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SITE-SPECIFIC TECHNICAL REPORT FOR BIOSLURPER TESTING AT THE BULK FUEL STORAGE AREA, MCGUIRE AFB, NEW JERSEY

DRAFT



PREPARED FOR:

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SITE-SPECIFIC TECHNICAL REPORT (A003)

for

**BIOSLURPER TESTING AT THE BULK FUEL STORAGE AREA,
MCGUIRE AFB, NEW JERSEY**

by

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for

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February 5, 1996

**Battelle
505 King Avenue
Columbus, Ohio 43201-2693**

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TABLE OF CONTENTS

LIST OF TABLES	ii
LIST OF FIGURES	ii
EXECUTIVE SUMMARY	iv
1.0 INTRODUCTION	1
1.1 Objectives	1
1.2 Testing Approach	2
2.0 SITE DESCRIPTION	2
3.0 BIOSLURPER SHORT-TERM PILOT TEST METHODS	6
3.1 Initial LNAPL/Groundwater Measurements and Baildown Testing	6
3.2 Well Construction Details	6
3.3 Soil Gas Monitoring Point Installation	6
3.4 Soil Sampling and Analysis	9
3.5 LNAPL Recovery Testing	9
3.5.1 System Setup	9
3.5.2 Initial Skimmer Pump Test	10
3.5.3 Bioslurper Pump Test	10
3.5.4 Second Skimmer Pump Test	13
3.5.5 Drawdown Pump Test	13
3.5.6 Off-Gas Sampling and Analysis	13
3.5.7 Groundwater Sampling and Analysis	15
3.6 Soil Gas Permeability Testing	15
3.7 In Situ Respiration Testing	15
4.0 RESULTS	16
4.1 Baildown Test Results	16
4.2 Soil Sample Analyses	18
4.3 LNAPL Pump Test Results	18
4.3.1 Initial Skimmer Pump Test Results	18
4.3.2 Bioslurper Pump Test Results	18
4.3.3 Second Skimmer Pump Test	23
4.3.4 Drawdown Pump Test	23
4.4 Extracted Groundwater, LNAPL, and Off-Gas Analyses	24
4.5 Bioventing Analyses	24
4.5.1 Soil Gas Permeability and Radius of Influence	24
4.5.2 In Situ Respiration Test Results	28
5.0 DISCUSSION	28
6.0 REFERENCES	29

APPENDIX A:	SITE-SPECIFIC TEST PLAN FOR BIOSLURPER FIELD ACTIVITIES AT MCGUIRE AFB, NEW JERSEY	A-1
APPENDIX B:	LABORATORY ANALYTICAL REPORTS	B-1
APPENDIX C:	OPERATIONAL DATA FOR THE ICE	C-1
APPENDIX D:	SYSTEM CHECKLIST	D-1
APPENDIX E:	DATA SHEETS FROM THE SHORT-TERM PILOT TEST	E-1
APPENDIX F:	SOIL GAS PERMEABILITY TEST RESULTS	E-1
APPENDIX G:	IN SITU RESPIRATION TEST RESULTS	F-1

LIST OF TABLES

Table 1.	Free Product Thicknesses at the Bulk Fuel Storage Area, McGuire AFB, NJ . . .	5
Table 2.	Initial Soil Gas Compositions at the Bulk Fuel Storage Area, McGuire AFB, NJ	8
Table 3.	Results of Baildown Testing in Monitoring Wells 08-MW-19, 08-MW-12 and 08-MW-51	17
Table 4.	BTEX and TPH Concentrations in Soil Samples from the Bulk Fuel Storage Area, McGuire AFB, NJ	19
Table 5.	Physical Characterization of Soil from the Bulk Fuel Storage Area, McGuire AFB, NJ	19
Table 6.	Depths to Groundwater and LNAPL Prior to Each Pump Test	20
Table 7.	Pump Test Results at the Bulk Fuel Storage Area, McGuire AFB, NJ	20
Table 8.	Oxygen Concentrations During the Bioslurper Pump Test at the Bulk Fuel Storage Area, McGuire AFB, NJ	23
Table 9.	BTEX and TPH Concentrations in Extracted Groundwater During the Bioslurper Pump Test at the Bulk Fuel Storage Area, McGuire AFB, NJ	25
Table 10.	BTEX and TPH Concentrations in Off-Gas During the Bioslurper Pump Test at the Bulk Fuel Storage Area, McGuire AFB, NJ	25
Table 11.	BTEX Concentrations in LNAPL from the Bulk Fuel Storage Area, McGuire AFB, NJ	26
Table 12.	C-Range Compounds in LNAPL from the Bulk Fuel Storage Area, McGuire AFB, NJ	26
Table 13.	In Situ Respiration Test Results at the Bulk Fuel Storage Area, McGuire AFB . .	28

LIST OF FIGURES

Figure 1.	Schematic Diagram Showing Monitoring well Locations and the Lateral Extent of Groundwater Contamination and Free-Product Thicknesses at the Bulk Fuel Storage Area, McGuire AFB, NJ	3
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Figure 2.	Schematic Diagram Illustrating Site Lithology and Construction Details of the Bioslurper Well and Soil Gas Monitoring Points at the Bulk Fuel Storage Area, McGuire AFB, NJ	7
Figure 3.	Slurper Tube Placement and Valve Position for the Skimmer Pump Test	11
Figure 4.	Slurper Tube Placement and Valve Position for the Bioslurper Pump Test	12
Figure 5.	Slurper Tube Placement and Valve Position for the Drawdown Pump Test	14
Figure 6.	LNAPL Recovery Versus Time During Each Pump Test	21
Figure 7.	LNAPL Recovery Rate Versus Time During the Bioslurper Pump Test	22
Figure 8.	Distribution of C-Range Compounds in Extracted LNAPL at the BFSA, McGuire AFB, NJ	27

EXECUTIVE SUMMARY

This report summarizes the field activities conducted at McGuire AFB, for a short-term field pilot test to compare vacuum-enhanced free-product recovery (bioslurping) to traditional free-product recovery techniques to remove light, nonaqueous-phase liquid (LNAPL) from subsurface soils and aquifers. The field testing at McGuire AFB is part of the Bioslurper Initiative, which is funded and managed by the U.S. Air Force Center for Environmental Excellence (AFCEE) Technology Transfer Division. The AFCEE Bioslurper Initiative is a multisite program designed to evaluate the efficacy of the bioslurping technology for (1) recovery of LNAPL from groundwater and the capillary fringe, and (2) enhancing natural in situ degradation of petroleum contaminants in the vadose zone via bioventing.

The main objective of the Bioslurper Initiative is to develop procedures for evaluating the potential for recovering free-phase LNAPL present at petroleum-contaminated sites. The overall study is designed to evaluate bioslurping and identify site parameters that are reliable predictors of bioslurping performance. To measure LNAPL recovery in a wide variety of in situ conditions, tests are being performed at many sites. The test at McGuire AFB is one of at least 35 similar field tests to be conducted at various locations throughout the United States and its possessions.

The intent of field testing is to collect data to support determination of the predictability of LNAPL recovery and to evaluate the applicability, cost, and performance of the bioslurping technology for removal of free product and remediation of the contaminated area. The on-site testing is structured to allow direct comparison of the LNAPL recovery achieved by bioslurping with the performance of more conventional LNAPL recovery technologies. The test method included an initial site characterization followed by LNAPL recovery testing. The three LNAPL recovery technologies tested at McGuire AFB were skimmer pumping, bioslurping, and drawdown pumping.

Site characterization activities were conducted to evaluate site variables that could affect LNAPL recovery efficiency and to determine the bioventing potential of the site. Testing included baildown testing, soil sampling, soil gas permeability testing, and in situ respiration testing.

Following the site characterization activities, the pilot tests for skimmer pumping, bioslurping, and drawdown pumping were conducted. The LNAPL recovery testing was conducted in the following sequence: 46 hours in the skimmer configuration, approximately 89 hours in the bioslurper configuration, an additional 24 hours in the skimmer configuration, and approximately 37 hours in the drawdown configuration. Measurements of extracted soil gas composition, LNAPL thickness, and

groundwater level were taken throughout the testing. The volume of LNAPL recovered and groundwater extracted were quantified over time.

Skimmer and drawdown pumping were not as effective as bioslurping at recovering LNAPL from this site. Free product recovery rates decreased steadily during skimmer pumping, beginning at a rate of approximately 9.5 gallons/day during the initial skimmer pump test and decreasing to approximately 2.3 gallons/day by the end of the test. During drawdown pumping, LNAPL recovery rates averaged 1.2 gallons/day. In contrast, free product recovery rates during the bioslurper pump test remained relatively stable at an average of approximately 30 gallons/day.

Groundwater recovery rates during the bioslurper pump test were high in comparison to rates during the skimmer and drawdown pump tests. On average, groundwater was extracted at rates of 4,600 gallons/day during bioslurping, 92 gallons/day during skimming, and 730 gallons/day during drawdown pumping.

Soil gas concentrations were measured at monitoring points during the bioslurper pump test to determine whether the vadose zone was being oxygenated. In general, oxygen concentrations increased at most monitoring points; however, due to the high soil moisture content, soil gas samples were difficult to collect and an adequate evaluation of the oxygen radius of influence could not be made. Because of the high soil moisture content, it was not possible to determine a pressure radius of influence.

Implementation of bioslurping at the McGuire AFB test site probably would facilitate enhanced recovery of LNAPL from the water table. However, bioslurping will result in a vapor stream requiring treatment and the extraction of significant quantities of groundwater. Given the treatment options of an ICE for vapors and discharge of extracted groundwater to the Industrial Wastewater Treatment Plant, bioslurping would be an economically viable alternative for this site.

DRAFT SITE-SPECIFIC TECHNICAL REPORT (A003)

for

BIOSLURPER TESTING AT THE BULK FUEL STORAGE AREA, MCGUIRE AFB, NEW JERSEY

February 5, 1996

1.0 INTRODUCTION

This report describes activities performed and data collected during a field test at McGuire Air Force Base (AFB), New Jersey, to compare vacuum-enhanced free-product recovery (bioslurping) to traditional free-product recovery technologies for removal of light, nonaqueous-phase liquid (LNAPL) from subsurface soils and aquifers. The field testing at McGuire AFB is part of the Bioslurper Initiative, which is funded and managed by the U.S. Air Force Center for Environmental Excellence (AFCEE) Technology Transfer Division. The AFCEE Bioslurper Initiative is a multisite program designed to evaluate the efficacy of the bioslurping technology for (1) recovery of LNAPL from groundwater and the capillary fringe and (2) enhancing natural in situ degradation of petroleum contaminants in the vadose zone via bioventing.

