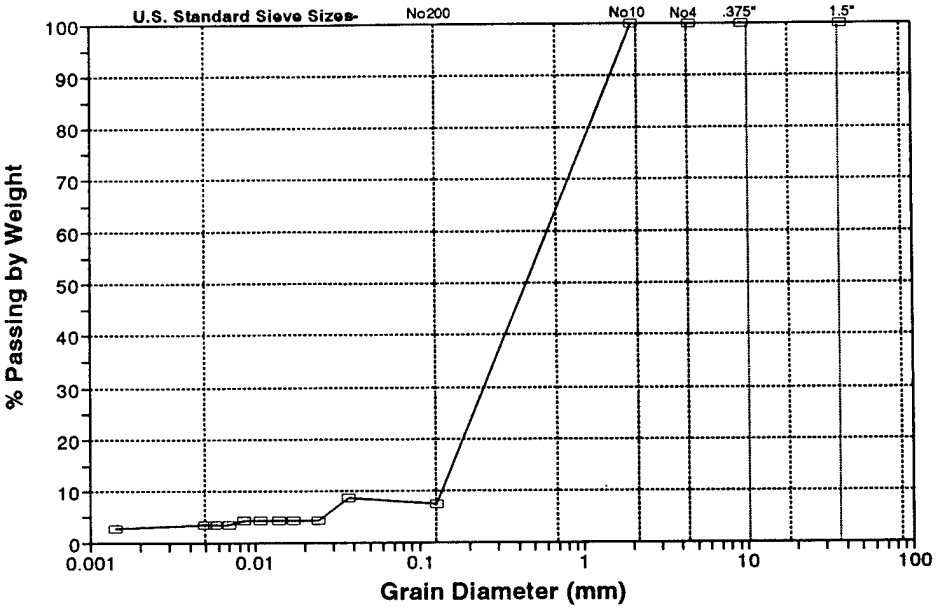
W = (J x 100)/C

J = D x G

000056

Method: **ASTM D422-63**
Analyzed: 3/16/94
Lab ID: 9403626-02

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coars	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	100.00
2	99.96
0.127	7.48
0.0370	8.69
0.0240	4.35
0.0170	4.35
0.0139	4.35
0.0107	4.35
0.0085	4.35
0.0070	3.48
0.0057	3.48
0.0049	3.48
0.0014	2.61

Sample Composition:

(1) Gravel, passing 3-in. and retained on No. 4 sieve	0.0 %
(2) Sand, passing No. 4 sieve and retained on No. 200 sieve	92.5 %
(3) Silt size, 0.074 to 0.005 mm	4.0 %
(4) Clay size, smaller than 0.005 mm	3.5 %

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: **ASTM D422-63**
Analyzed: 3/16/94
Lab ID: 9403626-03
Client ID: EG2-VMPB-2-4
Sample Description: SOIL

SIEVE TEST

A. Total weight of sample:	225.88	g
B. Weight retained in No.10 sieve:	1.19	g
C. % passing No.10 sieve:	99.47	%

Sieve test for weight retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	1.19	0.53	0.53	99.47
No. 200	207.01	91.65	92.17	7.83

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE DIAM. in mm (S)	% SUSPENDED (P)
2	20	14	10	14.7	0.0370	8.6
5	20	14	10	14.7	0.0234	8.6
10	20	13	9	14.8	0.0166	7.8
15	20	12	8	15	0.0137	6.9
25	20	12	8	15	0.0106	6.9
40	20	11	7	15.2	0.0084	6.1
60	20	11	7	15.2	0.0069	6.1
90	20	11	7	15.2	0.0056	6.1
120	20	11	7	15.2	0.0049	6.1
1440	20	10	6	15.3	0.0014	5.2

Weight of soil used in hydrometer test (D):	115	g
Hydroscopic moisture correction factor (G):	1	
Specific gravity (Assumed):	2.65	
Dispersing agent correction factor (E):	3	
Meniscus correction factor (F):	1	
Temp./Spec. gravity dependant constant (K):	0.01365	

Formulas:

R = H - E - F

S = K[SQRT(L/T)]

P = (R/W)100

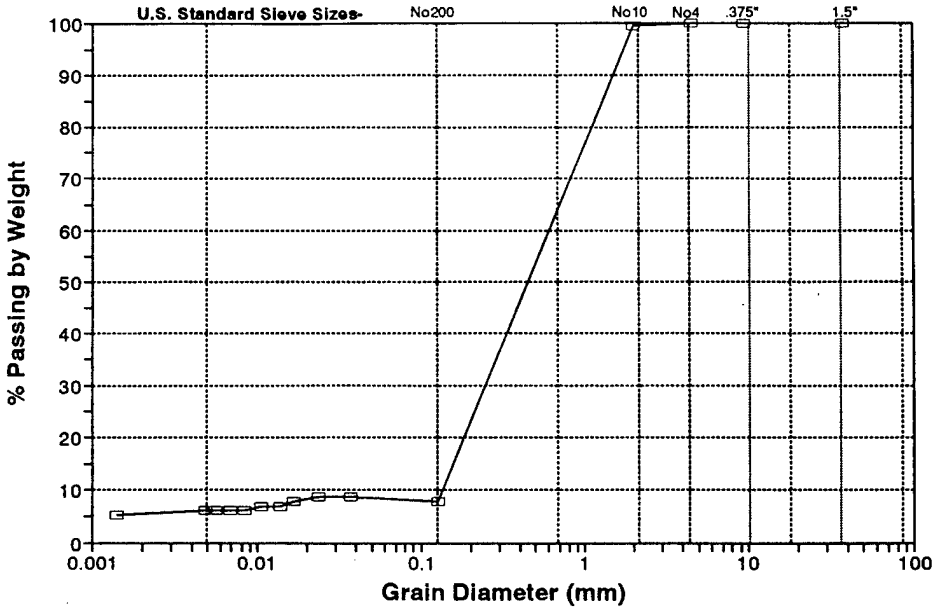
W = (J x 100)/C

J = D x G

000058

Method: **ASTM D422-63**
Analyzed: 3/16/94
Lab ID: 9403626-03

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coars	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	100.00
2	99.47
0.127	7.83
0.0370	8.65
0.0234	8.65
0.0166	7.78
0.0137	6.92
0.0106	6.92
0.0084	6.05
0.0069	6.05
0.0056	6.05
0.0049	6.05
0.0014	5.19

Sample Composition:

(1) Gravel, passing 3-in. and retained on No. 4 sieve	0.0 %
(2) Sand, passing No. 4 sieve and retained on No. 200 sieve	92.2 %
(3) Silt size, 0.074 to 0.005 mm	1.8 %
(4) Clay size, smaller than 0.005 mm	6.1 %

pace INCORPORATED
THE ASSURANCE OF QUALITY

CHAIN-OF-CUSTODY RECORD
Analytical Request

Client: PACE

Address:

Phone:

Report To: MELANIE CONCEPCION

Bill To:

P.O. # / Billing Reference: 75-3444

Project Name / No.: EGLIN AFB

Pace Client No.:

Pace Project Manager:

Pace Project No.: 740307-502

*Requested Due Date: 3-21

Sampled By (PRINT):

Sampler Signature: Date Sampled:

ITEM NO.	SAMPLE DESCRIPTION	TIME	MATRIX	PACE NO.	NO. OF CONTAINERS	PRESERVATIVES: UNPRESERVED	H_2SO_4	HNO_3	VOA			ANALYSES REQUEST: TKN	PHOS	SOIL CLASS.	REMARKS
1	EG2-VW-3' (3-3)		SOIL		1							X	X	X	9403626 01
2	EG2-VMPA-39' (3-4)		"		1							X	X	X	02
3	EG2-VMPB-2-4' (3-4)		"		1							X	X	X	03
4															
5															
6															
7															
8															

COOLER NOS.	BAILERS	SHIPMENT METHOD OUT / DATE	SHIPMENT METHOD RETURNED / DATE

Additional Comments:

ITEM NUMBER	RELINQUISHED BY / AFFILIATION	ACCEPTED BY / AFFILIATION	DATE	TIME
	[signature] PACE VIA FED EX		3-7	1700
	[signature]		3-8-94	1022

SDG 0055

ORIGINAL

SEE REVERSE SIDE FOR INSTRUCTIONS

pace INCORPORATED
THE ASSURANCE OF QUALITY
5702 Bolsa Avenue
Huntington Beach, CA 92649
TEL: 714 892-2565 FAX: 714 890-4032

Copy S. Archabal

Atlanta

OLA Atlanta
57 Executive Park South
N.E.
Suite 590
Atlanta, GA
30329-2261

Fax Transmittal Cover Sheet

Date : 3-7-94

To : DOUG DOWNEY At: ENGINEERING SCIENCE

Fax # : (303) 831-8208

Total # of Pages (Including This Cover): 5

PACE Project No./Department# : 740303.502

Comments :

If you have questions regarding this fax transmission, please

Contact: Melanie Phone: (714) 892-2565

Response Requested? Yes____ No____

FIGURE B.2

740303.SD2

CHAIN OF CUSTODY RECORD

Page 1 of 1

ENGINEERING-SCIENCE, INC.
1700 BROADWAY, SUITE 900
DENVER, COLORADO 80290
303-831-8100

AFCEE BIOVENTING PILOT TESTS

Base: EGLIN AFB

Site: HURLBURT FTA (EG3)

ES Job No.
DE268.43-4008

Sampler(s): (Signature)

OLA AWOSIKA

Ship To:
ATTENTION: Mr. Melanie Queerciong
PACE LABORATORY
~~11 Digital Drive~~ 5702 BOLSA AV.
~~Novato, California 94949~~
~~Attn: Stacy Hook~~ HUNTINGTON BEACH
(415) 883-6100 CA
(714) 892-2565

Date	Time	Sample Description	Lab I.D.	No. of Contrs.	Preservative	Analysis Required										Sample Type	Matrix	Remarks
						ISW 8015 (PH)	IA 405 (ALKA)	ISW 7380 (IRON)	ISW 846 (NICKEL)	ISW 8020 (BTEX)	IE 418.1 (TPHR)	IE 9012 (TOC)	IE 9013 (PHOS)	IUCN (CLASS)				
					NONE					HOLD	AT 4C	NONE						
02/01/94	1100	EG3-VW-6-8		3		✓				✓		✓				G C	SOIL	
02/02	0860	EG3-MPA-3-5		3		✓				✓		✓				G C	SOIL	
02/02/94	0930	EG3-MPB-5		3		✓				✓		✓				G C	SOIL	
																G C	SOIL	
																G C	SOIL	
																G C	SOIL	
																G C	SOIL	
																G C	SOIL	
																G C	SOIL	
																G C	SOIL	
																G C	SOIL	
																G C	SOIL	
																G C	SOIL	
																G C	SOIL	
																G C	SOIL	

INCORRECT DATES MC 3/7/94
CORRECT DATES ON CONTAINER

Relinquished by: (Signature)

Date / Time: 02/03/94 1900

Received for Laboratory by: (Signature): FED EX

Date / Time: 3-2 1900

Remarks: RED @ 3° C GW

Relinquished by: (Signature): VIA FED EX

Date / Time: 3-3 0940

Received for Laboratory by: (Signature): PACE

Date / Time: 3-3 0940

G - Grab Sample, C - Composite Sample

Distribution: Original Accompanies Shipment. Copies to: Coordinator Field Files

Federal Express Number:

Airbill Number:

ENGINEERING-SCIENCE, INC.
1700 Broadway, Suite 900 - Denver, Colorado
(303) 831-8100

CCFRSOA

DATE: 3/03/94 P A C E PAGE: 2
5:09 PM SOUTHERN CALIFORNIA REGION

Sample and Analysis Data Entry Form - New Sample(s)

Engineering-Science, Inc. Client No : 521022
Mr. Doug Downey : Client Contact
Project No: 740303.502 Due Date: 4/03/94 Client P.O. No:

Sample No: 75 003077.2 Collected Date: 3/02/94 ✓ Collected By: O. A.
Lab Rec'd Date: 3/03/94 ✓ Checked-In By: GHW Priority: 4
Due Date: 3/17/94 ✓ Sample Desc: EG3-MPB-5 ✓
Bottle Types: GM GN GN BT
Comnt: WALK P-1 (EGLIN AFB-BIOVENT) Matrix: SOIL

Analysis Abbr:	Name:
AF-SPH ✓	pH
AF-ALK-S ✓	Alkalinity, Total (As CaCO3)
SAFFAA-FE ✓	AIR FORCE FAA IRON
AF-MOIST ✓	Moisture, Percent
SAF-BTEX-B ✓	AIR FORCE AROMATIC VOLATILE ORGANICS
SAF-418.1 ✓	AIR FORCE TOTAL PETROLEUM HYDROCARBONS
O-TKN ✓	Nitrogen, Total Kjeldahl
O-PO4 ✓	Total Phosphate
O-DISTCURV ✓	Grain Size Distribution Curve

MK
3-7-94

PACE, Inc. reserves the right to return all samples at its discretion.

DATE: 3/03/94 5:09 PM

PACE
SOUTHERN CALIFORNIA REGION

PAGE: 1

Sample and Analysis Data Entry Form - New Sample(s)

Engineering-Science, Inc. : Client No : 521022
Mr. Doug Downey : Client Contact
1700 Broadway, Suite 900 : Address
Denver, CO. 80290

303-831-8100 : Telephone No
303-831-8208 : FAX No

Project No: 740303.502 Due Date: ~~4/03/94~~ 3/31/94 Client P.O. No:
Project Manager: MRC Project Name: Eglin AFB
Manager's Name: Melanie R. Concepcion
Project Type: L
QC Level: B Report Style: M
Desc: TKN, Phos., Soil Class sent to Sequoia Labs.

Sample No: 75 003075.6 Collected Date: 3/01/94 ✓ Collected By: O. A.
Lab Rec'd Date: 3/03/94 ✓ Checked-In By: GHW Priority: 4
Due Date: 3/17/94 ✓ Sample Desc: EG3-VW-6-8 ✓
Bottle Types: GM GN GN BT
Comnt: WALK P-1 (EGLIN AFB-BIOVENT) Matrix: SOIL

Analysis Abbr:	Name:
AF-SPH ✓	pH
AF-ALK-S ✓	Alkalinity, Total (As CaCO3)
SAFFAA-FE ✓	AIR FORCE FAA IRON
AF-MOIST ✓	Moisture, Percent
SAF-BTEX-B ✓	AIR FORCE AROMATIC VOLATILE ORGANICS
SAF-418.1 ✓	AIR FORCE TOTAL PETROLEUM HYDROCARBONS
O-TKN ✓	Nitrogen, Total Kjeldahl
O-PO4 ✓	Total Phosphate
O-DISTCURV ✓	Grain Size Distribution Curve

Sample No: 75 003076.4 Collected Date: 3/02/94 Collected By: O. A.
Lab Rec'd Date: 3/03/94 Checked-In By: GHW Priority: 4
Due Date: 3/17/94 Sample Desc: EG3-MPA-3- 5 ✓
Bottle Types: GM GN GN BT
Comnt: WALK P-1 (EGLIN AFB-BIOVENT) Matrix: SOIL

Analysis Abbr:	Name:
AF-SPH ✓	pH
AF-ALK-S ✓	Alkalinity, Total (As CaCO3)
SAFFAA-FE ✓	AIR FORCE FAA IRON
AF-MOIST ✓	Moisture, Percent
SAF-BTEX-B ✓	AIR FORCE AROMATIC VOLATILE ORGANICS
SAF-418.1 ✓	AIR FORCE TOTAL PETROLEUM HYDROCARBONS
O-TKN ✓	Nitrogen, Total Kjeldahl
O-PO4 ✓ ✓	Total Phosphate
O-DISTCURV	Grain Size Distribution Curve

ML 3-7-94

PACE, Inc. reserves the right to return all samples at its discretion.

pace
INCORPORATED
THE ASSURANCE OF QUALITY

Dear PACE Client:

The accompanying Sample and Analysis Data Entry form is provided to you as a part of the PACE Incorporated Quality Program. Please review the sample description(s) and analyses listed for each sample. Should there be any discrepancy between the sample and tests listed and the data you have requested, please notify our Client Service Coordinator immediately at (714) 892-2565.

All communications should reference the project number and the individual sample number. Please note the sample due date is for internal use only. The project due date is the scheduled date for completion of your analysis report.

PACE Incorporated reserves the right to dispose of all samples at our discretion. Our standard policy is to return all hazardous or potentially hazardous samples to the client upon completion of the project unless other arrangements are made prior to sample receipt.

If you have any questions, please contact our client services coordinator or me.

Sincerely,

Kenneth Faust
Director
Southern California Region

5702 Bolsa Avenue
Huntington Beach, CA 92649
TEL: 714-892-2565
FAX: 714-890-4032

pace INCORPORATED
THE ASSURANCE OF QUALITY

5702 Bolsa Avenue
Huntington Beach, CA 92649
TEL: 714 892-2565 FAX: 714 890-4032

SoH
As Mail copy to Ola Awosika ES-Atlnt

Fax Transmittal Cover Sheet

Date : 3-29-94

To : DOUG DOWNEY At: ENGINEERING SCIENCE

Fax # : (303) 831-8208

Total # of Pages (Including This Cover): 13

PACE Project No./Department# :

Comments : EGLIN AFB

If you have questions regarding this fax transmission, please

Contact: Melanie Concepcion Phone: (714) 892-2565

Response Requested? Yes____ No____

PRELIMINARY:
DATA PENDING
FINAL REVIEW

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290

March 29, 1994
PACE Project Number: 740307502

Attn: Mr. Doug Downey

Client Reference: Eglin AFB

Parameter	Units	MDL		METHOD	DATE ANALYZED
PACE Sample Number:			75 0031647		
Date Collected:			03/03/94		
Date Received:			03/07/94		
Client Sample ID:			EG2-VW-3'		
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	43	ND	351.3	03/16/94
Total Phosphate	mg/kg	1.1	28	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	42	354	SM403(M)	03/16/94
Moisture, Percent	PERCENT		6.0	D2216	03/09/94
pH	PH UNITS		8.2	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/16/94		
Iron	MG/KG	200	2560		03/21/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/12/94		
Total Petroleum Hydrocarbons	MG/KG	133	2210		03/14/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	5.3	10		03/08/94
Toluene	MG/KG	5.3	21		03/08/94
Ethylbenzene	MG/KG	5.3	24		03/08/94
Xylenes, Total	MG/KG	7.4	72		03/08/94
a,a,a-Trifluorotoluene	PERCENT		94		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			10000		03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290

March 29, 1994
PACE Project Number: 740307502

Attn: Mr. Doug Downey

Client Reference: Eglin AFB

Parameter	Units	MDL		METHOD	DATE ANALYZED
PACE Sample Number:			75 0031647		
Date Collected:			03/03/94		
Date Received:			03/07/94		
Client Sample ID:			EG2-VW-3'		
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	43	ND	351.3	03/16/94
Total Phosphate	mg/kg	1.1	28	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	42	354	SM403(M)	03/16/94
Moisture, Percent	PERCENT		6.0	D2216	03/09/94
pH	PH UNITS		8.2	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/16/94		
Iron	MG/KG	200	2560		03/21/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/12/94		
Total Petroleum Hydrocarbons	MG/KG	133	2210		03/14/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	5.3	10		03/08/94
Toluene	MG/KG	5.3	21		03/08/94
Ethylbenzene	MG/KG	5.3	24		03/08/94
Xylenes, Total	MG/KG	7.4	72		03/08/94
a,a,a-Trifluorotoluene	PERCENT		94		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			10000		03/08/94

PRELIMINARY: DATA PENDING FINAL REVIEW

Mr. Doug Downey
Page 2

March 29, 1994
PACE Project Number: 740307502

Client Reference: Eglin AFB

Parameter	Units	MDL	EG2-VMPA-39'	METHOD	DATE ANALYZED
PACE Sample Number:			75 0031655		
Date Collected:			03/04/94		
Date Received:			03/07/94		
Client Sample ID:					
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	43	ND	351.3	03/16/94
Total Phosphate	mg/kg	1.1	29	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	42	ND	SM403(M)	03/16/94
Moisture, Percent	PERCENT		7.0	D2216	03/09/94
pH	PH UNITS		6.6	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/16/94		
Iron	MG/KG	20	135		03/21/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/12/94		
Total Petroleum Hydrocarbons	MG/KG	134	3370		03/14/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	0.067	0.15		03/08/94
Toluene	MG/KG	0.067	0.19		03/08/94
Ethylbenzene	MG/KG	0.067	0.40		03/08/94
Xylenes, Total	MG/KG	0.094	2.5		03/08/94
a,a,a-Trifluorotoluene	PERCENT		79		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			125		03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

Mr. Doug Downey
Page 3

March 29, 1994
PACE Project Number: 740307502

Client Reference: Eglin AFB

Parameter	Units	MDL	75 0031663 EG2-VMPB- 2-4'	METHOD	DATE ANALYZED
PACE Sample Number:			75 0031663		
Date Collected:			03/04/94		
Date Received:			03/07/94		
Client Sample ID:			EG2-VMPB-2-4'		
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	43	ND	351.3	03/16/94
Total Phosphate	mg/kg	1.1	15	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	43	128	SM403(M)	03/16/94
Moisture, Percent	PERCENT		7.6	D2216	03/09/94
pH	PH UNITS		7.8	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/16/94		
Iron	MG/KG	170	2100		03/21/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/12/94		
Total Petroleum Hydrocarbons	MG/KG	270	6610		03/14/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	2.7	ND		03/08/94
Toluene	MG/KG	2.7	ND		03/08/94
Ethylbenzene	MG/KG	2.7	9.9		03/08/94
Xylenes, Total	MG/KG	3.8	22		03/08/94
a,a,a-Trifluorotoluene	PERCENT		92		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			5000		03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

Mr. Doug Downey
Page 4

March 29, 1994
PACE Project Number: 740307502

Client Reference: Eglin AFB

These data have been reviewed and are approved for release.

Kenneth D. Faust,
Southern California Regional Director

FOOTNOTES
for pages 1 through 4

Client Reference: Eglin AFB

MDL Method Detection Limit
ND Not detected at or above the MDL.

730307.502

FIGURE B.2

CHAIN OF CUSTODY RECORD

Page 1 of 1

ENGINEERING-SCIENCE, INC.
1700 BROADWAY, SUITE 900
DENVER, COLORADO 80290
303-831-8100

AFCEE SVE/VENTING PILOT TESTS

ES Job No.: DE268.43.08

Base: EGLIN AFB

Site: OLD EGLIN FTA (EG2)

Sampler(s): (Signature)
OLA A. AWOSIKA

Preservative: NONE | HOLD AT 4C | NONE

Analysis Required: ISW 8015 (PH) | ISW 8015 (ALKA) | ISW 7520 (IRON) | ISW 9056 (NICKEL) | ISW 8020 (BTEX) | IE 418.1 (TRPH) | IE 231.2 (TKN) | IE 365.3 (PHOS) | IUCN (CLASS)

Date	Time	Sample Description	Lab I.D.	No. of Contrs.	Sample Type	Matrix	Remarks
3/3/94	1400	EG2 - VW - 3'		3	@ C	SOIL	
3/4/94	1030	EG2 - VMPA - 39'		3	@ C	SOIL	
3/4/94	1300	EG2 - VMPB - 2-4'		3	@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	
					@ C	SOIL	

Ship To:
ATTENTION: MS. MELANIE BURKELLINE
PACE LABORATORY
~~11 Digital Drive~~ 5782 BOLSA AV.
~~Novato, California 94949~~
~~Attn: Stacy Hock~~ HUNTINGTON BEACH
~~(415) 883-6100~~
(714) 892-2565

Relinquished by: (Signature) — Date / Time: 3/4/94 1800 — Received for Laboratory by: (Signature): VIA FED EX — Date / Time: 3-4

Relinquished by: (Signature): FED EX — Date / Time: 3-7 0956 — Received for Laboratory by: (Signature): (DALE) — Date / Time: 3-7 0954

Remarks: RELD @ 4.3°C GW 3-7-94

G - Grab Sample, C - Composite Sample

Distribution: Original Accompanies Shipment. Copies to: Coordinator Field Files

Federal Express Number: 7290958110

Airbill Number: 7290988110

ENGINEERING-SCIENCE, INC.
1700 Broadway, Suite 900 - Denver, Colorado
(303) 831-8100

OCR504

7290988110

PRELIMINARY: DATA PENDING FINAL REVIEW

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290

March 29, 1994
PACE Project Number: 740303502

Attn: Mr. Doug Downey

Client Reference: Eglin AFB

PACE Sample Number:			75 0030756		
Date Collected:			03/01/94		
Date Received:			03/03/94		
			EG3-VW-6-8		
Parameter	Units	MDL		METHOD	DATE ANALYZED
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	40	ND	351.3	03/16/94
Total Phosphate	mg/kg	1.1	35	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	43	331	SM403(M)	03/16/94
Moisture, Percent	PERCENT		6.9	D2216	03/09/94
pH	PH UNITS		8.1	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/09/94		
Iron	MG/KG	21	240		03/09/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/08/94		
Total Petroleum Hydrocarbons	MG/KG	513	15800		03/08/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	0.54	ND		03/08/94
Toluene	MG/KG	0.54	15		03/08/94
Ethylbenzene	MG/KG	0.54	3.3		03/08/94
Xylenes, Total	MG/KG	0.75	26		03/08/94
a,a,a-Trifluorotoluene	PERCENT		60		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			1000		03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

Mr. Doug Downey
Page 2

March 29, 1994
PACE Project Number: 740303502

Client Reference: Eglin AFB

Parameter	Units	MDL	75 0030764 03/02/94 03/03/94 EG3-MPA-3-5	METHOD	DATE ANALYZED
PACE Sample Number:					
Date Collected:					
Date Received:					
Client Sample ID:					
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	42	120	351.3	03/16/94
Total Phosphate	mg/kg	1.1	18	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	42	253	SM403(M)	03/16/94
Moisture, Percent	PERCENT		5.8	D2216	03/09/94
pH	PH UNITS		8.2	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/09/94		
Iron	MG/KG	40	620		03/09/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/08/94		
Total Petroleum Hydrocarbons	MG/KG	490	12100		03/08/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	2.6	ND		03/08/94
Toluene	MG/KG	2.6	22		03/08/94
Ethylbenzene	MG/KG	2.6	14		03/08/94
Xylenes, Total	MG/KG	3.7	88		03/08/94
a,a,a-Trifluorotoluene	PERCENT		88		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			5000		03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

Mr. Doug Downey
Page 3

March 29, 1994
PACE Project Number: 740303502

Client Reference: Eglin AFB

Parameter	Units	MDL		METHOD	DATE ANALYZED
PACE Sample Number:			75 0030772		
Date Collected:			03/02/94		
Date Received:			03/03/94		
Client Sample ID:			EG3-MPB-5		
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	43	83	351.3	03/16/94
Total Phosphate	mg/kg	1.1	46	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	43	321	SM403(M)	03/16/94
Moisture, Percent	PERCENT		7.1	D2216	03/09/94
pH	PH UNITS		8.2	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/09/94		
Iron	MG/KG	81	1160		03/09/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/08/94		
Total Petroleum Hydrocarbons	MG/KG	10.6	848		03/08/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	2.7	ND		03/08/94
Toluene	MG/KG	2.7	5.1		03/08/94
Ethylbenzene	MG/KG	2.7	4.5		03/08/94
Xylenes, Total	MG/KG	3.8	29		03/08/94
a,a,a-Trifluorotoluene	PERCENT		91		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			5000		03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

March 29, 1994
PACE Project Number: 740303502

Client Reference: Eglin AFB

These data have been reviewed and are approved for release.