1.1 Objectives

The main objective of the Bioslurper Initiative is to develop procedures for evaluating the potential for recovering free-phase LNAPL present at petroleum-contaminated sites. The overall study is designed to evaluate bioslurping and identify site parameters that are reliable predictors of bioslurping performance. To measure LNAPL recovery in a wide variety of in situ conditions, tests are being performed at many sites. The test at McGuire AFB is one of at least 35 similar field tests to be conducted at various locations throughout the United States and its possessions. Aspects of the testing program that apply to all sites are described in the *Test Plan and Technical Protocol for Bioslurping* (Battelle, 1995). Test provisions specific to activities at McGuire AFB were described in the Site-Specific Test Plan provided in Appendix A.

The intent of field testing is to collect data to support determination of the predictability of LNAPL recovery and to evaluate the applicability, cost, and performance of the bioslurping

technology for removal of free product and remediation of the contaminated area. The on-site testing is structured to allow direct comparison of the LNAPL recovery achieved by bioslurping with the performance of more conventional LNAPL recovery technologies. The test method included an initial site characterization followed by LNAPL recovery testing. The three LNAPL recovery technologies tested at McGuire AFB were skimmer pumping, bioslurping, and drawdown pumping. The specific test objectives, methods, and results for the McGuire AFB test program are discussed in the following sections.

1.2 Testing Approach

Site characterization activities were conducted to evaluate site variables that could affect LNAPL recovery efficiency and to determine the bioventing potential of the site. Testing included baildown testing to evaluate the mobility of LNAPL, soil sampling to determine physical/chemical site characteristics, soil gas permeability testing to determine the radius of influence, and in situ respiration testing to evaluate site microbial activity.

Following the site characterization activities, the pilot tests for skimmer pumping, bioslurping, and drawdown pumping were conducted. The LNAPL recovery testing was conducted in the following sequence: 46 hours in the skimmer configuration, approximately 89 hours in the bioslurper configuration, an additional 24 hours in the skimmer configuration, and approximately 37 hours in the drawdown configuration. Measurements of extracted soil gas composition, LNAPL thickness, and groundwater level were taken throughout the testing. The volume of LNAPL recovered and groundwater extracted were quantified over time.

2.0 SITE DESCRIPTION

McGuire AFB is located in the south-central portion of New Jersey. The installation is bordered by the Fort Dix Military Reservation to the east, south, and west, and by residential areas of the Town of Wrightstown (Burlington County), New Jersey to the north.

The Bulk Fuel Storage Area is in the central portion of McGuire AFB and occupies approximately 24 acres (Figure 1). The facility consists of a series of eight aboveground storage tanks with capacities ranging from 500,000 to 850,000 gallons. Five of these tanks are dedicated to

JP-4 jet fuel storage while the remaining tanks hold heating fuel for the central heating plant. All of the tanks are contained by an asphalt-covered earthen berm.

McGuire AFB rests on coastal plain sediments. The shallow stratigraphy consists primarily of interbedded continental and marine sands and silts. The thickness of these units vary, with each being up to 50 ft thick in the general area of McGuire AFB. Site soils consist primarily of silty fine sands, interspersed with silt laminae and gravel seams. An organic silt layer with wood fragments and rootlets is present across the site between 11 and 14 ft below ground surface (bgs). Groundwater is part of the unconfined Cohansey/Kirkwood aquifer system and generally is found between 8 and 14 ft bgs across the site. This shallow aquifer is not used for consumptive purposes on the base.

The Bulk Fuel Storage Area has been in operation since 1963. During this time, fuel spills and storage/disposal activities have resulted in contamination at the site. In 1967, 500,000 gallons of JP-4 jet fuel were discharged from an open valve (location unknown, spill reportedly channelled to stream). In 1984, 500,000 gallons of JP-4 jet fuel were released from a ruptured underground pipeline northeast of Tank 2109. In 1987, 10,000 gallons of JP-4 jet fuel were spilled into the berm of Tank 2110. In 1988, an unspecified volume of heating oil was discharged north of Tanks 2120 and 2121. Finally, up until 1970, tank sludge was disposed of in the tank bermed areas, and fly ash and coal slag were stored and disposed north of the tank area.

In 1992, fuel was observed discharging from a subsurface organic silt layer into the unnamed tributary of South Run. The water in this unnamed tributary comes from shallow groundwater discharges, storm drain runoff, and cooling water discharge from the central heating plant.

Preliminary investigations of the site occurred in 1982, followed by site inspections in 1983 and 1988. During this time, monitoring wells were installed, groundwater samples were collected, and a pump test was performed. From 1990 to 1992, remedial investigations were performed to assess the extent of contamination.

Soil samples, both surface and subsurface, have been collected and analyzed for the presence of organic contamination. Benzene, toluene, ethylbenzene, and xylenes (BTEX) as well as semivolatile organic compounds (SVOCs) have been identified in a portion of the soil samples. Generally, the concentration levels or the frequency of occurrence indicated that the compounds identified did not exceed the New Jersey Department of Environmental Protection and Energy's (NJDEPE) proposed cleanup standards. The data do indicate that the contaminants are those typically associated with fuel spills and are therefore considered site related.

Soil gas samples collected in 1992 showed high BTEX and total petroleum hydrocarbon (TPH) concentrations, with average BTEX concentrations of 360 ppmv and average TPH concentrations of 54,000 ppmv.

Groundwater samples have been collected from locations upgradient and downgradient of the Bulk Fuel Storage Area. The upgradient monitoring wells included: 08-MW-X20, 08-MW-X23, 08-MW-X24, 08-MW-101, and 08-MW-201. A total of 20 downgradient wells were sampled to establish the extent of groundwater contamination. Monitoring wells that contained LNAPL were not sampled.

LNAPL measurements have been made at the monitoring points at the Bulk Fuel Storage Area. Product thickness measurements are presented in Table 1. The distribution of LNAPL indicates that the thickest subsurface layer of organic contamination resides north of Tank 2115. It is in this location that the demonstration of the bioslurper technology is expected to take place. One of the existing monitoring wells (08-MW-X12, 08-MW-X19, or 08-MW-X51) is expected to be used for the LNAPL extraction.

Table 1. Free Product Thicknesses at the Bulk Fuel Storage Area, McGuire AFB, NJ

Monitoring Well	Free Product Thickness (ft)	
	5/30/91	6/22/94
08-MW-X12	4.44	4.69
08-MW-X18	2.46	2.85
08-MW-X19	6.71	5.37
08-MW-X21	3.01	2.46
08-MW-X51	1.61	3.27
08-MW-X54	0.12	0.04

3.0 BIOSLURPER SHORT-TERM PILOT TEST METHODS

This section documents the initial conditions at the test site and describes the test equipment and methods used for the short-term pilot test at McGuire AFB.

3.1 Initial LNAPL/Groundwater Measurements and Baildown Testing

Monitoring wells 08-MW-19, 08-MW-12, and 08-MW-51 were evaluated for use in the bioslurper pilot testing. Initial depths to LNAPL and to groundwater were measured using an oil/water interface probe (ORS Model #1068013). LNAPL was removed from the well with a Teflon™ bailer until the LNAPL thickness could no longer be reduced. The rate of increase in the thickness of the floating LNAPL layer was monitored for approximately 17 hours using the oil/water interface probe.

3.2 Well Construction Details

Existing monitoring well 08-MW-19 was selected for use in the bioslurper pilot testing. The well is constructed of 4-inch-diameter, schedule 40 polyvinyl chloride (PVC) with a total depth of 20.5 ft and a screen interval extending from 5.5 to 20.5 ft. A schematic diagram illustrating well construction details is provided in Figure 2.

3.3 Soil Gas Monitoring Point Installation

On November 11, 1995, three monitoring points were installed in the area of monitoring well 08-MW-19 and were labeled MPA, MPB, and MPC. The locations and construction details of the monitoring points are illustrated in Figure 2.

The monitoring points consisted of sets of ¼-inch tubing, with 1-inch-diameter, 6-inch-long screened areas. The screened lengths were positioned at the appropriate depths, and the annular space corresponding to the screened length was filled with silica sand. The interval between the screened lengths was filled with bentonite clay chips, as was the space from the top of the shallowest screened length to the ground surface. After placement, the bentonite clay was hydrated with water to expand the chips and provide a seal. The monitoring points were installed at depths as follows:

08-MW-19

MPA

MPB

MPC

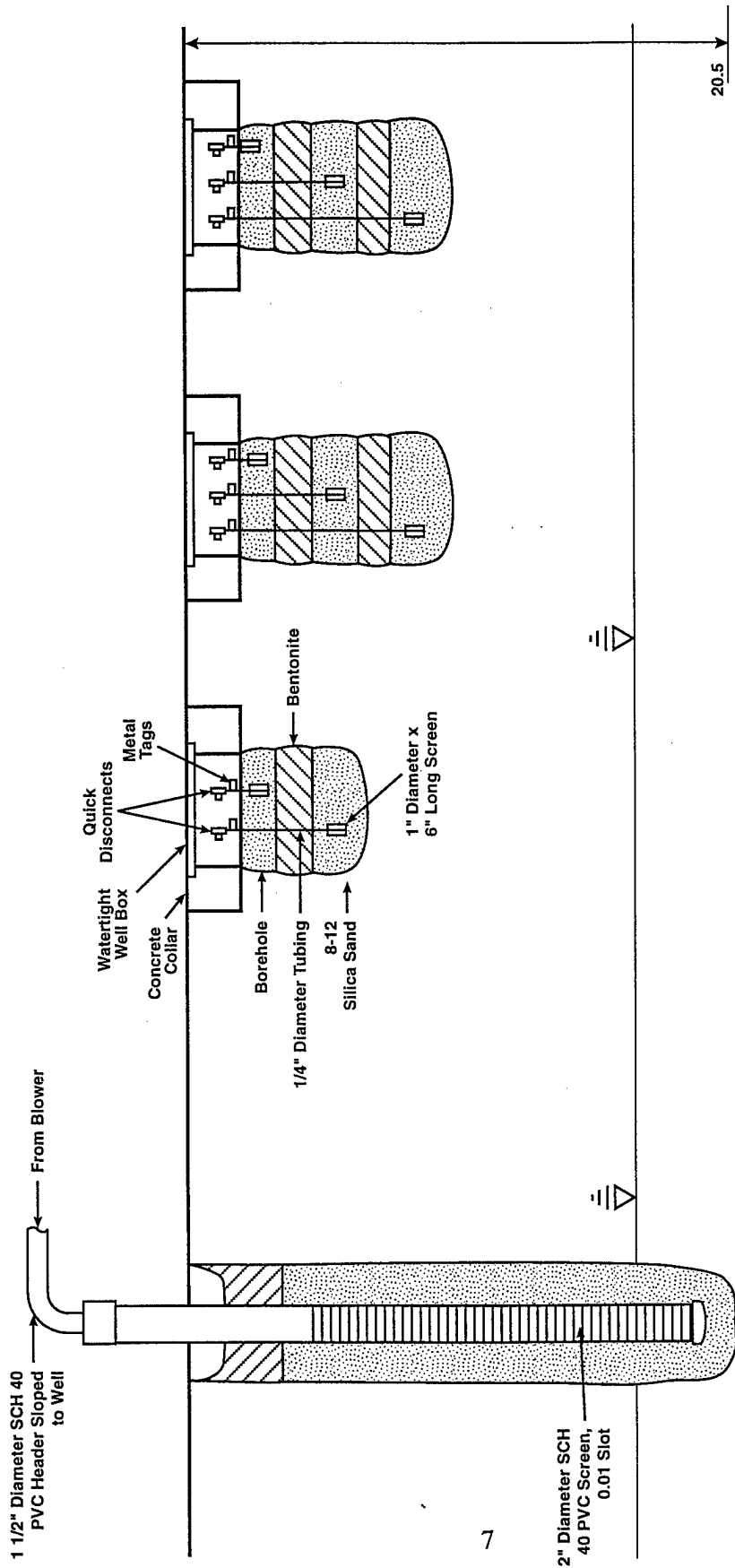


Figure 2. Schematic Diagram Illustrating Site Lithology and Construction Details of the Bioslurper Well and Soil Gas Monitoring Points at the Bulk Fuel Storage Area, McGuire AFB, NJ