Kenneth D. Faust,
Southern California Regional Director

PRELIMINARY:
DATA PENDING
FINAL REVIEW

Client Reference: Eglin AFB

MDL Method Detection Limit
ND Not detected at or above the MDL.

FIGURE B.2

740303.502

CHAIN OF CUSTODY RECORD

Page 1 of 1

ENGINEERING-SCIENCE, INC.
1700 BROADWAY, SUITE 900
DENVER, COLORADO 80290
303-831-8100

AFCEE BIOVENTING PILOT TESTS

Base: EGLIN AFB

Site: HURLBURT FTA (EG3)

ES Job No.
DE268.43.04.08

Sampler(s): (Signature)

OLA AWOSIKA

Preservative: NONE | HCLO | AT 4C | NONE

Analysis Required: (ISW 8015 (PH) | ISW 8015 (ALKA) | ISW 9056 (CHLO) | ISW 9056 (NITR) | ISW 8020 (BTEX) | E 418.1 (TPHR) | E 300.0 (FLUO) | E 300.0 (PHOS) | ICAP (CLASS))

Ship To:
ATTENTION: Ms. Melanie Quiercioni
PACE LABORATORY
~~11 Digital Drive~~ 5702 Bolsa Av.
~~Novato, California 94949~~
~~Attn: Stacey Hock~~ HUNTINGTON BEACH
(415) 883-6100 CA
(714) 892-2565

Date	Time	Sample Description	Lab I.D.	No. of Containers	Sample Type	Matrix	Remarks
02/01/94	1140	EG3-VW-6-8		3	G C	SOIL	
02/02	0850	EG3-MPA-3-5		3	G C	SOIL	
02/02/94	0930	EG3-MPB-5		3	G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	
					G C	SOIL	

INCORRECT DATES MC 3/7/94
CORRECT DATES ON CONTAINER

Relinquished by: (Signature) — Date / Time: 02/02/94 1900 — Received for Laboratory by: (Signature): FED EX — Date / Time: 3-2 1900

Relinquished by: (Signature): VIA FED EX — Date / Time: 3-3 0940 — Received for Laboratory by: (Signature): PACE — Date / Time: 3-3 0940

Remarks: RELD @ 3° C GW

G - Grab Sample, C - Composite Sample

Distribution: Original Accompanies Shipment, Copies to: Coordinator Field Files

Federal Express (Number):

Airbill Number:

ENGINEERING-SCIENCE, INC.
1700 Broadway, Suite 900 • Denver, Colorado
(303) 831-8100

CC/600

pace INCORPORATED
THE ASSURANCE OF QUALITY

5702 Bolsa Avenue
Huntington Beach, CA 92649
TEL: 714 892-2565 FAX: 714 890-4032

Fax Transmittal Cover Sheet

Date : 3-29-94

To : OLA AWOSIKA At: ENGINEERING SCIENCE

Fax # : (404) 235-2500

Total # of Pages (Including This Cover): ~~15~~ 25

PACE Project No./Department# :

Comments : 7403035O2 EGLIN AFB

7403075O2 " "

If you have questions regarding this fax transmission, please

Contact: Melanie Concepcion Phone: (714) 892-2565

Response Requested? Yes____ No____

PRELIMINARY: DATA PENDING FINAL REVIEW

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290

March 29, 1994
PACE Project Number: 740303502

Attn: Mr. Doug Downey

Client Reference: Eglin AFB

PACE Sample Number:			75 0030756		
Date Collected:			03/01/94		
Date Received:			03/03/94		
			EG3-VW-6-8		
Parameter	Units	MDL		METHOD	DATE ANALYZED
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	40	ND	351.3	03/16/94
Total Phosphate	mg/kg	1.1	35	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	43	331	SM403(M)	03/16/94
Moisture, Percent	PERCENT		6.9	D2216	03/09/94
pH	PH UNITS		8.1	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/09/94		
Iron	MG/KG	21	240		03/09/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/08/94		
Total Petroleum Hydrocarbons	MG/KG	513	15800		03/08/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	0.54	ND		03/08/94
Toluene	MG/KG	0.54	15		03/08/94
Ethylbenzene	MG/KG	0.54	3.3		03/08/94
Xylenes, Total	MG/KG	0.75	26		03/08/94
a,a,a-Trifluorotoluene	PERCENT		60		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			1000		03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

Mr. Doug Downey
Page 2

March 29, 1994
PACE Project Number: 740303502

Client Reference: Eglin AFB

Parameter	Units	MDL	75 0030764 03/02/94 03/03/94 EG3-MPA-3- 5	METHOD	DATE ANALYZED
PACE Sample Number:					
Date Collected:					
Date Received:					
Client Sample ID:					
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	42	120	351.3	03/16/94
Total Phosphate	mg/kg	1.1	18	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	42	253	SM403(M)	03/16/94
Moisture, Percent	PERCENT		5.8	D2216	03/09/94
pH	PH UNITS		8.2	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/09/94		
Iron	MG/KG	40	620		03/09/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/08/94		
Total Petroleum Hydrocarbons	MG/KG	490	12100		03/08/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	2.6	ND		03/08/94
Toluene	MG/KG	2.6	22		03/08/94
Ethylbenzene	MG/KG	2.6	14		03/08/94
Xylenes, Total	MG/KG	3.7	88		03/08/94
a,a,a-Trifluorotoluene	PERCENT		88		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			5000		03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

Mr. Doug Downey
Page 3

March 29, 1994
PACE Project Number: 740303502

Client Reference: Eglin AFB

Parameter	Units	MDL		METHOD	DATE ANALYZED
PACE Sample Number:			75 0030772		
Date Collected:			03/02/94		
Date Received:			03/03/94		
Client Sample ID:			EG3-MPB-5		
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	43	83	351.3	03/16/94
Total Phosphate	mg/kg	1.1	46	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	43	321	SM403(M)	03/16/94
Moisture, Percent	PERCENT		7.1	D2216	03/09/94
pH	PH UNITS		8.2	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/09/94		
Iron	MG/KG	81	1160		03/09/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/08/94		
Total Petroleum Hydrocarbons	MG/KG	10.6	848		03/08/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	2.7	ND		03/08/94
Toluene	MG/KG	2.7	5.1		03/08/94
Ethylbenzene	MG/KG	2.7	4.5		03/08/94
Xylenes, Total	MG/KG	3.8	29		03/08/94
a,a,a-Trifluorotoluene	PERCENT		91		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			5000		03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

March 29, 1994
PACE Project Number: 740303502

Client Reference: Eglin AFB

These data have been reviewed and are approved for release.

Kenneth D. Faust,
Southern California Regional Director

Client Reference: Eglin AFB

MDL Method Detection Limit
ND Not detected at or above the MDL.

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: ASTM D422-63
Analyzed: 3/16/94
Lab ID: 9403823-01
Client ID: EG3-VW-6-8

Sample Description: SOIL

SIEVE TEST

A. Total weight of sample:	179.03	g
B. Weight retained in No.10 sieve:	0	g
C. % passing No.10 sieve:	100.00	%

Sieve test for weight retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	0.00	0.00	0.00	100.00
No. 200	171.03	95.53	95.53	4.47

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE DIAM. (D)	% SUSPENDED (P)
2	20	14	10	14.7	0.0370	8.7
5	20	14	10	14.7	0.0234	8.7
10	20	8	4	15.6	0.0170	3.5
15	20	8	4	15.6	0.0139	3.5
25	20	7	3	15.8	0.0109	2.6
40	20	7	3	15.8	0.0086	2.6
80	20	7	3	15.8	0.0070	2.6
90	20	7	3	15.8	0.0057	2.6
120	20	7	3	15.8	0.0050	2.6
1440	20	7	3	15.8	0.0014	2.6

Weight of soil used in hydrometer test (D):	115	g
Hygroscopic moisture correction factor (G):	1	
Specific gravity (Assumed):	2.65	
Dispersing agent correction factor (E):	3	
Meniscus correction factor (F):	1	
Temp./Spec. gravity dependant constant (K):	0.01365	

Formulas:

R = H - E - F

D = K[SQRT(L/T)]

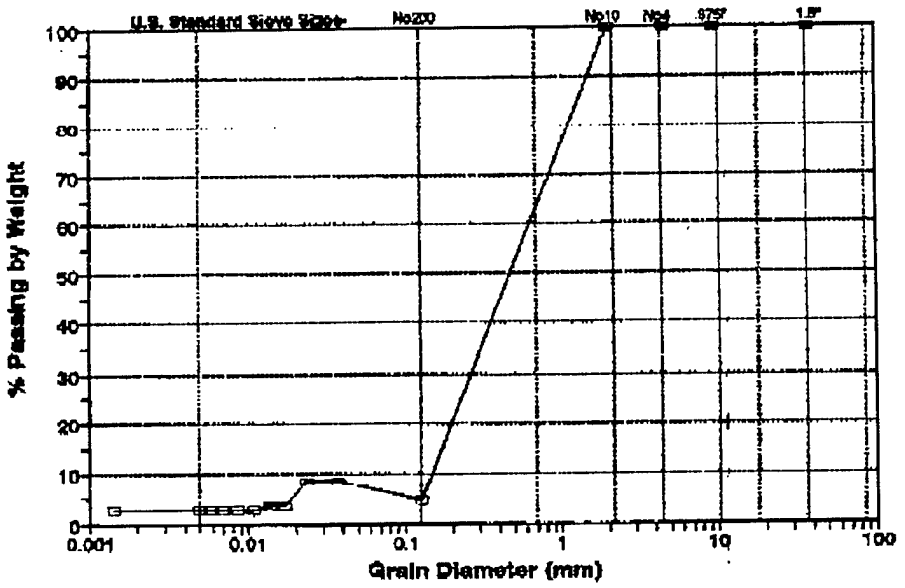
P = (R/W)100

W = (J x 100)/G

J = D x G

Method: ASTM D422-63
Analyzed: 3/16/94
Lab ID: 9403623-01

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coars	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	100.00
2	100.00
0.127	4.47
0.0370	4.70
0.0234	4.70
0.0170	3.48
0.0139	3.48
0.0109	2.61
0.0080	2.61
0.0070	2.61
0.0057	2.61
0.0050	2.61
0.0014	2.61

Sample Composition:

(1) Gravel, passing 3-in. and retained on No. 4 sieve	0.0 %
(2) Sand, passing No. 4 sieve and retained on No. 200 sieve	95.5 %
(3) Silt size, 0.074 to 0.005 mm	1.9 %
(4) Clay size, smaller than 0.005 mm	2.6 %

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: ASTM D422-63
Analyzed: 3/16/94
Lab ID: 9403623-02
Client ID: EG3-MPA-3-5

Sample Description: SOIL

SIEVE TEST

A. Total weight of sample:	129.18	g
B. Weight retained in No.10 sieve:	0.47	g
C. % passing No.10 sieve:	99.64	%

Sieve test for weight retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	0.47	0.36	0.36	99.64
No. 200	113.57	87.92	88.28	11.72

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE DIA. in mm (D)	% SUSPENDED (P)
2	20	18	14	14	0.0361	12.1
5	20	17	13	14.2	0.0230	11.3
10	20	15	11	14.5	0.0164	9.5
15	20	14	10	14.7	0.0135	8.7
25	20	13	9	14.8	0.0105	7.8
40	20	12	8	15	0.0084	6.9
60	20	11	7	15.2	0.0069	6.1
80	20	11	7	15.2	0.0056	6.1
120	20	10	6	15.3	0.0049	5.2
1440	20	6	4	15.6	0.0014	3.5

Weight of soil used in hydrometer test (D):	113	g
Hydroscopic moisture correction factor (G):	1	
Specific gravity (Assumed):	2.65	
Dispersing agent correction factor (E):	3	
Meniscus correction factor (F):	1	
Temp./Spec. gravity dependant constant (K):	0.01365	

Formulas:

R = H - E - F

S = K[SQRT(L/T)]

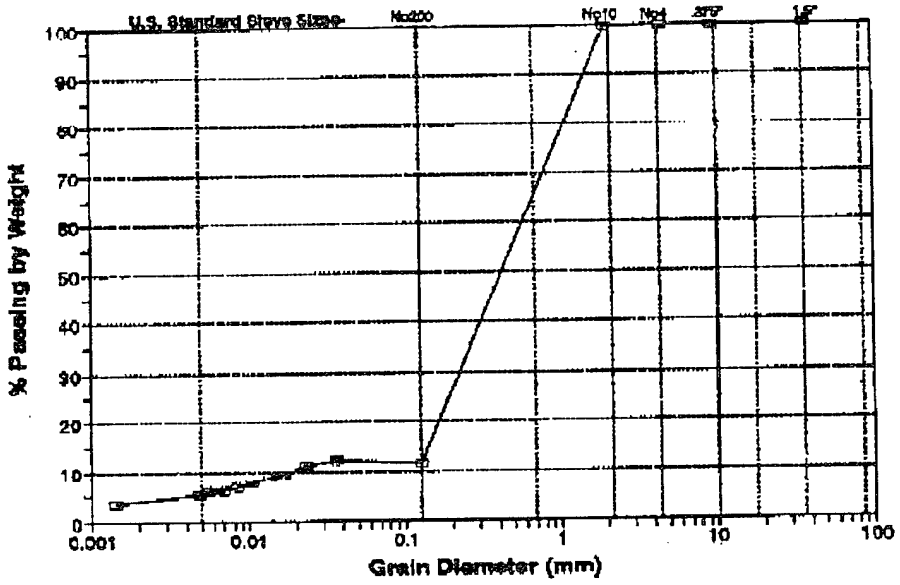
P = (R/W)100

W = (J x 100)/G

J = D x G

Method: ASTM D422-63
Analyzed: 3/16/94
Lab ID: 9403823-02

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coarse	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	100.00
2	99.64
0.127	11.72
0.0361	12.13
0.0230	11.26
0.0164	9.53
0.0135	8.66
0.0105	7.80
0.0084	6.93
0.0069	6.06
0.0056	6.06
0.0049	5.20
0.0014	3.47

Sample Composition:

(1) Gravel, passing 3-in. and retained on No. 4 sieve	0.0 %
(2) Sand, passing No. 4 sieve and retained on No. 200 sieve	88.3 %
(3) Silt size, 0.074 to 0.005 mm	6.5 %
(4) Clay size, smaller than 0.005 mm	5.2 %

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: ASTM D422-63
Analyzed: 3/18/94
Lab ID: 9403623-03
Client ID: EG3-MPB-5
Sample Description: SOIL

SIEVE TEST

A. Total weight of sample:	245.94	g
B. Weight retained in No.10 sieve:	0.1	g
C. % passing No.10 sieve:	99.96	%

Sieve test for weight retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	0.10	0.04	0.04	99.96
No. 200	221.19	89.94	89.98	10.02

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (M)	CORRECTED READING (R)	(L)	PARTICLE DIAM. in mm (D)	% SUSPENDED (P)
2	20	17	13	14.2	0.0364	11.3
5	20	17	13	14.2	0.0230	11.3
10	20	15	11	14.5	0.0164	9.6
15	20	14	10	14.7	0.0139	8.7
25	20	13	9	14.8	0.0105	7.8
40	20	12	8	15	0.0084	7.0
60	20	12	8	15	0.0068	7.0
90	20	11	7	15.2	0.0056	6.1
120	20	10	6	15.3	0.0049	5.2
1440	20	6	4	15.6	0.0014	3.5

Weight of soil used in hydrometer test (D):	115	g
Hydroscopic moisture correction factor (G):	1	
Specific gravity (Assumed):	2.65	
Dispersing agent correction factor (E):	3	
Meniscus correction factor (F):	1	
Temp./Spec. gravity dependant constant (K):	0.01385	

Formulas:

R = H - E - F

B = K[SQRT(L/T)]

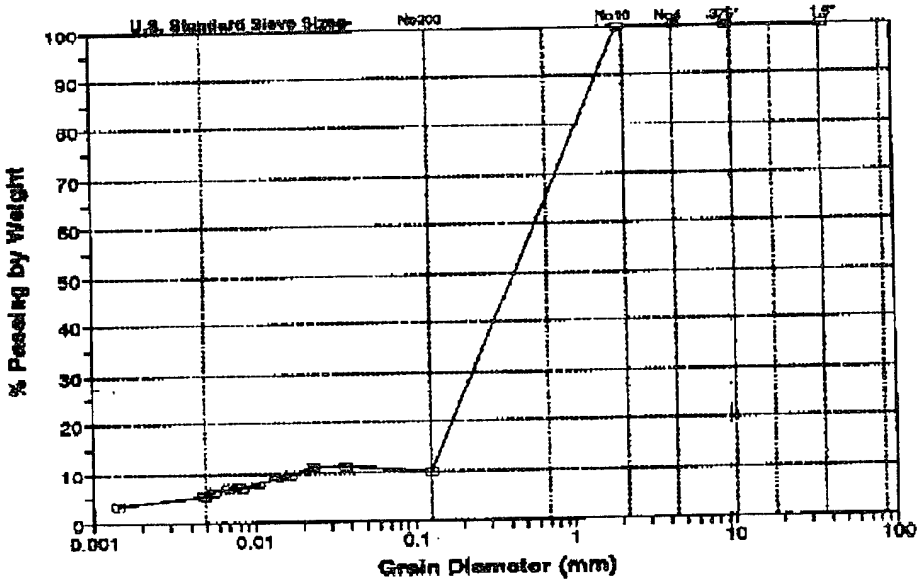
P = (R/W)100

W = (J x 100)/C

J = D x G

Method: ASTM D422-63
Analyzed: 3/16/94
Lab ID: 9403623-03

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coars	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
97.5	100.00
9.5	100.00
4.5	100.00
2	99.96
0.127	10.02
0.0364	11.30
0.0230	11.30
0.0164	9.56
0.0135	8.69
0.0105	7.82
0.0064	6.95
0.0058	6.95
0.0056	6.08
0.0049	5.22
0.0014	3.48

Sample Composition:

(1) Gravel, passing 3-in. and retained on No. 4 sieve	0.0 %
(2) Sand, passing No. 4 sieve and retained on No. 200 sieve	90.0 %
(3) Silt size, 0.074 to 0.005 mm	4.8 %
(4) Clay size, smaller than 0.005 mm	5.2 %

FIGURE B.2

740303.502

CHAIN OF CUSTODY RECORD

Page 1 of 1

ENGINEERING-SCIENCE, INC.
1700 Broadway, Suite 900
Denver, Colorado 80290
303-831-8100

ES Job No. DE288. 43.09.00

AFCEE BIOVENTING PILOT TESTS
Base: EGLIN AFB
Site: HURLBURT FTA (EG3)

Sampler(s) (Signature): [signature]
OLA ANOSIKA

Preservative: NONE | HOLD | AT 4C | NONE

Ship To:
ATTENTION: Ms. MELANIE ONCERCIONE
PACE LABORATORY
~~11 Digital Drive~~ 5702 BOLSA AV.
~~Novato, California 94949~~
~~Attn: Stacy Hook~~ HUNTINGTON BEACH CA
(415) 883-6100
(714) 892-2565

Analysis Required:

Date	Time	Sample Description	Lab I.D.	No. of Contrs.	SW 8015 (TPH)	A 403 (ALKA)	SW 7380 (IRON)	SW 846 (NO3)	SW 8020 (BTEX)	E 418.1 (TRPH)	E 353.2 (TKN)	E 365.2 (PHOS)	UCH (CLASS)	Sample Type	Matrix	Remarks
03/01/1911	1160	EG3-VW-6-8		3		✓				✓			✓	G C	SOIL	
03/02	0800	EG3-MPA-3-5		3		✓				✓			✓	G C	SOIL	
03/02/18	0930	EG3-MPB-5		3		✓				✓			✓	G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	
														G C	SOIL	

INCORRECT DATES MC 3/7/1900
CORRECT DATES ON CONTAINER

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time
[signature]	03/02/1900 1900	FED EX	3-2 1900
Relinquished by: (Signature) VIA FED EX	3-3 0940	[signature] PACE	3-3 0940

Remarks: REC'D @ 3° C 6W

G - Grab Sample, C - Composite Sample

Distribution: Original Accompanies Shipment. Copies to: Coordinator Field Files

Federal Express Number: ______

Airbill Number: ______

ENGINEERING-SCIENCE, INC.
1700 Broadway, Suite 900 - Denver, Colorado
(303) 831-8100

COC#201

PRELIMINARY:
DATA PENDING
FINAL REVIEW

March 29, 1994
PACE Project Number: 740307502

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290

Attn: Mr. Doug Downey

Client Reference: Eglin AFB

Parameter	Units	MDL		METHOD	DATE ANALYZED
PACE Sample Number:			75 0031647		
Date Collected:			03/03/94		
Date Received:			03/07/94		
Client Sample ID:			EG2-VW-3'		
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	43	ND	351.3	03/16/94
Total Phosphate	mg/kg	1.1	28	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	42	354	SM403(M)	03/16/94
Moisture, Percent	PERCENT		6.0	D2216	03/09/94
pH	PH UNITS		8.2	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/16/94		
Iron	MG/KG	200	2560		03/21/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/12/94		
Total Petroleum Hydrocarbons	MG/KG	133	2210		03/14/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	5.3	10		03/08/94
Toluene	MG/KG	5.3	21		03/08/94
Ethylbenzene	MG/KG	5.3	24		03/08/94
Xylenes, Total	MG/KG	7.4	72		03/08/94
a,a,a-Trifluorotoluene	PERCENT		94		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			10000		03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

Mr. Doug Downey
Page 2

March 29, 1994
PACE Project Number: 740307502

Client Reference: Eglin AFB

Parameter	Units	MDL	75 0031655 03/04/94 03/07/94 EG2-VMPA-39'	METHOD	DATE ANALYZED
PACE Sample Number:					
Date Collected:					
Date Received:					
Client Sample ID:					
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	43	ND	351.3	03/16/94
Total Phosphate	mg/kg	1.1	29	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	42	ND	SM403(M)	03/16/94
Moisture, Percent	PERCENT		7.0	D2216	03/09/94
pH	PH UNITS		6.6	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/16/94		
Iron	MG/KG	20	135		03/21/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/12/94		
Total Petroleum Hydrocarbons	MG/KG	134	3370		03/14/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	0.067	0.15		03/08/94
Toluene	MG/KG	0.067	0.19		03/08/94
Ethylbenzene	MG/KG	0.067	0.40		03/08/94
Xylenes, Total	MG/KG	0.094	2.5		03/08/94
a,a,a-Trifluorotoluene	PERCENT		79		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			125		03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

March 29, 1994
PACE Project Number: 740307502

Mr. Doug Downey
Page 3

Client Reference: Eglin AFB

Parameter	Units	MDL	75 0031663 03/04/94 03/07/94 EG2-VMPB-2-4'	METHOD	DATE ANALYZED
PACE Sample Number:					
Date Collected:					
Date Received:					
Client Sample ID:					
SUBCONTRACT ANALYSIS					
INDIVIDUAL PARAMETERS					
Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	43	ND	351.3	03/16/94
Total Phosphate	mg/kg	1.1	15	365.1	03/17/94
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Alkalinity, Total (As CaCO3)	MG/KG	43	128	SM403(M)	03/16/94
Moisture, Percent	PERCENT		7.6	D2216	03/09/94
pH	PH UNITS		7.8	SW9045	03/10/94
AIR FORCE FAA IRON				SW7380	
Soil FAA Metals Date Digested			03/16/94		
Iron	MG/KG	170	2100		03/21/94
AIR FORCE TOTAL PETROLEUM HYDROCARBONS				E418.1	
Soil TPH Prep Date			03/12/94		
Total Petroleum Hydrocarbons	MG/KG	270	6610		03/14/94
ORGANIC ANALYSIS					
AIR FORCE AROMATIC VOLATILE ORGANICS				SW8020	
Benzene	MG/KG	2.7	ND		03/08/94
Toluene	MG/KG	2.7	ND		03/08/94
Ethylbenzene	MG/KG	2.7	9.9		03/08/94
Xylenes, Total	MG/KG	3.8	22		03/08/94
a,a,a-Trifluorotoluene	PERCENT		92		03/08/94
Instrument ID #			4		03/08/94
Soil Prep Date			3/8/94		03/08/94
Dilution Factor			5000		03/08/94

PRELIMINARY;
DATA PENDING
FINAL REVIEW

March 29,
PACE Project Number: 740307502

Client Reference: Eglin AFB

These data have been reviewed and are approved for release.

Kenneth D. Faust,
Southern California Regional Director

PRELIMINARY: DATA PENDING FINAL REVIEW

FOOTNOTES
for pages 1 through 4

March 29, 1994
PACE Project Number: 7403075

Client Reference: Eglin AFB

MDL Method Detection Limit
ND Not detected at or above the MDL.

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: ASTM D422-63
Analyzed: 5/19/94
Lab ID: 9403626-01
Client ID: EG2-VW-3'
Sample Description: SOIL

SIEVE TEST

A. Total weight of sample:	212.91	g
B. Weight retained in No.10 sieve:	2.26	g
C. % passing No.10 sieve:	98.90	%

Sieve test for weight retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.26	0.12	0.12	99.88
No. 10	2.08	0.98	1.10	98.90
No. 200	193.33	90.80	91.91	8.09

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE DIAM. in mm (D)	% SUSPENDED (P)
2	20	15	11	14.5	0.0368	9.5
5	20	14	10	14.7	0.0234	8.6
10	20	13	9	14.8	0.0166	7.7
15	20	13	9	14.6	0.0136	7.7
25	20	12	8	15	0.0106	6.9
40	20	12	8	15	0.0084	6.9
60	20	12	8	15	0.0068	6.9
90	20	12	8	15	0.0056	6.9
120	20	11	7	15.2	0.0049	6.0
1440	20	10	6	15.3	0.0014	5.2

Weight of soil used in hydrometer test (D):	115	g
Hydroscopic moisture correction factor (G):	1	
Specific gravity (Assumed):	2.65	
Dispersing agent correction factor (F):	3	
Meniscus correction factor (F):	1	
Temp./Spec. gravity dependant constant (K):	0.01366	

Formulas:

$R = H - E - F$

$S = K[SQRT(L/T)]$

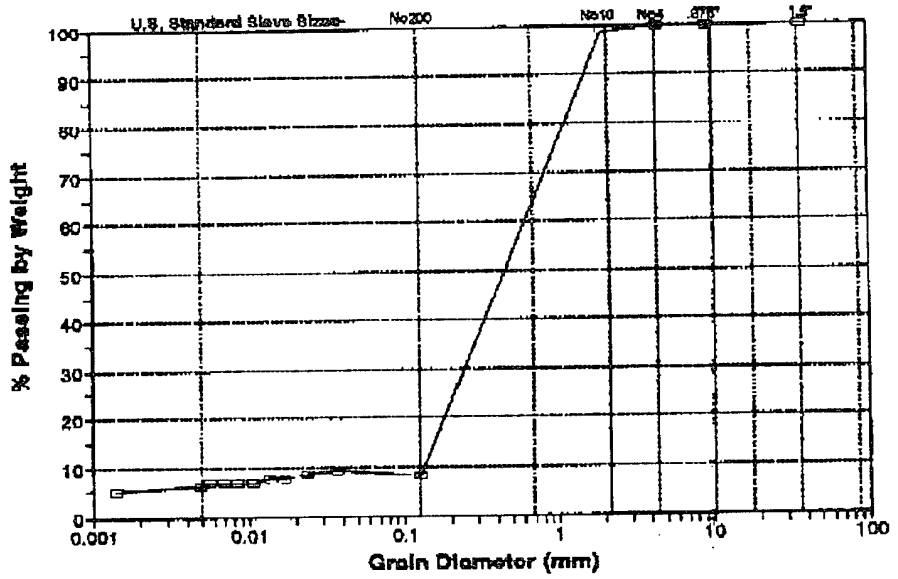
$P = (R/W)100$

$W = (J \times 100)/C$

$J = D \times G$

Method: ASTM D422-63
Analyzed: 3/16/94
Lab ID: 9403626-01

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coars	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	99.88
2	98.90
0.127	8.09
0.0368	9.46
0.0234	8.60
0.0166	7.74
0.0120	7.74
0.0106	6.88
0.0084	6.88
0.0068	6.88
0.0056	6.88
0.0049	6.02
0.0014	5.16