- Monitoring point MPA was installed at a depth of 5.8 ft into a 6-inch diameter borehole. The monitoring point was screened to two depths: 3.0 and 5.8 ft.
- Monitoring point MPB was installed at a depth of 9.0 ft into a 6-inch diameter borehole. The monitoring point was screened to three depths: 3.0, 6.0, and 9.0 ft.
- Monitoring point MPC was installed at a depth of 9.0 ft into a 6-inch diameter borehole. The monitoring point was screened to three depths: 2.5, 6.0, and 9.0 ft.

After installation of the monitoring points, initial soil gas measurements were taken with a GasTechtor portable O₂/CO₂ meter and a GasTech Trace-Techtor portable hydrocarbon meter. In general, oxygen limitation was observed at shallower depths, with oxygen concentrations in the range of 4.5 to 4.8% found at a depth of 3.0 ft (Table 2).

Table 2. Initial Soil Gas Compositions at the Bulk Fuel Storage Area, McGuire AFB, NJ

Monitoring Point	Depth (ft)	Oxygen (%)	Carbon Dioxide (%)	TPH (ppmv)
MPA	3.0	4.8	1.5	480
	6.0	20.9	0.050	140
MPB	3.0	4.5	2.5	640
	6.0	NM	NM	NM
	9.0	NM	NM	NM
MPC	2.5	19.0	0.40	190
	6.0	20.0	0.50	1,500
	9.0	18.0	2.5	2,000

NM = Not measured. High moisture content resulted in difficulties obtaining soil gas samples.

3.4 Soil Sampling and Analysis

Three soil samples were collected during the installation of monitoring point MPA. The soil samples were collected in brass sleeves driven down the center of the hollow-stem auger used to drill the monitoring well. The samples were collected at depths of 9.0 to 9.5 ft, 9.5 to 10 ft, and 10 to 10.5 ft and were labeled MG-S-1, MG-S-2, and MG-S-3, respectively. The samples were placed in insulated coolers, chain-of-custody records and shipping papers were completed, and the samples were sent to Alpha Analytical, Inc., in Sparks, Nevada by overnight express. All samples were analyzed for BTEX, bulk density, moisture content, particle size, porosity, and TPH. Laboratory analytical reports for all samples are provided in Appendix B.

3.5 LNAPL Recovery Testing

3.5.1 System Setup

The bioslurping pilot test system is a trailer-mounted mobile unit. The vacuum pump (Atlantic Fluidics Model A100, 7.5-hp liquid ring pump), oil/water separator, and required support equipment are carried to the test location on a trailer. The trailer was located near monitoring well 08-MW-19, the well cap was removed, a coupling and tee were attached to the top of the well, and the slurper tube was lowered into the well. The slurper tube was attached to the vacuum pump. Different configurations of the tee and the placement depth of the slurper tube allow for simulation of skimmer pumping, operation in the bioslurping configuration, or simulation of drawdown pumping as described in Sections 3.5.2, 3.5.3, and 3.5.5, respectively.

An internal combustion engine (ICE) was used to treat the bioslurper system off-gas. Data from the ICE operation is provided in Appendix C. Extracted groundwater was treated by passing the effluent through an oil/water separator and into a 1,500 gallon settling tank. After settling, the effluent was released into the sanitary sewer.

A brief system startup test was performed prior to LNAPL recovery testing to ensure that all system components were working properly. The system checklist is provided in Appendix D. All site data and field testing information were recorded in a field notebook and then transcribed onto pilot test data sheets provided in Appendix E.

3.5.2 Initial Skimmer Pump Test

Prior to test initiation, depths to LNAPL and groundwater were measured. The slurper tube was then set at the LNAPL/groundwater interface with the wellhead open to the atmosphere via a PVC connecting tee (Figure 3). The liquid ring pump and oil/water separator were primed with known amounts of groundwater to ensure that any LNAPL or groundwater entering the system could be quantified. The flow totalizers for the LNAPL and aqueous effluent were zeroed, and the liquid ring pump was started on November 11, 1995, to begin the skimmer pump test. The test was operated continuously for approximately 46 hours. The LNAPL and groundwater extraction rates were monitored throughout the test, as were all other relevant data for the skimmer pump test. Test data sheets are provided in Appendix E.

3.5.3 Bioslurper Pump Test

Upon completion of the skimmer pump test, preparations were made to begin the bioslurper pump test. Prior to test initiation, depths to LNAPL and groundwater were measured. The slurper tube was then set at the LNAPL/groundwater interface, as in the skimmer pump test. However, in contrast to the skimmer pump test, the PVC connecting tee was removed, sealing the wellhead and allowing the pump to establish a vacuum in the well (Figure 4). A pressure gauge was installed at the wellhead to measure the vacuum inside the extraction well. The liquid ring pump and oil/water separator were primed with known amounts of groundwater to ensure that any LNAPL or groundwater entering the system could be quantified. The flow totalizers for the LNAPL and aqueous effluent were zeroed, and the liquid ring pump was started on November 12, 1995, to begin the bioslurper pump test. The test was initiated approximately 5 hours after the skimmer pump test and was operated continuously for approximately 89 hours. The LNAPL and groundwater extraction rates were monitored throughout the test, as were all other relevant data for the bioslurper pump test. Test data sheets are provided in Appendix E.

An LNAPL sample was collected approximately 3 hours after initiation of the bioslurper test and was labeled MG-F-1. The sample was sent to Alpha Analytical, Inc., Sparks, Nevada for analysis of BTEX, TPH, and boiling point fractionation.

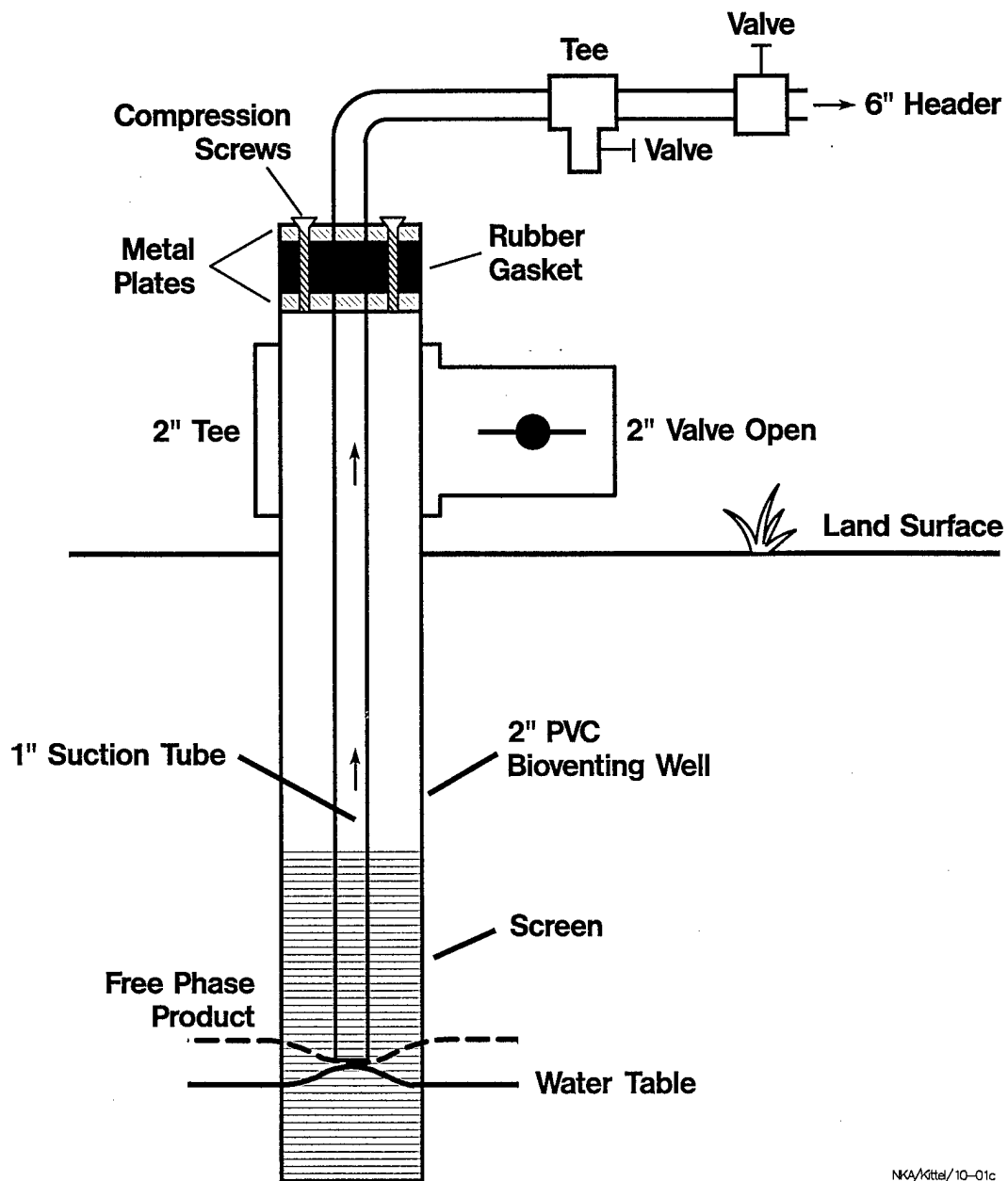
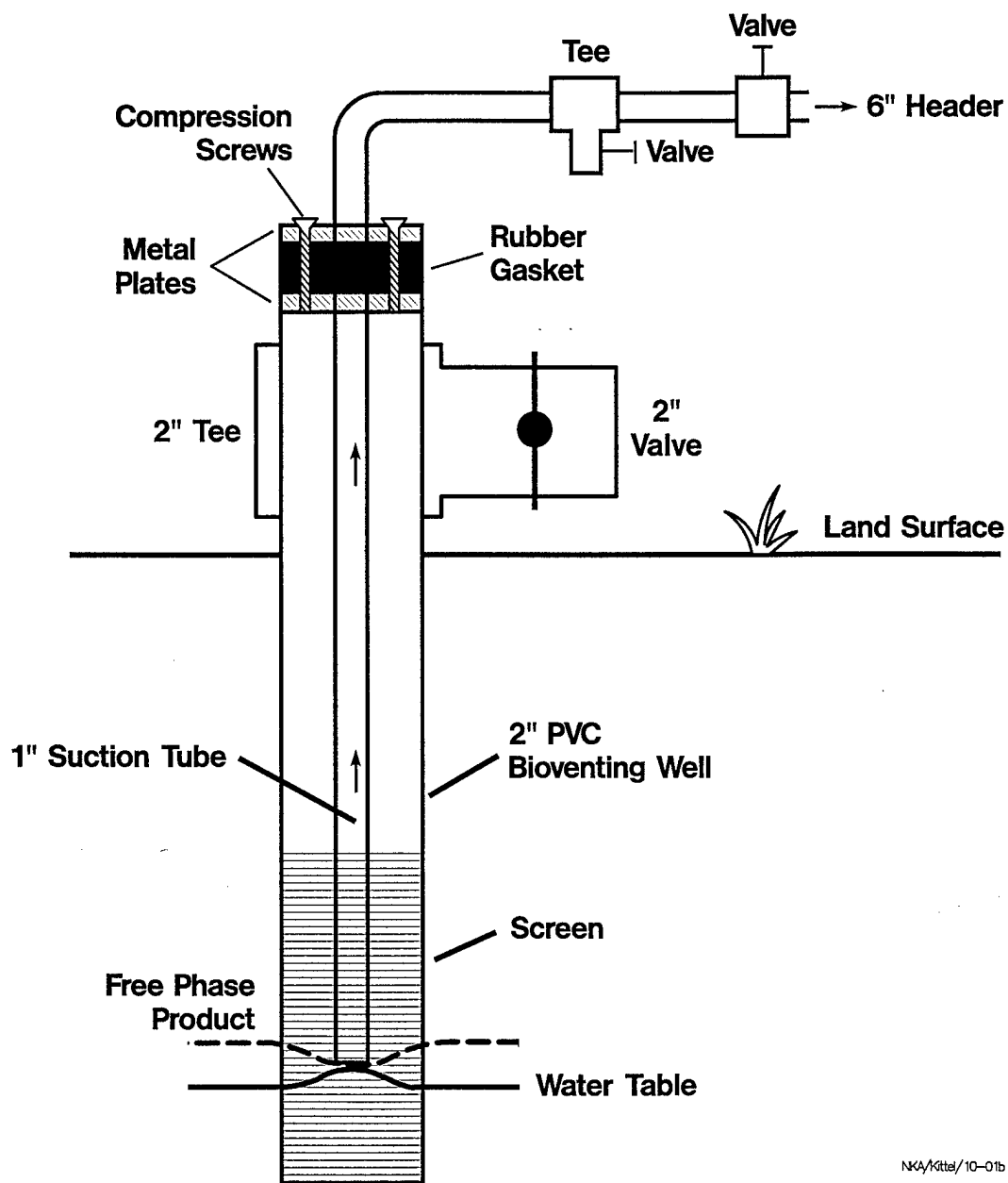