Sample Composition:

(1) Gravel, passing 3-in. and retained on No. 4 sieve	0.1 %
(2) Sand, passing No. 4 sieve and retained on No. 200 sieve	91.8 %
(3) Silt size, 0.074 to 0.005 mm	2.1 %
(4) Clay size, smaller than 0.005 mm	6.0 %

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: ASTM D422-63
Analyzed: 3/16/94
Lab ID: 9403626-02
Client ID: EG2-VMPA-39'
Sample Description: SOIL

SIEVE TEST

A. Total weight of sample:	280.58	g
B. Weight retained in No.10 sieve:	0.09	g
C. % passing No.10 sieve:	99.96	%

Sieve test for weight retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	0.09	0.04	0.04	99.96
No. 200	221.56	92.48	92.52	7.48

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg.C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE DIAM. in mm (D)	% SUSPENDED (P)
2	20	14	10	14.7	0.0370	8.7
5	20	9	6	15.5	0.0240	4.3
10	20	9	6	15.5	0.0170	4.3
15	20	9	6	15.5	0.0139	4.3
25	20	9	6	15.5	0.0107	4.3
40	20	9	6	15.5	0.0085	4.3
60	20	8	4	15.8	0.0070	3.5
90	20	8	4	15.8	0.0057	3.5
120	20	8	4	15.8	0.0049	3.5
1440	20	7	3	15.9	0.0014	2.6

Weight of soil used in hydrometer test (D):	115	g
Hydroscopic moisture correction factor (C):	1	
Specific gravity (Assumed):	2.65	
Dispersing agent correction factor (E):	8	
Meniscus correction factor (F):	1	
Temp./Spec. gravity dependent constant (K):	0.01365	

Formulas:

R = H - E - F

S = K[SQRT(L/T)]

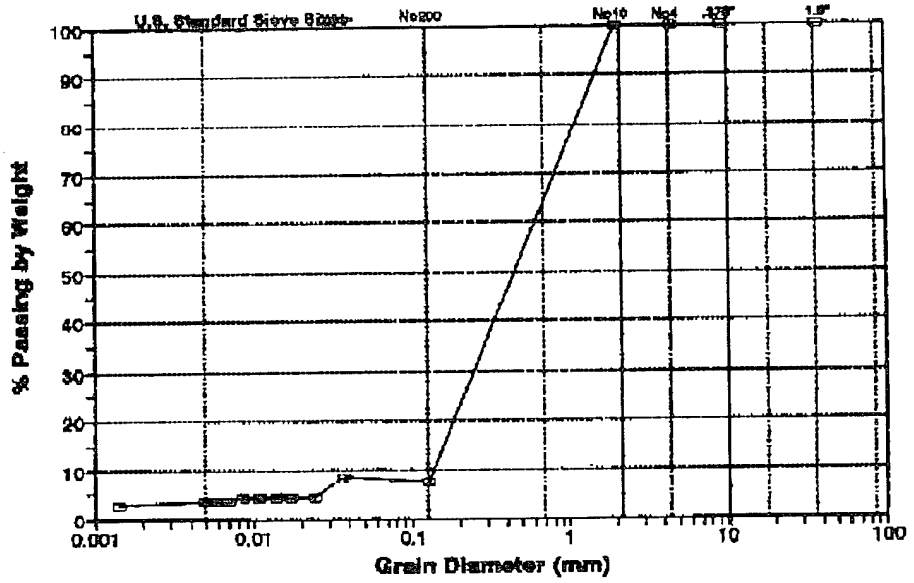
P = (R/W)100

W = (J x 100)/C

J = D x G

Method: ASTM D422-63
Analyzed: 3/16/94
Lab ID: 9403626-02

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coarse	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	100.00
2	99.96
0.127	7.48
0.0370	6.69
0.0240	4.35
0.0170	4.35
0.0139	4.35
0.0107	4.35
0.0065	4.35
0.0070	3.48
0.0057	3.48
0.0048	3.48
0.0014	2.61

Sample Composition:

(1) Gravel, passing 3-in. and retained on No. 4 sieve	0.0 %
(2) Sand, passing No. 4 sieve and retained on No. 200 sieve	92.5 %
(3) Silt size, 0.074 to 0.005 mm	4.0 %
(4) Clay size, smaller than 0.005 mm	3.5 %

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: ASTM D422-63
Analyzed: 3/16/94
Lab ID: 9403626-03
Client ID: EG2-VMPB-2-4
Sample Description: SOIL

SIEVE TEST

A. Total weight of sample:	225.89	g
B. Weight retained in No.10 sieve:	1.19	g
C. % passing No.10 sieve:	99.47	%

Sieve test for weight retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	1.19	0.53	0.53	99.47
No. 200	207.01	91.65	92.17	7.83

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE DIAM. in mm (D)	% SUSPENDED (P)
2	20	14	10	14.7	0.0370	8.6
5	20	14	10	14.7	0.0234	8.6
10	20	13	9	14.8	0.0166	7.8
15	20	12	8	15	0.0137	6.9
25	20	12	8	15	0.0106	6.9
40	20	11	7	15.2	0.0084	6.1
60	20	11	7	15.2	0.0069	6.1
90	20	11	7	15.2	0.0056	6.1
120	20	11	7	15.2	0.0049	6.1
1440	20	10	6	15.3	0.0014	5.2

Weight of soil used in hydrometer test (D):	115	g
Hydroscopic moisture correction factor (C):	1	
Specific gravity (Assumed):	2.65	
Dispersing agent correction factor (E):	9	
Meniscus correction factor (F):	1	
Temp./Spec. gravity dependant constant (K):	0.01365	

Formulas:

$R = H - E - F$

$D = K[SQRT(L/T)]$

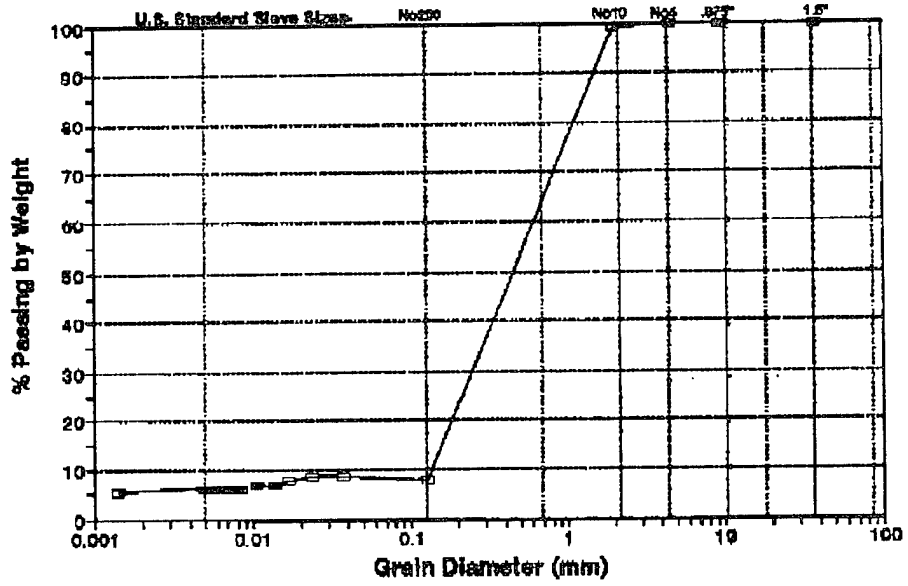
$P = (R/W)100$

$W = (J \times 100)/G$

$J = D \times G$

Method: ASTM D422-63
Analyzed: 3/16/94
Lab ID: 9403626-03

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coarse	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	100.00
2	99.47
0.127	7.83
0.0370	8.65
0.0234	8.65
0.0168	7.78
0.0137	6.92
0.0106	6.92
0.0084	6.05
0.0069	6.05
0.0056	6.05
0.0049	6.05
0.0014	5.19

Sample Composition:

(1) Gravel, passing 3-in. and retained on No. 4 sieve	0.0 %
(2) Sand, passing No. 4 sieve and retained on No. 200 sieve	92.2 %
(3) Silt size, 0.074 to 0.005 mm	1.5 %
(4) Clay size, smaller than 0.005 mm	6.1 %

730307.503

FIGURE B.2

CHAIN OF CUSTODY RECORD

Page 1 of 1

ENGINEERING-SCIENCE, INC.
1700 BROADWAY, SUITE 900
DENVER, COLORADO 80290
303-831-8100

ES Job No. DE268.43.05

AFCEE BIOVENTING PILOT TESTS

Base: EGLIN AFB

Site: old EGLIN FTA (EG2)

Sampler(s) (Signature): OLA A- AWOSIKA [signature]

Ship To: ATTENTION: Ms. MELANIE BUKOWSKI
PACE LABORATORY
~~11 Digital Drive~~ 5702 BOLSA Av.
~~Novato, California 94949~~
~~Attn: Stacy Hook~~ HUNTINGTON BEACH
~~(415) 883-6100~~
(714) 892-2565

Preservative: NONE | HOLD | AT 4C | NONE

Analysis Required:

Date	Time	Sample Description	Lab I.D.	No. of Contrs.	SW 8015 (FID)	A 403 (ALKA)	SW 7380 (IRON)	SW 846 (MOIST)	SW 8020 (BTEX)	E 418.1 (TRPH)	E 351.2 (TKN)	E 365.2 (PHOS)	USCS (CLASS)	Sample Type	Matrix	Remarks
3/3/94	1400	EG2 - VW - 3'		3			✓			✓			✓	(G) C	SOIL	
3/4/94	1030	EG2 - VMPA - 3.9'		3			✓			✓			✓	(G) C	SOIL	
3/4/94	1300	EG2 - VMPB - 2-4'		3			✓					✓		(G) C	SOIL	

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time
[signature]	3/4/94 1500	VIA FED EX	3-4
Relinquished by: (Signature) FED EX	3-7 0956	Received for Laboratory by: (Signature) [signature] (PACE)	3-7 0956

Remarks: RECD @ 4.3°C 3-7-94 GW

G - Grab Sample, C - Composite Sample

Distribution: Original Accompanies Shipment, Copies to: Coordinator Field Files

Federal Express Number:

Airbill Number: 7290988110

ENGINEERING-SCIENCE, INC.
1700 Broadway, Suite 900 - Denver, Colorado
(303) 831-8100

COC8803

7290988110

APPENDIX D

PERMEABILITY TEST AND BIODEGRADATION RATE CALCULATIONS FOR HURLBURT FTA

HURLBURT

EGLIN AFB / EG3 / ~~EGLIN~~ – FTA
Steady–state Equation – Air Injection

Enter data

Calculated data

$$k = \frac{Q \mu \ln (Rw / Ri)}{H \pi Patm [1 - (Pw / Patm)^2]}$$

Where:

Q = Volumetric flow rate of vent well

13.0	scfm x (30.48 cm/ft)^3 x (1 min/60 s) =	6.14E+03 cm^3/s
μ = Viscosity of Air @ 18° C =		1.80E–04 g/cm s

Patm = Ambient pressure @ 200 feet of elevation

403	inches H2O x (3.61E–2 psia/in. H2O) =	14.548 psia
14.548	psia x (6.89476E4 g/cm s^2)/psia =	1.00E+06 g/cm s^2

Rw = Radius of Vent Well

2	inches x 2.54 cm/in =	5.08 cm

H = Depth of Screen (length of screened interval)

5	feet x 30.48 cm/ft =	152 cm

Ri = Maximum Radius of Venting Influence

75	feet x 30.48 cm/ft : Eglin FTA	2286 cm

Pw = Absolute Pressure at Vent W

40	inches H2O x (3.611	1.444 psia
1.444	psia + [ ]	15.992 psia
15.992	psia x (6.89476E4 g/cm s^2)/psia =	1.10E+06 g/cm s^2

k = 6.742E–08 cm^2

6.740E–08	cm^2 x (1 m/100 cm)^2 =	6.700E–12 m^2
6.700E–12	m^2 x 1 darcy/(9.870E–13 m^2) =	6.79 darcys

Eglin AJB / Site EG3 / MPC-S, MPC-D, MPB-D

HyperVentilate© 1991

Air Permeability Test - Data Analysis (cont.)