Figure 3. Slurper Tube Placement and Valve Position for the Skimmer Pump Test



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Figure 4. Slurper Tube Placement and Valve Position for the Bioslurper Pump Test

3.5.4 Second Skimmer Pump Test

Upon completion of the bioslurper pump test, preparations were made to begin the second skimmer pump test. Prior to test initiation, depths to LNAPL and groundwater were measured. The valve and slurper tube configuration were identical to that used for the initial skimmer pump test. The liquid ring pump and oil/water separator were primed with known amounts of groundwater to ensure that any LNAPL or groundwater entering the system could be quantified. The flow totalizers for the LNAPL and aqueous effluent were zeroed, and the liquid ring pump was started on November 16, 1995, to begin the second skimmer pump test. The test was initiated approximately 1 hour after the bioslurper pump test and was operated continuously for 24 hours. The LNAPL and groundwater extraction rates were monitored throughout the test, as were all other relevant data for the bioslurper pump test. Test data sheets are provided in Appendix E.

3.5.5 Drawdown Pump Test

Upon completion of the second skimmer pump test, preparations were made to begin the drawdown pump test. Prior to test initiation, depths to LNAPL and groundwater were measured. The slurper tube was then set so that the tip was 36 inches below the oil/water interface with the PVC connecting tee open to the atmosphere (Figure 5). The liquid ring pump and oil/water separator were primed with known amounts of groundwater to ensure that any LNAPL or groundwater entering the system could be quantified. The flow totalizers for the LNAPL and aqueous effluent were zeroed, and the liquid ring pump was started on November 17, 1995, to begin the drawdown pump test. The test was initiated approximately 2 hours after the second skimmer pump test and was operated continuously for 37 hours. The LNAPL and groundwater extraction rates were monitored throughout the test, as were all other relevant data for the drawdown pump test. Test data sheets are provided in Appendix E.

3.5.6 Off-Gas Sampling and Analysis

Soil gas samples were collected from the bioslurper off-gas during the bioslurper pump test. Duplicate samples were collected in Summa™ canisters prior to and after treatment through the ICE. Samples labeled MG-LRP Reservoir-1 and MG-LRP Reservoir-2 were taken from the liquid ring

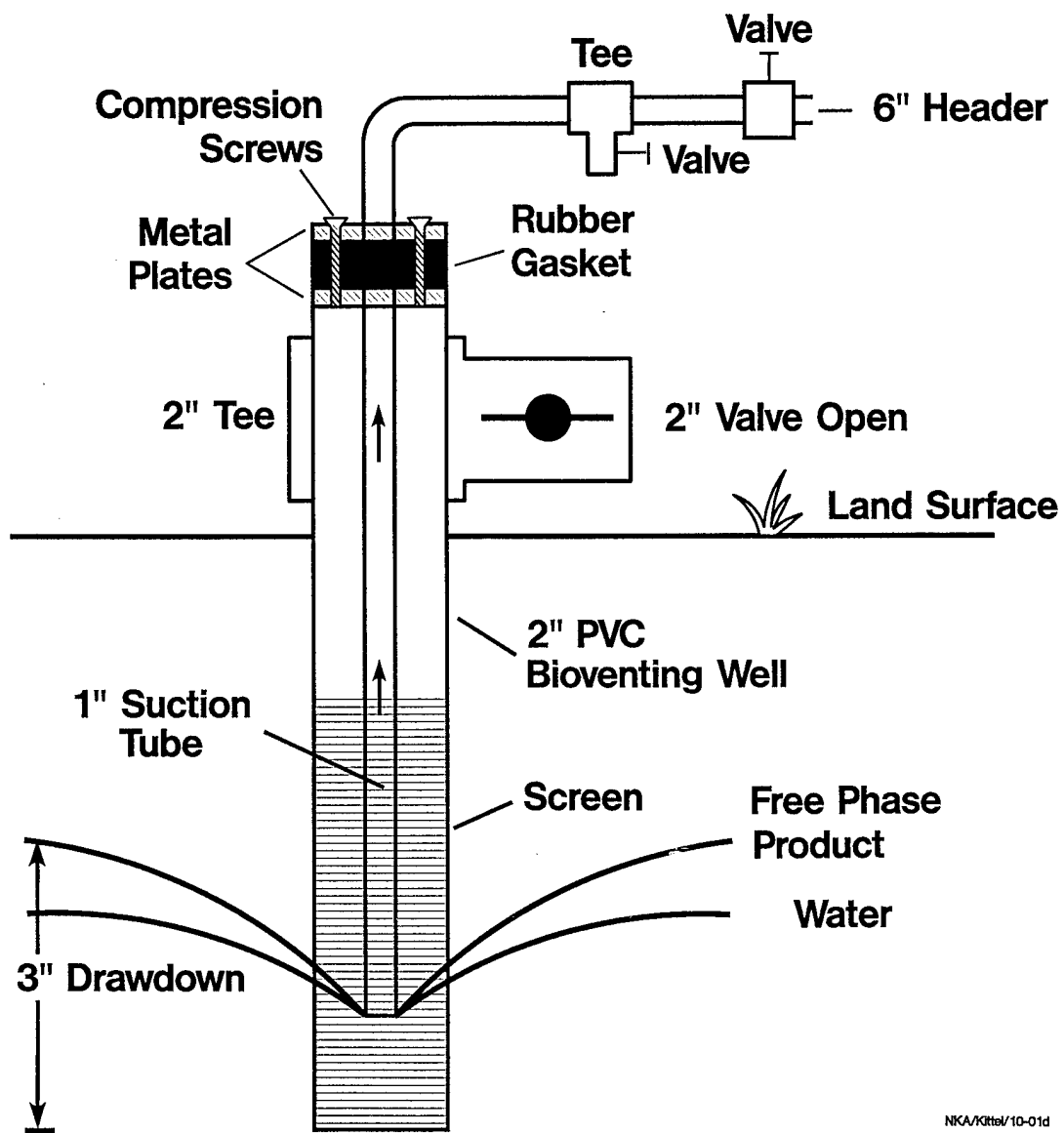


Figure 5. Slurper Tube Placement and Valve Position for the Drawdown Pump Test

pump reservoir and samples labeled MG-LRP Stack-1 and MG-LRP Stack-2 were taken from the stack of the liquid ring pump where ambient air was being taken in. All four of these samples were taken prior to ICE treatment. Samples labeled MG-ICE Stack-1 and MG-ICE Stack-2 were taken following ICE treatment. The samples were sent under chain of custody to Air Toxics, Ltd., in Rancho Cordova, California, for analyses of BTEX and TPH.

3.5.7 Groundwater Sampling and Analysis

Two groundwater samples were collected during the bioslurper pump test. One sample was collected from the discharge of the oil/water separator surge tank and was labeled MG-OWS-1. Another sample was collected from the effluent of the 1,500 gallon tank being discharged into the sanitary sewer and was labeled MG-Discharge-1. Samples were collected in 40-mL septa vials containing HCl preservative. Samples were checked to ensure no headspace was present and were then shipped on ice and sent under chain of custody to Alpha Analytical, Inc., in Sparks, Nevada for analyses of BTEX and TPH.

3.6 Soil Gas Permeability Testing

The soil gas permeability test data were collected during the bioslurper pump test. Before a vacuum was established in the extraction well, the initial soil gas pressures at the three installed monitoring points were recorded. The start of the bioslurper pump test created a steep pressure drop in the extraction well which was the starting point for the soil gas permeability testing. Soil gas pressures were measured at each of the three monitoring points at all depths to track the rate of outward propagation of the pressure drop in the extraction well. The soil gas pressures were recorded throughout the bioslurper pump test to determine the bioventing radius of influence. Test data are provided in Appendix F.