1. Enter radial distances of monitoring points → r= 40 (ft) | r= 40 (ft) | r= 20 (ft)

2. Enter measured times and gauge vacuums

	(min)	(in H2O)	(min)	(in H2O)	(min)	(in H2O)
	1	0	1	0	1	1.1
	2	0.35	2	0.4	2	2.6
	3	0.7	3	0.8	3	3.5
	4	1.1	4	1.2	4	4.1
	5	1.35	5	1.45	5	4.5
	6	1.6	6	1.7	6	4.9
	7	1.75	7	1.85	7	5.1
	8	1.9	8	2.0	8	5.3
	9	2.05	9	2.15	9	5.5
	10	2.15	10	2.25	10	5.7
		clear		clear		clear

3. Enter (optional):

a) flowrate: 13 (SCFM)

b) screened interval thickness: 5 (ft)

-->Calculate<--

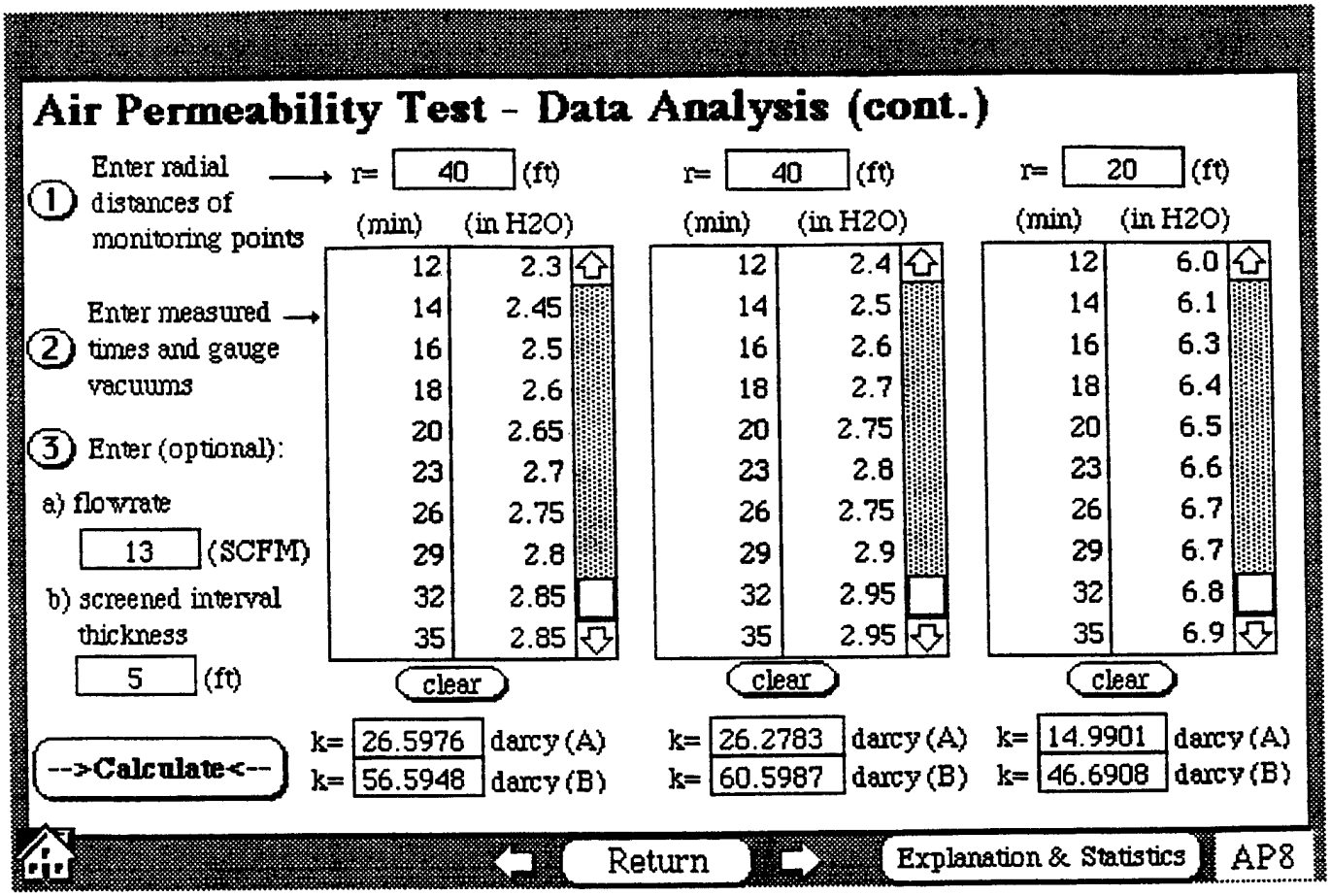
k= 26.5976 darcy (A)	k= 26.2783 darcy (A)	k= 14.9901 darcy (A)
k= 56.5948 darcy (B)	k= 60.5987 darcy (B)	k= 46.6908 darcy (B)

Return | Explanation & Statistics | AP8

QC-BNB
6-10-94

B:EGLIN\HV\EG3\MPC-S,MPC-D,MPB-D\6/10/94\rms

HyperVentilate© 1991



Air Permeability Test - Data Analysis (cont.)

On the previous Card (AP8), the data you input were fit to the approximate expression given on Card AP6. It was analyzed using both methods described on card AP7, if you input values for the extraction well flowrate (Q) and the stratum thickness (m). Below each column of data, the two calculated permeability values are denoted by:

darcy(A) - refers to calculation method 1 (see Card AP7)
darcy(B) - refers to calculation method 2 (see Card AP7)

During the regression analyses, the data expressed as pairs of points (ln(t), P') are fit to a line. The "correlation coefficient", r, is a measure of how well the data conform to the theoretical curve. As r-->1, the data points all fall on the theoretical curve. At the right are given the correlation coefficient values for the three data sets. For more info on the meaning of r, consult any introductory Statistics book.

	Correlation Coef. (r)
data set #1	0.987386
data set #2	0.986659
data set #3	0.980926

HyperVentilate© 1991

Eglin A1B / Site EG3

Air Permeability Test - Data Analysis (cont.)

1. Enter radial distances of monitoring points → r= 10 (ft) [MPA-S] | r= 10 (ft) [MPA-D] | r= 20 (ft) [MPB-S]

2. Enter measured times and gauge vacuums

(min)	MPA-S (in H2O)	MPA-D (in H2O)	MPB-S (in H2O)
1	4.0	5.0	1.1
2	6.1	7.0	2.2
3	7.25	8.0	2.9
4	7.9	8.5	3.3
5	8.4	9.0	3.6
6	8.75	9.25	3.9
7	9.0	9.6	4.1
8	9.2	9.8	4.3
9	9.4	10.0	4.4
10	9.9	10.1	4.55

clear | clear | clear

3. Enter (optional):

a) flowrate: 13 (SCFM)

b) screened interval thickness: 5 (ft)

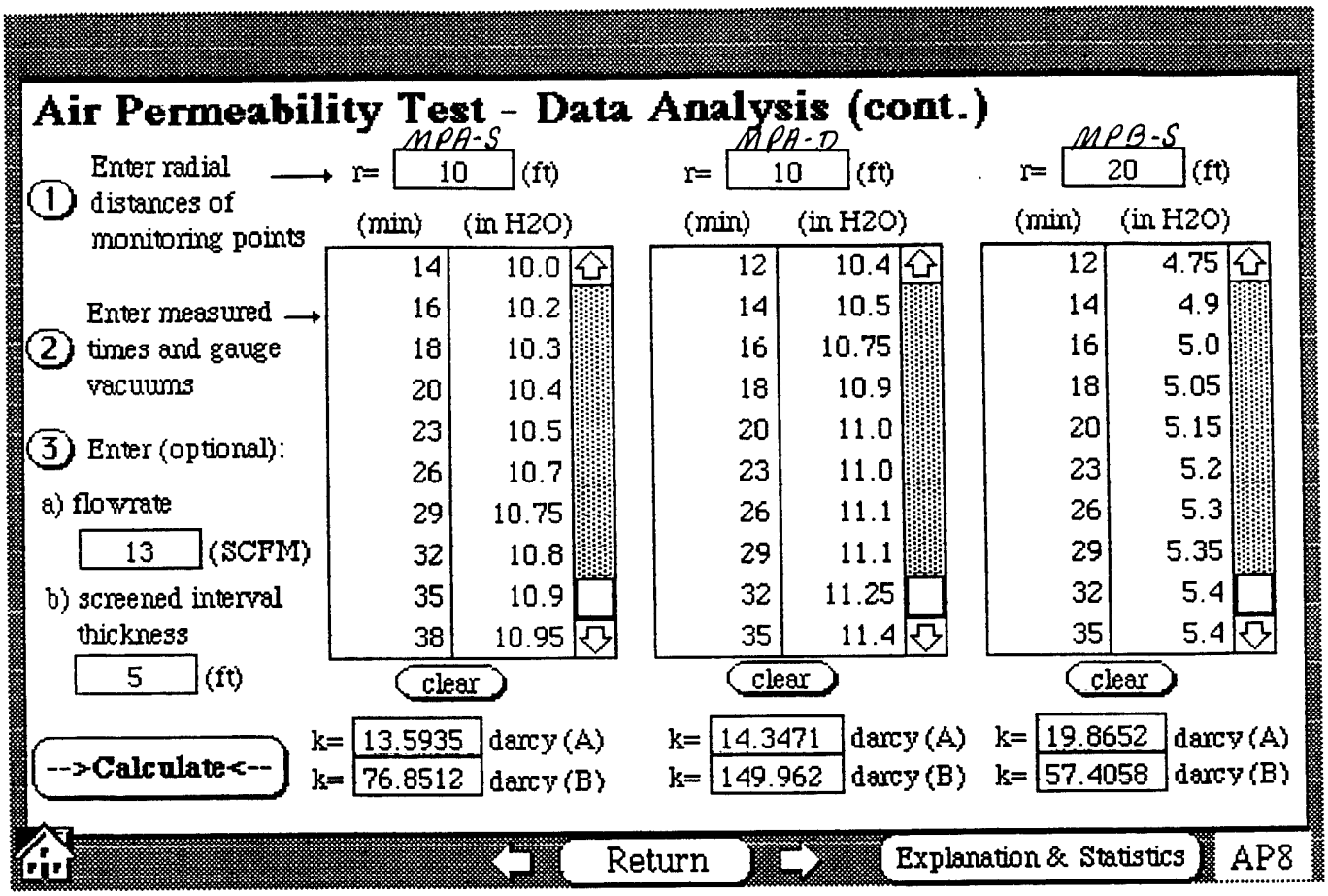
-->Calculate<--

	MPA-S	MPA-D	MPB-S
k=	13.5935 darcy (A)	14.3471 darcy (A)	19.8652 darcy (A)
k=	76.8512 darcy (B)	149.962 darcy (B)	57.4058 darcy (B)

Return | Explanation & Statistics | AP8

B:EGLIN\HIN\EG3\MPA-S.MPA-D MPB-S.HV\ 6/18/94\ rms

HyperVentilate© 1991



Air Permeability Test - Data Analysis (cont.)

On the previous Card (AP8), the data you input were fit to the approximate expression given on Card AP6. It was analyzed using both methods described on card AP7, if you input values for the extraction well flowrate (Q) and the stratum thickness (m). Below each column of data, the two calculated permeability values are denoted by:

darcy(A) - refers to calculation method 1 (see Card AP7)
darcy(B) - refers to calculation method 2 (see Card AP7)

During the regression analyses, the data expressed as pairs of points (ln(t), P') are fit to a line. The "correlation coefficient", r, is a measure of how well the data conform to the theoretical curve. As r-->1, the data points all fall on the theoretical curve. At the right are given the correlation coefficient values for the three data sets. For more info on the meaning of r, consult any introductory Statistics book.

	Correlation Coef. (r)
data set #1	0.968318
data set #2	0.972764
data set #3	0.981263

Return

EGLIN AFB (Hurlburt) – INITIAL – MPA–D(5)
Biodegradation Rate Calculations

enter data | calculated data

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where:

K_b = fuel biodegradation rate

K_o = O_2 utilization rate (%/min.)

A = volume of air/kg soil

D_o = O_2 density 1340 mg/L

C = Carbon/O_2 ratio for hexane mineralization = 1/3.5

Test Results: MPA–D(5) K_o = max. observed rate 0.0029 %/min.
w = moisture content 5.8 %

Assume: Soil properties for Mixed grained sand, loose Specify from Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn, John Wiley Press, 1974)

Porosity:	*n* =	0.40
Unit weight (dry):	^{g}d =	1.59
Void ratio:	*e* = *n*/1–*n* =	0.67
Specific gravity:	G =	2.65

Calculate A = Air filled volume (V_a)/unit wt.
Solving for 1 liter of soil

a) $V_v = n * 1$ L
V_v = 0.4 liters V_v = void volume

b) $S_r = Gw/e$
S_r = 0.23 S_r = degree of saturation

c) $V_w = S_r \times V_v$
V_w = 0.09 liters V_w = volume of water

d) $V_a = V_v - V_{vw}$
V_a = 0.31 liters V_w = volume of water

e) Bulk density = ^{g}d + ($V_w \times {}^g$w) = 1.7 kg/l soil

f) A = V_a/Bulk density = 0.182 l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times$ 525,600 min/yr = 1062 mg TPH/year

EGLIN AFB (Hurlburt) – INITIAL – MPB–D(5)

Biodegradation Rate Calculations | enter data | calculated data |

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where:

K_b = fuel biodegradation rate

K_o = O_2 utilization rate (%/min.)

A = volume of air/kg soil

D_o = O_2 density 1340 mg/L

C = Carbon/O_2 ratio for hexane mineralization = 1/3.5

Test Results: MPB–D(5) K_o = max. observed rate 0.0026 %/min.

w = moisture content 7.1 %

Assume: Soil properties for Mixed grained sand, loose Specify from Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn, John Wiley Press, 1974)

Porosity:	*n* =	0.40
Unit weight (dry):	^{g}d =	1.59
Void ratio:	*e* = *n*/1–*n* =	0.67
Specific gravity:	G =	2.65

Calculate A = Air filled volume (V_a)/unit wt.

Solving for 1 liter of soil

a) $V_v = n * 1$ L

V_v = 0.4 liters V_v = void volume

b) $S_r = Gw/e$

S_r = 0.28 S_r = degree of saturation

c) $V_w = S_r \times V_v$

V_w = 0.11 liters V_w = volume of water

d) $V_a = V_v - V_{vw}$

V_a = 0.29 liters V_w = volume of water

e) Bulk density = ^{g}d + ($V_w \times {}^g$w) = 1.7 kg/l soil

f) A = V_a/Bulk density = 0.171 l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times$ 525,600 min/yr = 895 mg TPH/year

EGLIN AFB (Hurlburt) – INITIAL – MPC–S(3)
Biodegradation Rate Calculations

enter data | calculated data

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where:

K_b = fuel biodegradation rate

K_o = O_2 utilization rate (%/min.)