3.7 In Situ Respiration Testing

Air containing approximately 1.0% helium was injected into four monitoring points for approximately 24 hours beginning on November 17, 1995. The setup for the in situ respiration test is described in the *Test Plan and Technical Protocol a Field Treatability Test for Bioventing* (Hinchee et

al., 1992). A ½-hp diaphragm pump was used for air and helium injection. Air and helium were injected through the following monitoring points at the depths indicated: MPA-6.0', MPB-9.0', MPC-6.0', and MPC-9.0'. After the air/helium injection was terminated, soil gas concentrations of oxygen, carbon dioxide, TPH, and helium were monitored periodically. The respiration test was terminated on November 18, 1995. Oxygen utilization and biodegradation rates were calculated as described in Hinchey et al. (1992). Raw data for these tests are presented in Appendix G.

Helium concentrations were measured during the in situ respiration test to quantify helium leakage to or from the surface around the monitoring points. Helium loss over time is attributable to either diffusion through the soil or leakage. A rapid drop in helium concentration usually indicates leakage. A gradual loss of helium along with a first-order curve generally indicates diffusion. As a rough estimate, the diffusion of gas molecules is inversely proportional to the square root of the molecular weight of the gas. Based on molecular weights of 4 for helium and 32 for oxygen, helium diffuses approximately 2.8 times faster than oxygen, or the diffusion of oxygen is 0.35 times the rate of helium diffusion. As a general rule, we have found that if helium concentrations at test completion are at least 50 to 60% of the initial levels, measured oxygen uptake rates are representative. Greater helium loss indicates a problem, and oxygen utilization rates are not considered representative.

4.0 RESULTS

This section documents the results of the site characterization, the comparative LNAPL recovery pump test, and other supporting tests conducted at McGuire AFB.

4.1 Baildown Test Results

Results from baildown tests in monitoring wells 08-MW-19, 08-MW-12, and 08-MW-51 are presented in Table 3. The LNAPL thickness in 08-MW-19 recovered most rapidly of the three wells by the end of the 17-hour test period. Based on the amount of free product recovered and free product thickness, monitoring well 08-MW-19 was selected for the bioslurper field testing.

Table 3. Results of Baildown Testing in Monitoring Wells 08-MW-19, 08-MW-12 and 08-MW-51

Monitoring Well	Date-Time	Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)
08-MW-19	Initial Reading 11/9/95-1415	16.80	12.89	3.91
	11/9/95-1418	14.76	14.70	0.06
	11/9/95-1419	14.57	14.42	0.15
	11/9/95-1422	14.42	14.25	0.17
	11/9/95-1431	14.25	13.94	0.31
	11/9/95-1443	14.22	13.80	0.42
	11/9/95-1451	14.25	13.75	0.50
	11/9/95-1520	14.38	13.68	0.70
	11/9/95-1608	14.52	13.62	0.90
	11/9/95-1716	14.72	13.56	1.16
	11/9/95-1942	15.00	13.47	1.53
	11/10/95-0744	15.59	13.29	2.30
08-MW-12	Initial Reading 11/9/95-1440	16.11	13.15	2.96
	11/9/95-1445	15.33	15.13	0.20
	11/9/95-1447	15.26	14.91	0.35
	11/9/95-1450	15.16	14.75	0.41
	11/9/95-1455	14.97	14.42	0.55
	11/9/95-1516	15.57	13.90	1.67
	11/9/95-1610	14.43	13.70	0.73
	11/9/95-1717	14.47	13.67	0.80
	11/9/95-1944	14.53	13.65	0.88
	11/10/95-0745	14.65	13.60	1.05
08-MW-51	Initial Reading 11/9/95-1535	17.32	13.39	3.93
	11/9/95-1538	16.45	16.37	0.08
	11/9/95-1540	16.08	16.00	0.08
	11/9/95-1549	15.33	15.22	0.11
	11/9/95-1611	14.68	14.45	0.23
	11/9/95-1720	14.52	14.27	0.25
	11/9/95-1945	14.61	14.24	0.37
	11/10/95-0747	14.78	14.18	0.60

4.2 Soil Sample Analyses

Table 4 shows the BTEX and TPH concentrations measured in soil samples collected from the Bulk Fuel Storage Area. BTEX and TPH concentrations were relatively low, with an average total BTEX concentration of 5.4 mg/kg and an average TPH concentration of 140 mg/kg. Benzene was below 1 mg/kg in all samples. The results of the physical characterization of the soils are presented in Table 5.

4.3 LNAPL Pump Test Results

4.3.1 Initial Skimmer Pump Test Results

The LNAPL thickness prior to the initial skimmer pump test was 13.29 ft (Table 6). A total of 11 gallons of LNAPL was recovered during this test, with an average recovery rate of 5.9 gallons/day (Table 7). A total of 180 gallons of groundwater was extracted with an average extraction rate of 92 gallons/day (Table 7). Results of LNAPL recovery versus time are shown in Figure 6.

4.3.2 Bioslurper Pump Test Results

LNAPL recovery rates increased significantly during the bioslurper pump test (Figure 8). The increase in recovery rate indicates that LNAPL was mobilized to the extraction well under vacuum-enhanced conditions. A total of 110 gallons of LNAPL and 17,000 gallons of groundwater were extracted during the bioslurper pump test, with daily average recovery rates of 30 gallons/day for LNAPL and 4,600 gallons/day for groundwater (Table 7). The LNAPL recovery rate versus time is shown in Figure 7. The vacuum-exerted wellhead pressure on monitoring well 08-MW-19 was kept relatively constant throughout the bioslurper pump test at approximately 12 inches of mercury.

Soil gas concentrations were measured at monitoring points during the bioslurper pump test to determine whether the vadose zone was being oxygenated. In general, oxygen concentrations increased at most monitoring points (Table 8); however, due to the high soil moisture content, soil gas samples were difficult to collect and an adequate evaluation of the oxygen radius of influence could not be made.

Table 4. BTEX and TPH Concentrations in Soil Samples from the Bulk Fuel Storage Area, McGuire AFB, NJ

Parameter	Concentration (mg/kg)		
	MG-S-1	MG-S-2	MG-S-3
TPH as jet fuel	58	< 10	360
Benzene	0.12	0.033	< 0.40
Toluene	0.29	0.061	1.2
Ethylbenzene	0.30	0.061	1.6
Xylenes	1.9	0.39	10

Table 5. Physical Characterization of Soil from the Bulk Fuel Storage Area, McGuire AFB, NJ

Parameter		Sample		
		MG-S-1	MG-S-2	MG-S-3
Moisture Content (%)		21.7	24.5	26.1
Porosity (%)		54.3	48.7	51.3
Specific Gravity (g/cm ³)		1.21	1.36	1.29
Particle Size	Gravel (%)	0	0	0
	Sand (%)	78	88	82
	Silt (%)	15	5	10
	Clay (%)	7	7	8

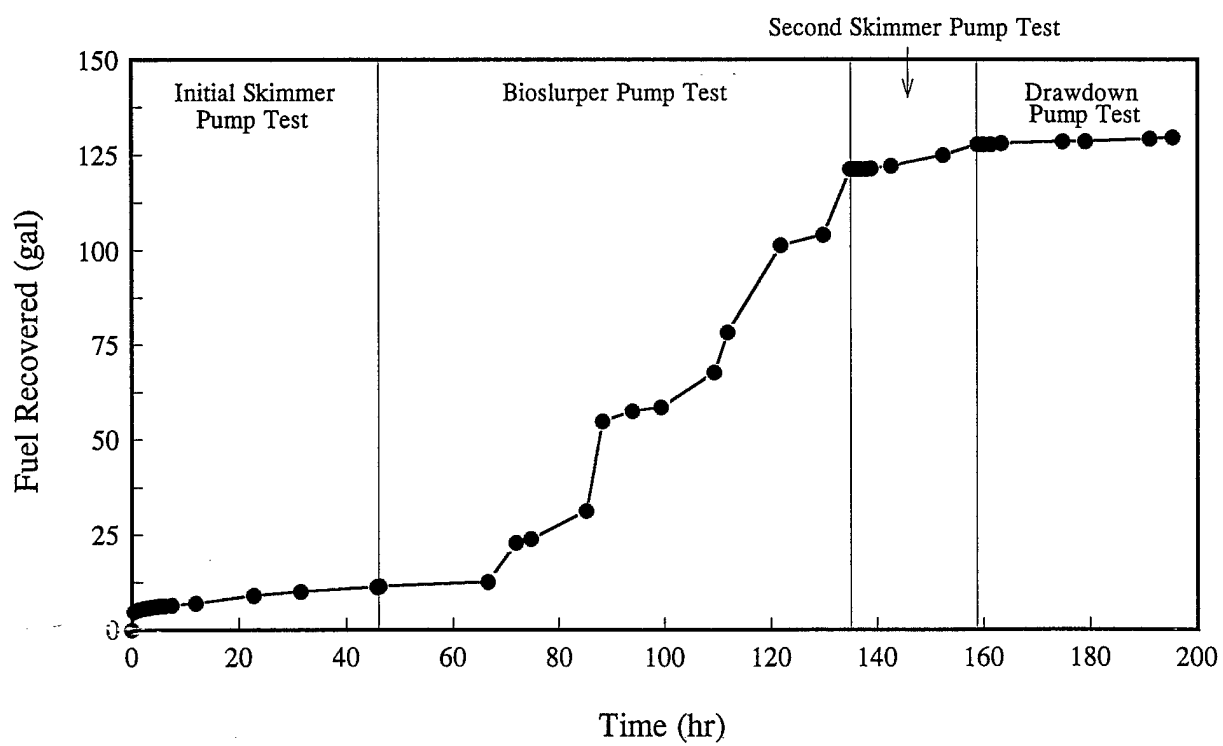
Table 6. Depths to Groundwater and LNAPL Prior to Each Pump Test

Test	Test Start Date	Depth to LNAPL (ft)	Depth to Groundwater (ft)	LNAPL Thickness (ft)
Initial Skimmer Pump Test	11/10/95	13.29	15.59	2.30
Bioslurper Pump Test	11/12/95	13.64	13.86	0.22
Second Skimmer Pump Test	11/16/95	15.95	15.96	0.010
Drawdown Test	11/17/95	No fuel detected	13.33	0

Table 7. Pump Test Results at the Bulk Fuel Storage Area, McGuire AFB, NJ

Recovery Rate (gal/day)	Initial Skimmer Pump Test		Bioslurper Pump Test		Second Skimmer Pump Test		Drawdown Pump Test	
	LNAPL	Groundwater	LNAPL	Groundwater	LNAPL	Groundwater	LNAPL	Groundwater
Day 1	9.5	53	1.6	4,900	6.6	110	1.1	350
Day 2	2.3	130	47	3,100	NA	NA	1.3	1,100
Day 3	NA	NA	24	5,400	NA	NA	NA	NA
Day 4	NA	NA	45	5,100	NA	NA	NA	NA
Average	5.9	92	30.0	4,600	6.6	110	1.2	730
Total Recovery (gal)	11	180	110	17,000	6.6	110	1.8	1100

NA = Not applicable.