A = volume of air/kg soil

D_o = O_2 density 1340 mg/L

C = Carbon/O_2 ratio for hexane mineralization = 1/3.5

Test Results: MPC–S(3)

K_o = max. observed rate 0.0034 %/min.

w = moisture content 5.8 %

Assume: Soil properties for Mixed grained sand, loose Specify from Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn, John Wiley Press, 1974)

Porosity:	*n* =	0.40
Unit weight (dry):	^{g}d =	1.59
Void ratio:	*e* = *n*/1–*n* =	0.67
Specific gravity:	G =	2.65

Calculate A = Air filled volume (V_a)/unit wt.

Solving for 1 liter of soil

a) $V_v = n * 1$ L

V_v = 0.4 liters V_v = void volume

b) $S_r = Gw/e$

S_r = 0.23 S_r = degree of saturation

c) $V_w = S_r \times V_v$

V_w = 0.09 liters V_w = volume of water

d) $V_a = V_v - V_{vw}$

V_a = 0.31 liters V_w = volume of water

e) Bulk density = ^{g}d + (V_w x ^{g}w) = 1.7 kg/l soil

f) A = V_a/Bulk density = 0.182 l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times$ 525,600 min/yr = 1245 mg TPH/year

APPENDIX E

PERMEABILITY TEST AND BIODEGRADATION RATE CALCULATIONS FOR EGLIN FTA

EGLIN

EGLIN AFB / ~~HURLBURT~~ FTA
Steady–state Equation – Air Injection

Enter data

Calculated data

$$k = \frac{Q \mu \ln (Rw / Ri)}{H \pi Patm [1 - (Pw / Patm)^2]}$$

Where:

Q = Volumetric flow rate of vent well

92.0	scfm x $(30.48 cm/ft)^3$ x (1 min/60 s) =	4.34E+04 cm^3/s
μ = Viscosity of Air @ 18° C =		1.80E–04 g/cm s

Patm = Ambient pressure @ 200 feet of elevation

403	inches H2O x (3.61E–2 psia/in. H2O) =	14.548 psia
14.548	psia x (6.89476E4 g/cm s^2)/psia =	1.00E+06 g/cm s^2

Rw = Radius of Vent Well

2	inches x 2.54 cm/in =	5.08 cm

H = Depth of Screen (length of screened interval)

35	feet x 30.48 cm/ft =	1067 cm

Ri = Maximum Radius of Venting Influence

65	feet x 30.48 cm/ft =	1981 cm

Pw = Absolute Pressure at Vent Well

4	inches H2O x (3.61E–2 psia/in. H2O) =	0.144 psia
0.144 psia +	14.548 psia =	14.693 psia
14.693	psia x (6.89476E4 g/cm s^2)/psia =	1.01E+06 g/cm s^2

	k =	6.953E–07 cm^2
6.953E–07	cm^2 x (1 m/100 cm)^2 =	6.950E–11 m^2
6.950E–11	m^2 x 1 darcy/(9.870E–13 m^2) =	70.42 darcys

EGLIN / ITA / MPB-S, MPA-S, MPA-M

HyperVentilate© 1991

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points → r= 20 (ft) | r= 10 (ft) | r= 10 (ft)

② Enter measured times and gauge vacuums

③ Enter (optional):

a) flowrate: 92 (SCFM)

b) screened interval thickness: 35 (ft)

	r= 20 ft		r= 10 ft		r= 10 ft	
	(min)	(in H2O)	(min)	(in H2O)	(min)	(in H2O)
1	1	0.5	1	.85	1	1.1
2	2	.8	2	1.2	2	1.45
3	3	.95	3	1.25	3	1.6
4	4	1.05	4	1.4	4	1.65
5	5	1.1	5	1.5	5	1.75
6	6	1.15	6	1.5	6	1.8
7	7	1.17	7	1.55	7	1.8
8	8	1.2	8	1.55	8	1.85
9	9	1.22	9	1.6	9	1.90
10	10	1.25	10	1.65	10	1.90

clear | clear | clear

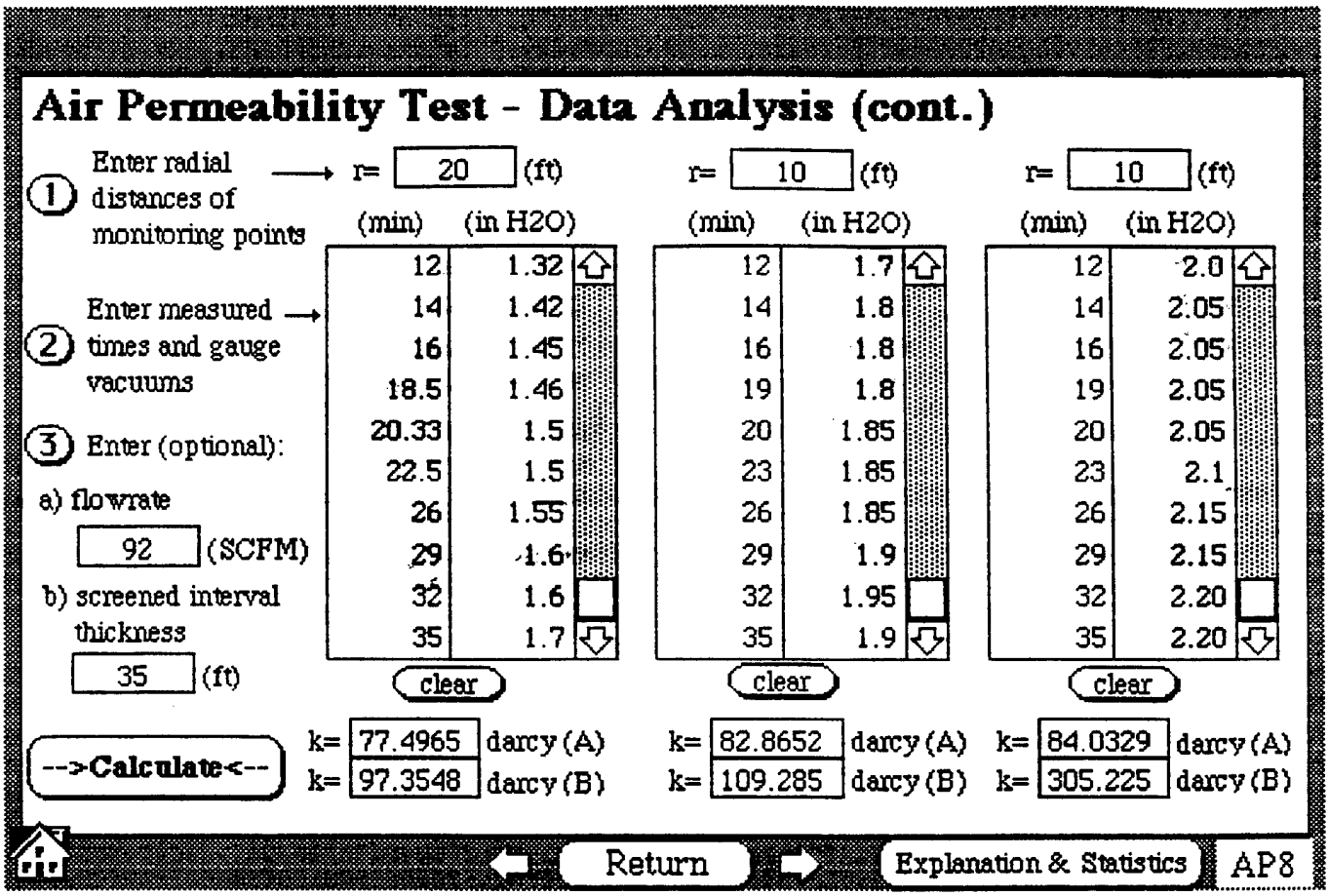
-->Calculate<--

k= 77.4965 darcy (A)	k= 82.8652 darcy (A)	k= 84.0329 darcy (A)
k= 97.3548 darcy (B)	k= 109.285 darcy (B)	k= 305.225 darcy (B)

Return | Explanation & Statistics | AP8

QC - BAB - 6-13-94

B:\EGLIN\HV\ETA\MPA-S MPA-S 1100-AA\Winhlp\rms


Air Permeability Test - Data Analysis (cont.)
1 Enter radial distances of monitoring points
r= 20 (ft)
r= 10 (ft)
r= 10 (ft)
2 Enter measured times and gauge vacuums
(min) (in H2O)
12 1.32
14 1.42
16 1.45
18.5 1.46
20.33 1.5
22.5 1.5
26 1.55
29 1.6
32 1.6
35 1.7
clear
12 1.7
14 1.8
16 1.8
19 1.8
20 1.85
23 1.85
26 1.85
29 1.9
32 1.95
35 1.9
clear
12 2.0
14 2.05
16 2.05
19 2.05
20 2.05
23 2.1
26 2.15
29 2.15
32 2.20
35 2.20
clear
3 Enter (optional):
a) flowrate
92 (SCFM)
b) screened interval thickness
35 (ft)
-->Calculate<--
k= 77.4965 darcy (A)
k= 97.3548 darcy (B)
k= 82.8652 darcy (A)
k= 109.285 darcy (B)
k= 84.0329 darcy (A)
k= 305.225 darcy (B)
Return
Explanation & Statistics
AP8

Air Permeability Test - Data Analysis (cont.)

On the previous Card (AP8), the data you input were fit to the approximate expression given on Card AP6. It was analyzed using both methods described on card AP7, if you input values for the extraction well flowrate (Q) and the stratum thickness (m). Below each column of data, the two calculated permeability values are denoted by:

darcy(A) - refers to calculation method 1 (see Card AP7)
darcy(B) - refers to calculation method 2 (see Card AP7)

During the regression analyses, the data expressed as pairs of points (ln(t), P') are fit to a line. The "correlation coefficient", r, is a measure of how well the data conform to the theoretical curve. As r-->1, the data points all fall on the theoretical curve. At the right are given the correlation coefficient values for the three data sets. For more info on the meaning of r, consult any introductory Statistics book.

	Correlation Coef. (r)
data set #1	0.994199
data set #2	0.985485
data set #3	0.984607

HyperVentilate© 1991 Eglin AIB/FTA/MPB-M, MPB-D

Air Permeability Test - Data Analysis (cont.)

1. Enter radial distances of monitoring points → r= 20 (ft) | r= 20 (ft) | r= (ft)

2. Enter measured times and gauge vacuums

	(min)	(in H2O)	(min)	(in H2O)	(min)	(in H2O)
1	1	.55	1	0.05		
2	2	.85	2	0.05		
3	3	.95	3	0.05		
4	4	1.05	4	0.05		
5	5	1.1	5	0.05		
6	6	1.15	6	0.05		
7	7	1.15	7	0.05		
8	8	1.2	8	0.05		
9	9	1.25	9	0.05		
10	10	1.25	10	0.05		
	clear		clear		clear	

3. Enter (optional):

a) flowrate: 92 (SCFM)

b) screened interval thickness: 35 (ft)

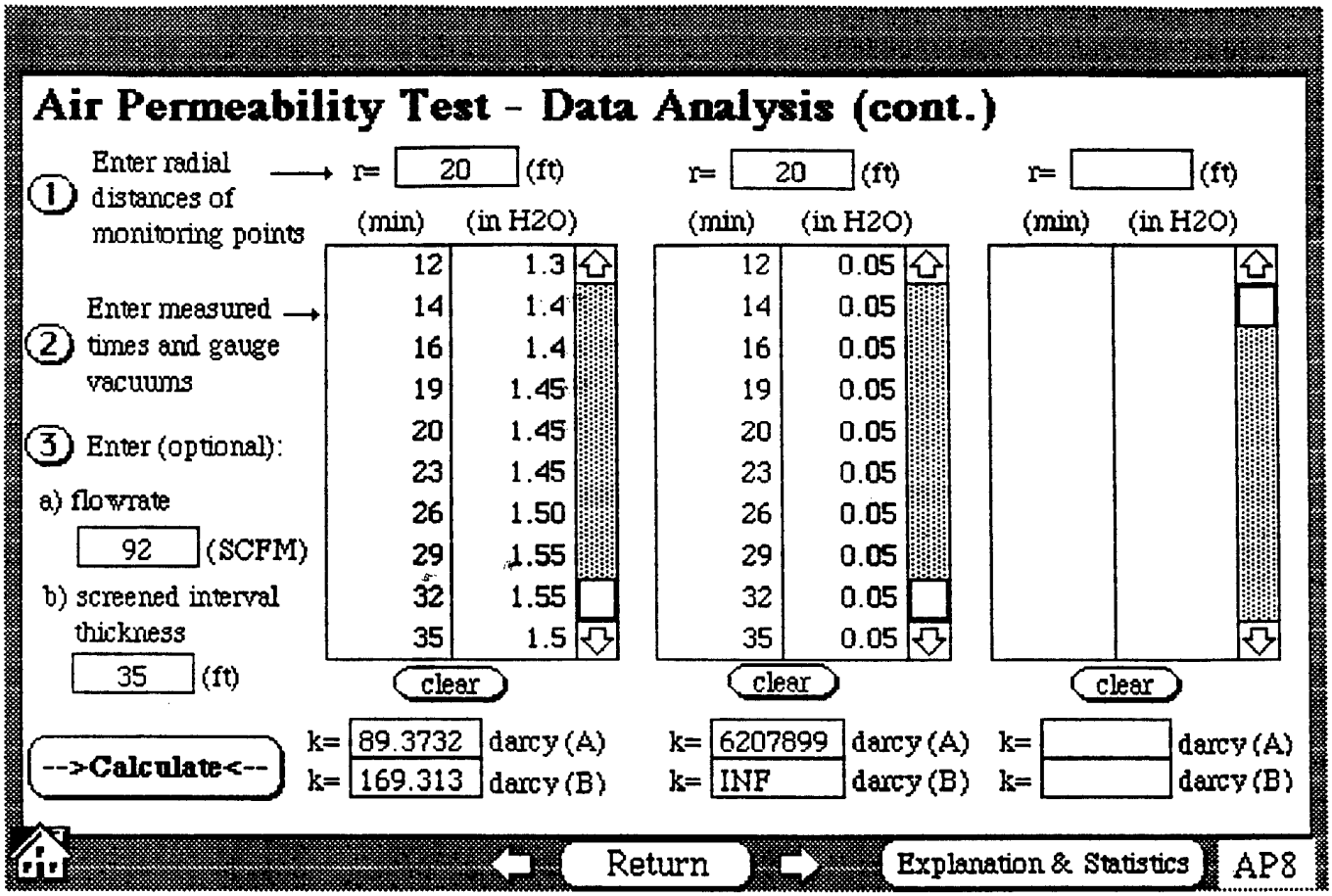
-->Calculate<--

k=	89.3732	darcy (A)	k= 6207899	darcy (A)	k=	darcy (A)
k=	169.313	darcy (B)	k= INF	darcy (B)	k=	darcy (B)

Return | Explanation & Statistics | AP8

Q-gpm
5-13-94

B:EGLIN\HV\FTA\MPB-M, MPB-D\6/10/94\rms


Air Permeability Test - Data Analysis (cont.)
1 Enter radial distances of monitoring points
r= 20 (ft)
r= 20 (ft)
r= (ft)
2 Enter measured times and gauge vacuums
(min) (in H2O)
12 1.3
14 1.4
16 1.4
19 1.45
20 1.45
23 1.45
26 1.50
29 1.55
32 1.55
35 1.5
(min) (in H2O)
12 0.05
14 0.05
16 0.05
19 0.05
20 0.05
23 0.05
26 0.05
29 0.05
32 0.05
35 0.05
(min) (in H2O)
3 Enter (optional):
a) flowrate
92 (SCFM)
b) screened interval thickness
35 (ft)
clear
clear
clear
-->Calculate<--
k= 89.3732 darcy (A)
k= 169.313 darcy (B)
k= 6207899 darcy (A)
k= INF darcy (B)
k= darcy (A)
k= darcy (B)
Return
Explanation & Statistics
AP8

Air Permeability Test - Data Analysis (cont.)