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Figure 6. LNAPL Recovery Versus Time During Each Pump Test

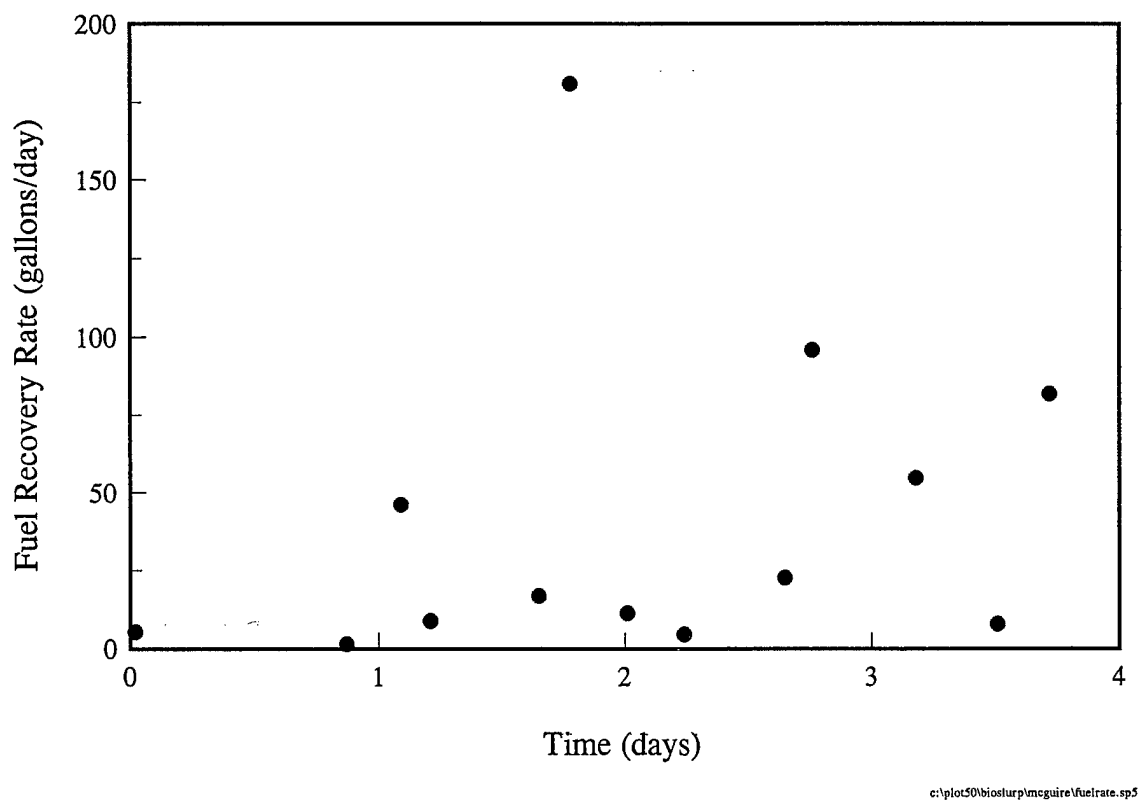


Figure 7. LNAPL Recovery Rate Versus Time During the Bioslurper Pump Test

Table 8. Oxygen Concentrations During the Bioslurper Pump Test at the Bulk Fuel Storage Area, McGuire AFB, NJ

Monitoring Point	Oxygen Concentrations (%) Versus Time (hours)			
	0	54	71	95
MPA-3.0'	4.8	9.5	NM	NM
MPA-6.0'	20.9	NM	NM	NM
MPB-3.0'	4.5	8.0	8.5	11
MPB-6.0'	NM	NM	NM	NM
MPB-9.0'	NM	15	NM	14
MPC-2.5'	19.0	17	12	11
MPC-6.0'	20.0	13	NM	NM
MPC-9.0'	18.0	8.5	5.5	6.0

NM = Not measured. Moisture content was too high to allow for collection of a soil gas sample.

4.3.3 Second Skimmer Pump Test

Totals of 6.6 gallons of LNAPL and 110 gallons of groundwater were recovered during the second skimmer pump test, with daily average recovery rates of 6.6 gallons/day for LNAPL and 110 gallons/day for groundwater (Table 7). These results demonstrate that operation of the bioslurper system in the skimmer mode was not as effective a means of free-product recovery as the bioslurper system at this site.

4.3.4 Drawdown Pump Test

Totals of 1.8 gallons of LNAPL and 1,100 gallons of groundwater were recovery during the drawdown pump test, with daily average recovery rates of 1.2 gallons/day for LNAPL and 730 gallons/day for groundwater (Table 7). These results demonstrate that operation of the bioslurper

system in the drawdown mode was not as effective a means of free-product recovery as the bioslurper system at this site.

4.4 Extracted Groundwater, LNAPL, and Off-Gas Analyses

Extracted groundwater samples were collected during the bioslurper pump test. BTEX concentrations were relatively high, with average BTEX concentrations of 20 mg/L, while TPH concentrations were relatively low with an average concentrations of 43 mg/L (Table 9).

Off-gas samples from the bioslurper system also were collected during the bioslurper pump test. The results from the off-gas analyses are presented in Table 10. Given a vapor flow of 60 scfm from the bioslurper well and a vapor concentration before ICE treatment of approximately 67,000 ppmv TPH and 220 ppmv benzene, emissions without ICE treatment would have been approximately 2,300 lb/day of TPH and 4.0 lb/day of benzene. With the ICE in place, at a vapor discharge rate of 120 scfm and using an average concentration of 1.3 ppmv TPH, approximately 0.087 lb/day of TPH was emitted to the air during the bioslurper pump test. Benzene emissions were below detection limits after treatment through the ICE. These results demonstrated the treatment efficiency of the ICE unit, with >99% destruction of BTEX and TPH.

The composition of LNAPL is shown in Tables 11 and 12 in terms of BTEX concentrations and distribution of C-range compounds, respectively. The distribution of C-range compounds is shown graphically in Figure 8.

4.5 Bioventing Analyses

4.5.1 Soil Gas Permeability and Radius of Influence

The bioslurper pilot test was conducted during a period of heavy rains. During the soil gas permeability test, the high moisture content in the soils caused erroneous pressure readings, probably due to water movement in the soil. Therefore, a radius of influence could not be calculated at this site.

Table 9. BTEX and TPH Concentrations in Extracted Groundwater During the Bioslurper Pump Test at the Bulk Fuel Storage Area, McGuire AFB, NJ

Parameter	Concentration (mg/L)	
	MG-OWS-1	MG-DISCHARGE-1
TPH	47	38
Benzene	4.0	3.6
Toluene	9.4	8.6
Ethylbenzene	1.1	1.0
Total Xylenes	6.7	6.1

Table 10. BTEX and TPH Concentrations in Off-Gas During the Bioslurper Pump Test at the Bulk Fuel Storage Area, McGuire AFB, NJ

Parameter	Concentration (ppmv)					
	MG-LRP Reservoir-1	MG-LRP Reservoir-2	MG-LRP Stack-1	MG-LRP Stack-2	MG-ICE Stack-1	MG-ICE Stack-2
TPH as jet fuel	70,000	63,000	5.8	13	1.1	1.4
Benzene	47	390	0.021	0.044	<0.0040	<0.0020
Toluene	460	460	0.12	0.17	<0.0040	<0.0020
Ethylbenzene	25	27	0.011	0.017	<0.0040	<0.0020
Xylenes	78	86	0.053	0.056	<0.0040	<0.0020

Table 11. BTEX Concentrations in LNAPL from the Bulk Fuel Storage Area, McGuire AFB, NJ

Compound	Concentrations (mg/kg)
Benzene	1,600
Toluene	13,000
Ethylbenzene	2,900
Total Xylenes	18,000

Table 12. C-Range Compounds in LNAPL from the Bulk Fuel Storage Area, McGuire AFB, NJ

C-Range Compounds	Percentage of Total
< C7	26.4
C8	13.2
C9	10.8
C10	8.8
C11	9.5
C12	10.9
C13	10.0
C14	6.3
> C15	4.1

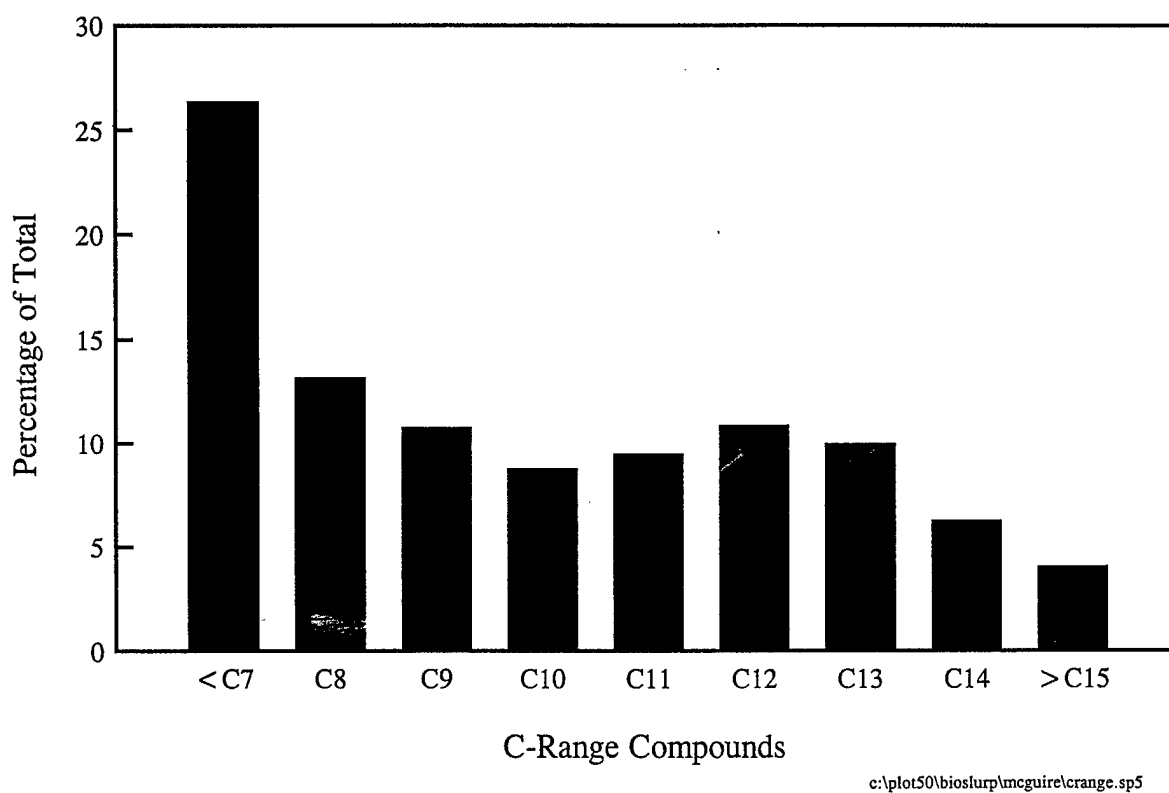


Figure 8. Distribution of C-Range Compounds in Extracted LNAPL at the BFSA, McGuire AFB, NJ

4.5.2 In Situ Respiration Test Results

Results from the in situ respiration test are presented in Table 13. Oxygen depletion was very rapid, with oxygen utilization rates ranging from 1.9 to 4.0% O₂/hr. Biodegradation rates ranged from 32 to 65 mg/kg-day. The helium concentration was steady, indicating that leakage and diffusion were insignificant.