On the previous Card (AP8), the data you input were fit to the approximate expression given on Card AP6. It was analyzed using both methods described on card AP7, if you input values for the extraction well flowrate (Q) and the stratum thickness (m). Below each column of data, the two calculated permeability values are denoted by:

darcy(A) - refers to calculation method 1 (see Card AP7)
darcy(B) - refers to calculation method 2 (see Card AP7)

During the regression analyses, the data expressed as pairs of points (ln(t), P') are fit to a line. The "correlation coefficient", r, is a measure of how well the data conform to the theoretical curve. As r-->1, the data points all fall on the theoretical curve. At the right are given the correlation coefficient values for the three data sets. For more info on the meaning of r, consult any introductory Statistics book.

	Correlation Coef. (r)
data set #1	0.989789
data set #2	-NAN(00
data set #3	No Data

Return

AP9

HyperVentilate© 1991

Eglin AFB / ITA

Air Permeability Test - Data Analysis (cont.)

	MPC-S	MPC-M	MPC-D
① Enter radial distances of monitoring points → r=	40 (ft)	40 (ft)	40 (ft)

② Enter measured times and gauge vacuums

	MPC-S (min)	MPC-S (in H2O)	MPC-M (min)	MPC-M (in H2O)	MPC-D (min)	MPC-D (in H2O)
	1	.12	1	.11	1	.12
	2	.32	2	.30	2	.32
	3	.45	3	.42	3	.44
	4	.54	4	.49	4	.52
	5	.59	5	.54	5	.57
	6	.62	6	.57	6	.59
	7	.65	7	.61	7	.62
	8	.67	8	.63	8	.64
	9	.69	9	.64	9	.66
	10	.72	10	.68	10	.70
	clear		clear		clear	

③ Enter (optional):

a) flowrate: 92 (SCFM)

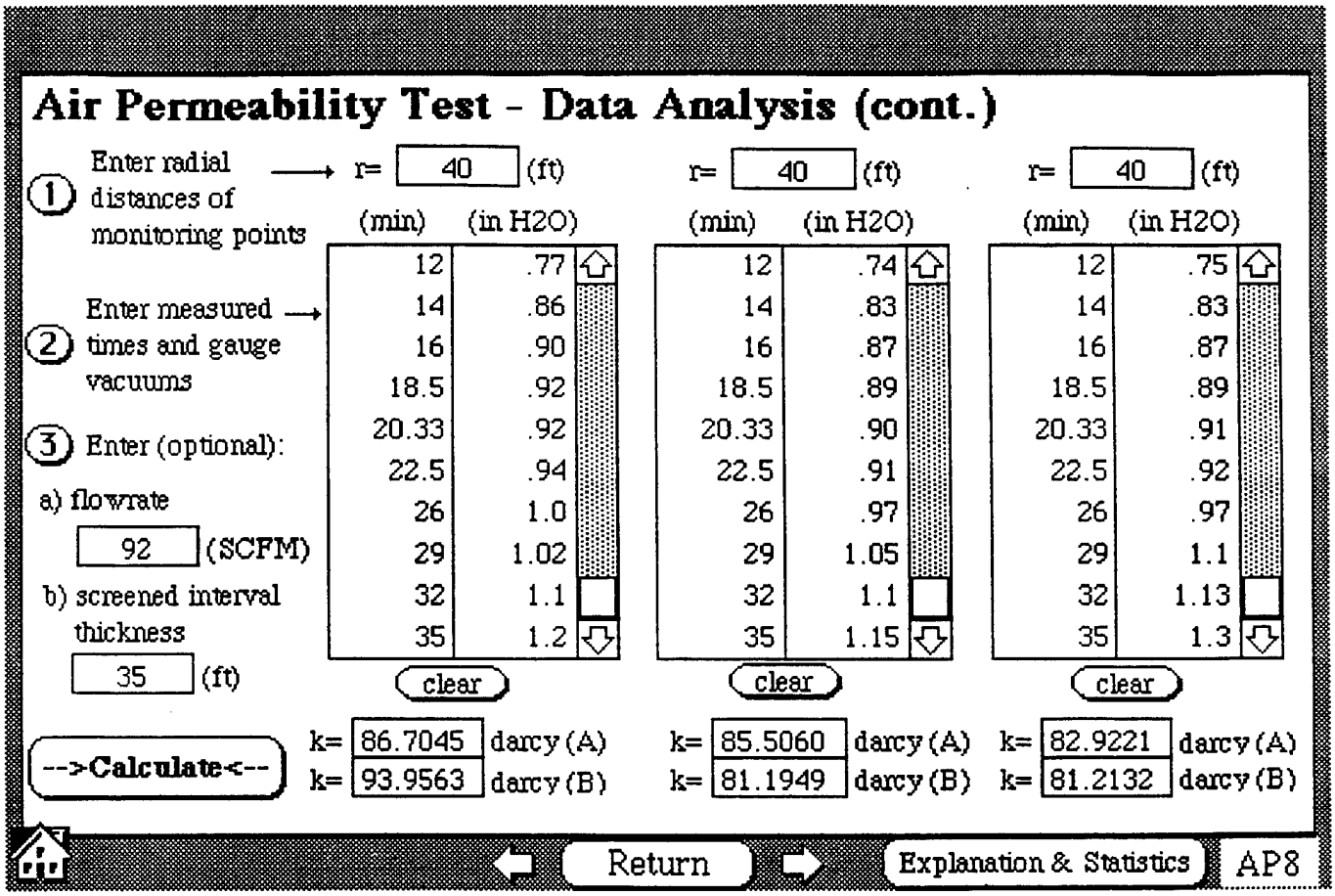
b) screened interval thickness: 35 (ft)

-->Calculate<--

	MPC-S	MPC-M	MPC-D
k=	86.7045 darcy (A)	85.5060 darcy (A)	82.9221 darcy (A)
k=	93.9563 darcy (B)	81.1949 darcy (B)	81.2132 darcy (B)

Return | Explanation & Statistics | AP8

9:\EGLIN\HV\ITA\MPC-S.MPC-M MPC-D.HV\6/13/94\rms


Air Permeability Test - Data Analysis (cont.)
1 Enter radial distances of monitoring points
r= 40 (ft)
r= 40 (ft)
r= 40 (ft)
(min) (in H2O)
2 Enter measured times and gauge vacuums
12 .77
14 .86
16 .90
18.5 .92
20.33 .92
22.5 .94
26 1.0
29 1.02
32 1.1
35 1.2
clear
12 .74
14 .83
16 .87
18.5 .89
20.33 .90
22.5 .91
26 .97
29 1.05
32 1.1
35 1.15
clear
12 .75
14 .83
16 .87
18.5 .89
20.33 .91
22.5 .92
26 .97
29 1.1
32 1.13
35 1.3
clear
3 Enter (optional):
a) flowrate
92 (SCFM)
b) screened interval thickness
35 (ft)
-->Calculate<--
k= 86.7045 darcy (A)
k= 93.9563 darcy (B)
k= 85.5060 darcy (A)
k= 81.1949 darcy (B)
k= 82.9221 darcy (A)
k= 81.2132 darcy (B)
Return
Explanation & Statistics
AP8

Air Permeability Test - Data Analysis (cont.)

On the previous Card (AP8), the data you input were fit to the approximate expression given on Card AP6. It was analyzed using both methods described on card AP7, if you input values for the extraction well flowrate (Q) and the stratum thickness (m). Below each column of data, the two calculated permeability values are denoted by:

darcy(A) - refers to calculation method 1 (see Card AP7)
darcy(B) - refers to calculation method 2 (see Card AP7)

During the regression analyses, the data expressed as pairs of points (ln(t), P') are fit to a line. The "correlation coefficient", r, is a measure of how well the data conform to the theoretical curve. As r-->1, the data points all fall on the theoretical curve. At the right are given the correlation coefficient values for the three data sets. For more info on the meaning of r, consult any introductory Statistics book.

	Correlation Coef. (r)
data set #1	0.992033
data set #2	0.991906
data set #3	0.977866

Return

EGLIN AFB (EG2) – INITIAL – MPA–S
Biodegradation Rate Calculations

enter data | calculated data

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where:

K_b = fuel biodegradation rate

K_o = O_2 utilization rate (%/min.)

A = volume of air/kg soil

D_o = O_2 density 1340 mg/L

C = Carbon/O_2 ratio for hexane mineralization = 1/3.5

Test Results: MPA–S

K_o = max. observed rate: 0.0042 %/min.

w = moisture content: 6.8 %

Assume: Soil properties for Mixed grained sand, loose Specify from Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn, John Wiley Press, 1974)

Porosity:	*n* =	0.40
Unit weight (dry):	^{g}d =	1.59
Void ratio:	*e* = *n*/1–*n* =	0.67
Specific gravity:	G =	2.65

Calculate A = Air filled volume (V_a)/unit wt.

Solving for 1 liter of soil

a) $V_v = n * 1$ L

V_v = 0.4 liters V_v = void volume

b) $S_r = Gw/e$

S_r = 0.27 S_r = degree of saturation

c) $V_w = S_r \times V_v$

V_w = 0.11 liters V_w = volume of water

d) $V_a = V_v - V_{vw}$

V_a = 0.29 liters V_w = volume of water

e) Bulk density = ^{g}d + ($V_w \times {}^g$w) = 1.7 kg/l soil

f) A = V_a/Bulk density = 0.171 l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times$ 525,600 min/yr = 1445 mg TPH/year

EGLIN AFB (EG2) – INITIAL – MPB–M
Biodegradation Rate Calculations

enter data | calculated data

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where:

K_b = fuel biodegradation rate

K_o = O_2 utilization rate (%/min.)

A = volume of air/kg soil

D_o = O_2 density 1340 mg/L

C = Carbon/O_2 ratio for hexane mineralization = 1/3.5

Test Results: MPB–M

K_o = max. observed rate 0.0035 %/min.

w = moisture content 7 %

Assume: Soil properties for Mixed grained sand Specify from Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn, John Wiley Press, 1974)

Porosity:	n =	0.35
Unit weight (dry):	^{g}d =	1.72
Void ratio:	$e = n/1-n$ =	0.54
Specific gravity:	G =	2.65

Calculate A = Air filled volume (V_a)/unit wt.

Solving for 1 liter of soil

a) $V_v = n * 1$ L

V_v = 0.35 liters V_v = void volume

b) $S_r = Gw/e$

S_r = 0.34 S_r = degree of saturation

c) $V_w = S_r \times V_v$

V_w = 0.12 liters V_w = volume of water

d) $V_a = V_v - V_{vw}$

V_a = 0.23 liters V_w = volume of water

e) Bulk density = ^{g}d + ($V_w \times {}^g$w) = 1.8 kg/l soil

f) A = V_a/Bulk density = 0.128 l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times$ 525,600 min/yr = 902 mg TPH/year

EGLIN AFB (EG2) – INITIAL – MPC–D(39)

Biodegradation Rate Calculations enter data | calculated data

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where:

K_b = fuel biodegradation rate

K_o = O_2 utilization rate (%/min.)

A = volume of air/kg soil

D_o = O_2 density 1340 mg/L

C = Carbon/O_2 ratio for hexane mineralization = 1/3.5

Test Results: MPC–D (39) K_o = max. observed rate: 0.0013 %/min.

w = moisture content: 7 %

Assume: Soil properties for Mixed grained sand,dense Specify from Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn, John Wiley Press, 1974)

Porosity:	*n* =	0.30
Unit weight (dry):	^{g}d =	1.86
Void ratio:	*e* = *n*/1–*n* =	0.43
Specific gravity:	G =	2.65

Calculate A = Air filled volume (V_a)/unit wt.

Solving for 1 liter of soil

a) $V_v = n * 1$ L

V_v = 0.3 liters V_v = void volume

b) $S_r = Gw/e$

S_r = 0.43 S_r = degree of saturation

c) $V_w = S_r \times V_v$

V_w = 0.13 liters V_w = volume of water

d) $V_a = V_v - V_{vw}$

V_a = 0.17 liters V_w = volume of water

e) Bulk density = ^{g}d + ($V_w \times {}^g$w) = 2 kg/l soil

f) A = V_a/Bulk density = 0.085 l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times$ 525,600 min/yr = 222 mg TPH/year