Table 13. In Situ Respiration Test Results at the Bulk Fuel Storage Area, McGuire AFB, NJ

Monitoring Point	Oxygen Utilization Rate (%/hr)	Biodegradation Rate (mg/kg-day)
MPA-6.0'	4.0	65
MPB-9.0'	3.9	63
MPC-6.0'	1.9	32
MPC-9.0'	2.6	42

5.0 DISCUSSION

Skimmer and drawdown pumping were not as effective as bioslurping at recovering LNAPL from this site. Free product recovery rates decreased steadily during skimmer pumping, beginning at a rate of approximately 9.5 gallons/day during the initial skimmer pump test and decreasing to approximately 2.3 gallons/day by the end of the test. During drawdown pumping, LNAPL recovery rates averaged 1.2 gallons/day. In contrast, free product recovery rates during the bioslurper pump test remained relatively stable at an average of approximately 30 gallons/day.

Groundwater recovery rates during the bioslurper pump test were high in comparison to rates during the skimmer and drawdown pump tests. On average, groundwater was extracted at rates of 4,600 gallons/day during bioslurping, 92 gallons/day during skimming, and 730 gallons/day during drawdown pumping.

Soil gas concentrations were measured at monitoring points during the bioslurper pump test to determine whether the vadose zone was being oxygenated. In general, oxygen concentrations

increased at most monitoring points; however, due to the high soil moisture content, soil gas samples were difficult to collect and an adequate evaluation of the oxygen radius of influence could not be made. Because of the high soil moisture content, it was not possible to determine a pressure radius of influence.

Implementation of bioslurping at the McGuire AFB test site probably would facilitate enhanced recovery of LNAPL from the water table. However, bioslurping will result in a vapor stream requiring treatment and the extraction of significant quantities of groundwater. Given the treatment options of an ICE for vapors and discharge of extracted groundwater to the Industrial Wastewater Treatment Plant, bioslurping would be an economically viable alternative for this site.

6.0 REFERENCES

Battelle. 1995. *Test Plan and Technical Protocol for Bioslurping*, Report prepared by Battelle Columbus Operations for the U.S. Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas.

Hinchee, R.E., S.K. Ong, R.N. Miller, D.C. Downey, and R. Frandt. 1992. *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing* (Rev. 2), Report prepared by Battelle Columbus Operations, U.S. Air Force Center for Environmental Excellence, and Engineering Sciences, Inc. for the U.S. Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas.

APPENDIX A

**SITE-SPECIFIC TEST PLAN FOR BIOSLURPER FIELD ACTIVITIES
AT MCGUIRE AFB, NEW JERSEY**

**SITE-SPECIFIC TEST PLAN
FOR BIOSLURPER TESTING AT THE
BULK FUEL STORAGE AREA
MCGUIRE AIR FORCE BASE,
NEW JERSEY**

FINAL



PREPARED FOR:

**AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
TECHNOLOGY TRANSFER DIVISION
(AFCEE/ERT)
8001 ARNOLD DRIVE
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AND

**305 SPTG/CEV
MCGUIRE AFB, NEW JERSEY**

30 OCTOBER 1995

**SITE-SPECIFIC TEST PLAN FOR BIOSLURPER TESTING
AT MCGUIRE AIR FORCE BASE, NEW JERSEY (A002)
CONTRACT NO. F41624-94-C-8012**

FINAL

to

**Air Force Center for Environmental Excellence
Technology Transfer Division
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October 30, 1995

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TABLE OF CONTENTS

LIST OF TABLES	ii
LIST OF FIGURES	ii
1.0 INTRODUCTION	1
2.0 SITE DESCRIPTION	2
2.1 Site Geology	6
2.2 Aquifer Characteristics	6
2.3 Site Contamination	6
3.0 PROJECT ACTIVITIES	10
3.1 Mobilization to the Site	10
3.2 Site Characterization Tests	10
3.2.1 Baildown Tests	10
3.2.2 Soil Gas Survey (Limited)	13
3.2.3 Monitoring Point Installation	13
3.2.4 Soil Sampling	13
3.3 Bioslurper System Installation and Operation	16
3.3.1 System Setup	16
3.3.2 System Shakedown	16
3.3.3 System Startup and Test Operations	16
3.3.4 Soil Gas Profile/Oxygen Radius of Influence Test	19
3.3.5 Soil Gas Permeability Tests	19
3.3.6 LNAPL and Groundwater Level Monitoring	19
3.3.7 In Situ Respiration Test	19
3.3.8 Extended Testing	19
3.4 Demobilization	20
4.0 BIOSLURPER SYSTEM DISCHARGE	20
4.1 Vapor Discharge Disposition	20
4.2 Aqueous Influent/Effluent Disposition	20
4.3 Free-Product Recovery Disposition	22
5.0 SCHEDULE	22
6.0 PROJECT SUPPORT ROLES	22
6.1 Battelle Activities	22
6.2 McGuire AFB Support Activities	23
6.3 AFCEE Activities	23
7.0 REFERENCE	25

APPENDIX A:	GEOLOGIC CROSS-SECTIONAL PROFILES, GEOTECHNICAL DATA, AND WELL INSTALLATION LOGS FOR THE BFS, MCGUIRE AFB, NJ	A-1
APPENDIX B:	AIR PERMIT FOR OPERATION OF THE BIOSLURPER PILOT TEST AT THE BFS, MCGUIRE AFB, NJ	B-1
APPENDIX C:	MAP SHOWING LOCATION OF BURLINGTON COUNTY HOSPITAL	C-1

LIST OF TABLES

Table 1.	Concentrations of BTEX and Selected VOCs in Soil at the BFS, McGuire AFB, NJ	8
Table 2.	Concentrations of BTEX and Selected VOCs in Groundwater at the BFS, McGuire AFB, NJ	9
Table 3.	Free Product Thicknesses at the BFS, McGuire AFB, NJ	9
Table 4.	Schedule of Bioslurper Pilot Test Activities	12
Table 5.	Benzene and TPH Vapor Discharge Levels at Previous Bioslurper Test Sites . . .	21
Table 6.	Air Release Summary Information	21
Table 7.	Effluent Groundwater Concentrations of Benzene and TPH After Treatment at Previous Bioslurper Test Sites	22
Table 8.	Health and Safety Information Checklist	24

LIST OF FIGURES

Figure 1.	Map Showing Location of McGuire AFB, NJ	3
Figure 2.	Schematic Diagram of the BFS, McGuire AFB, NJ	4
Figure 3.	Schematic Diagram Showing Locations of Reported Spills and Disposal Areas at the BFS, McGuire AFB, NJ	5
Figure 4.	Schematic Diagram Showing Groundwater Elevation Contours at the BFS, McGuire AFB, NJ	7
Figure 5.	Schematic Diagram of the Lateral Extent of Groundwater Contamination and Product Thickness at the BFS, McGuire AFB, NJ	11
Figure 6.	General Bioslurper Well and Monitoring Point Arrangement	14
Figure 7.	Schematic Diagram of a Typical Monitoring Point	15
Figure 8.	Bioslurper Process Flow at the BFS, McGuire AFB, NJ	17
Figure 9.	Schematic Diagram of a Typical Bioslurper Well	18

**SITE-SPECIFIC TEST PLAN FOR BIOSLURPER TESTING
AT MCGUIRE AIR FORCE BASE, NEW JERSEY**

FINAL

to

**Air Force Center for Environmental Excellence
Technology Transfer Division
(AFCEE/ERT)
Brooks AFB, Texas 78235**

October 30, 1995

1.0 INTRODUCTION

The U.S. Air Force Center for Environmental Excellence (AFCEE) Technology Transfer Division is conducting a nationwide application of an innovative technology for free-product recovery and soil bioremediation. The technologies tested in the Bioslurper Initiative include vacuum-enhanced free-product recovery/bioremediation (bioslurping) as well as traditional skimmer and groundwater depression approaches. The field test and evaluation are intended to demonstrate the feasibility of free product recovery by measuring system performance in the field. System performance parameters, mainly free-product recovery, will be determined at numerous sites. Field testing will be performed at many sites to determine the effects of different organic contaminant types and concentrations and different geologic conditions on bioslurping effectiveness.

Plans for the field test activities are presented in two documents. The first is the overall Test Plan and Technical Protocol for the entire program entitled *Test Plan and Technical Protocol for Bioslurping* (Battelle, 1995). The overall plan is supplemented by plans specific to each test site. The concise site-specific plans effectively communicate planned site activities and operational parameters.

The overall Test Plan and Technical Protocol was developed as a generic plan for the Bioslurper Initiative to improve the accuracy and efficiency of site-specific Test Plan preparation. The field program involves installation and operation of the bioslurping system supported by a wide variety of site characterization, performance monitoring, and chemical analysis activities. The basic methods to be applied from site to site do not change. Preparation and review of the overall Test Plan and Technical Protocol allows efficient documentation and review of the basic approach to the test program. Peer and regulatory review were performed for the overall Test Plan and Technical Protocol to ensure the credibility of the overall program.

This report is the site-specific Test Plan for application of bioslurping at McGuire Air Force Base (AFB), New Jersey. It was prepared based on site-specific information received by Battelle from McGuire AFB and other pertinent site-specific information to support the overall Test Plan and Technical Protocol.

Site-specific information for McGuire AFB has identified subsurface hydrocarbon contamination at the Bulk Fuel Storage Area (BFSA). The contamination is generally associated with JP-4 jet fuel spills in the vicinity of the storage tanks. Free product, as light, non-aqueous phase liquid (LNAPL), has been measured north of Storage Tank 2115 at monitoring wells 08-MW-X12, 09-MW-X19, and 08-MW-X51. It is anticipated that the bioslurper demonstration will take place in the vicinity of these monitoring wells and if possible, one of these wells would be used to perform the extraction of JP-4 jet fuel.

2.0 SITE DESCRIPTION

The information presented in this section was obtained from the document titled, *Bulk Storage Area Feasibility Study, McGuire Air Force Base, New Jersey Volumes I and II, Internal Draft* prepared for HAZWRAP, Oak Ridge, Tennessee, Project No. 7610-02 by ABB Environmental Services Inc., October 1992.

McGuire AFB is located in the south-central portion of New Jersey (Figure 1). The installation is bordered by the Fort Dix Military Reservation to the east, south, and west, and by residential areas of the Town of Wrightstown (Burlington County), New Jersey to the north.

The BFSA is in the central portion of McGuire AFB and occupies approximately 24 acres (Figure 2). The facility consists of a series of eight aboveground storage tanks with capacities ranging from 500,000 to 850,000 gallons. Five of these tanks are dedicated to JP-4 jet fuel storage while the remaining tanks hold heating fuel for the central heating plant. All of the tanks are contained by an asphalt-covered earthen berm.

The BFSA has been in operation since 1963. During this time, fuel spills and storage/disposal activities have resulted in contamination at the site (Figure 3). In 1967, 500,000 gallons of JP-4 jet fuel were discharged from an open valve (location unknown, spill reportedly channelled to stream). In 1984, 500,000 gallons of JP-4 jet fuel were released from a ruptured underground pipeline northeast of Tank 2109. In 1987, 10,000 gallons of JP-4 jet fuel were spilled into the berm of Tank 2110. In 1988, an unspecified volume of heating oil was discharged north of Tanks 2120 and 2121. Finally, up until 1970, tank sludge was disposed of in the tank bermed areas, and fly ash and coal slag were stored and disposed north of the tank area.

In 1992, fuel was observed discharging from a subsurface organic silt layer into the unnamed tributary of South Run (Figure 3). The water in this unnamed tributary comes from shallow groundwater discharges, storm drain runoff, and cooling water discharge from the central heating plant.

Preliminary investigations of the site occurred in 1982, followed by site inspections in 1983 and 1988. During this time, monitoring wells were installed, groundwater samples were collected, and a pump test was performed. From 1990 to 1992, remedial investigations were performed to assess the extent of contamination.

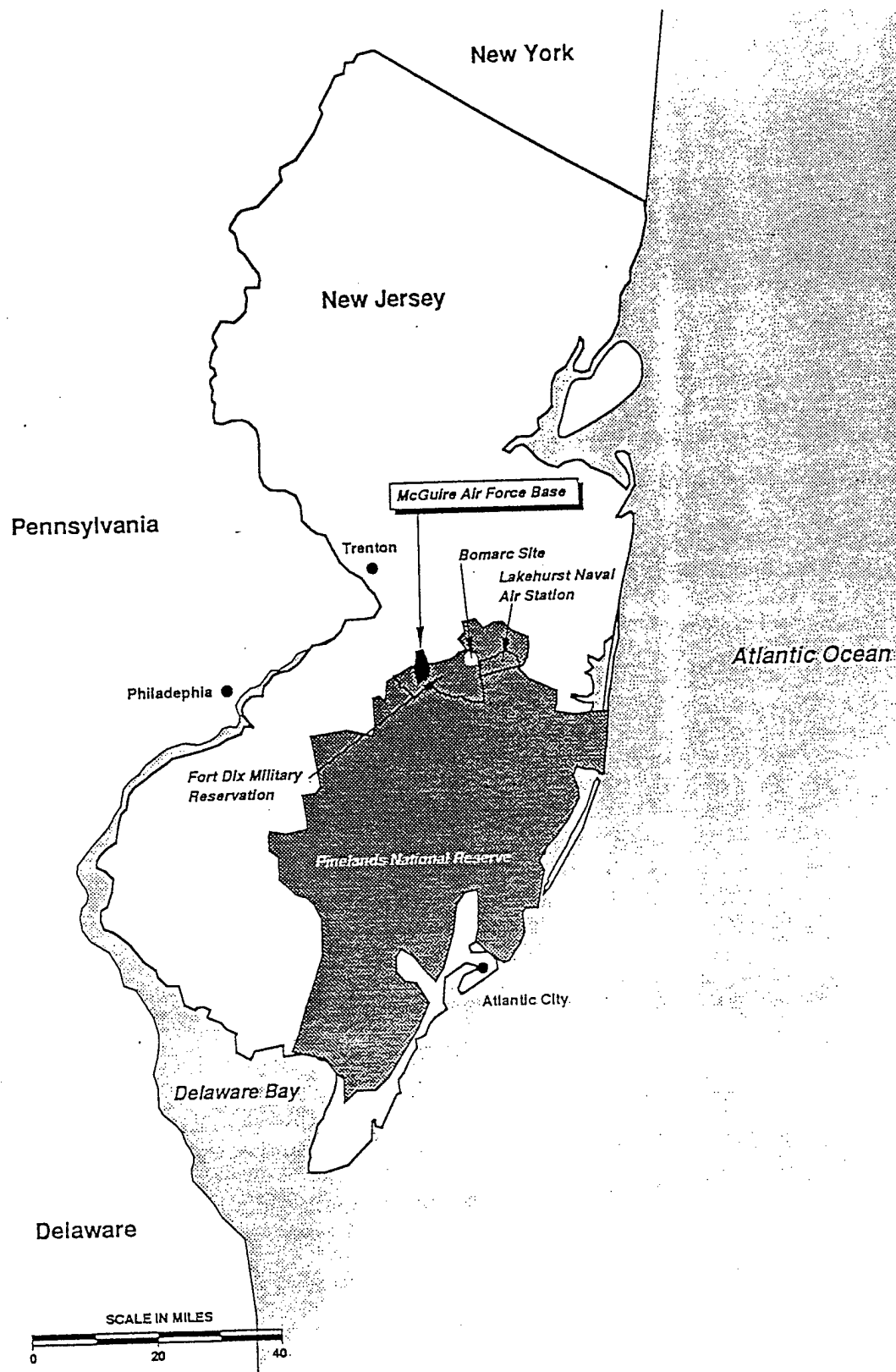
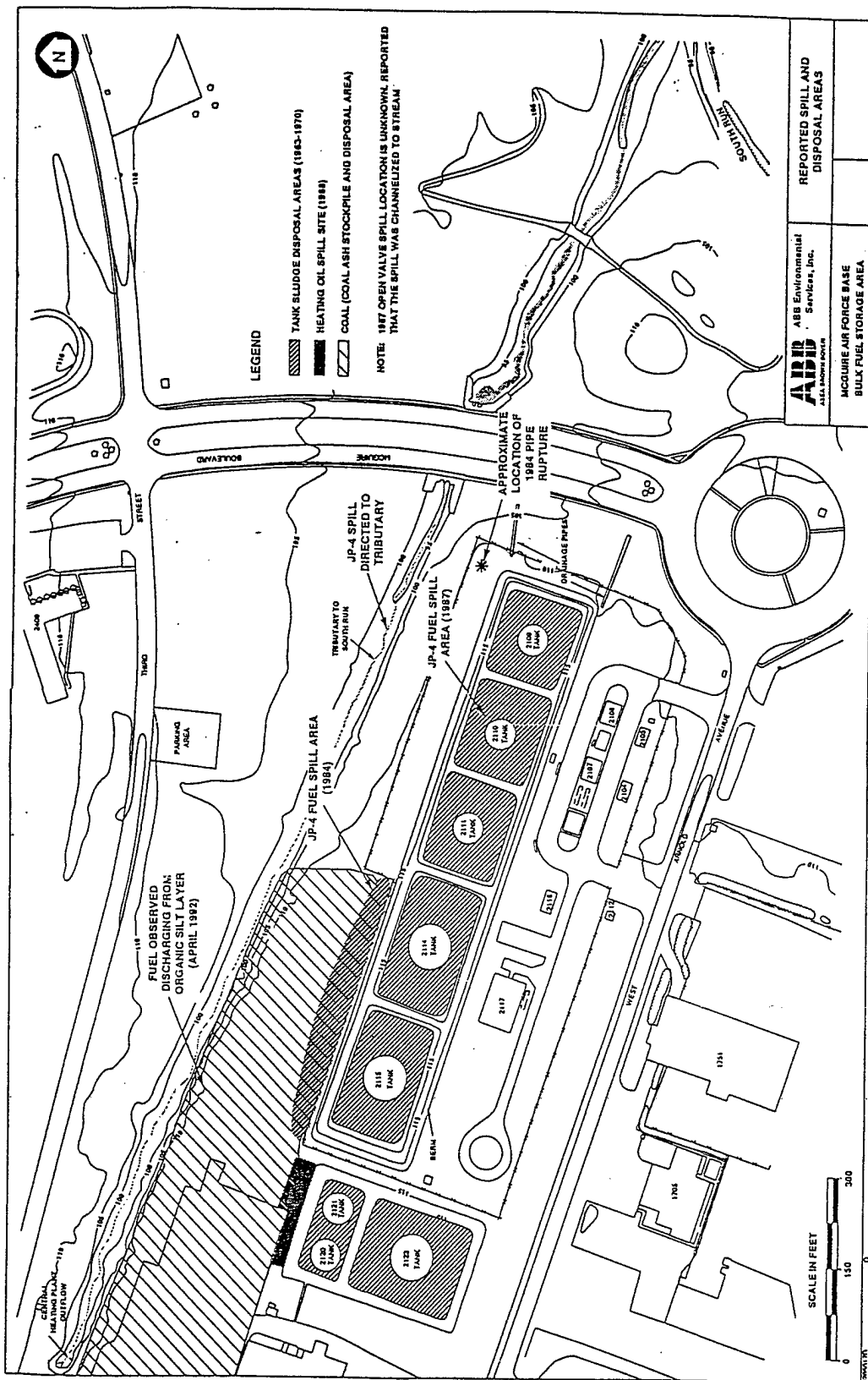


Figure 1. Map Showing Location of McGuire AFB, NJ



2.1 Site Geology

McGuire AFB rests on coastal plain sediments. The shallow stratigraphy consists primarily of interbedded continental and marine sands and silts. The thickness of these units vary, with each being up to 50 ft thick in the general area of McGuire AFB.

Site soils consist primarily of silty fine sands, interspersed with silt laminae and gravel seams. An organic silt layer with wood fragments and rootlets is present across the site between 11 and 14 ft below ground surface (bgs).

Geological profiles, geotechnical data (unit weight determinations and grain-size distributions), and piezometer and monitoring well installation logs from the BFSa are presented in Appendix A.

2.2 Aquifer Characteristics

Groundwater is part of the unconfined Cohansey/Kirkwood aquifer system and generally is found between 8 and 14 ft bgs across the site. This shallow aquifer is not used for consumptive purposes on the base. Groundwater elevation contours are shown in Figure 4.

The average hydraulic gradient across the site has been estimated at 0.006 ft/ft. The proximity of the tributary of South Run, which borders the site, results in gradients that are generally steeper closer to the tributary. Permeability testing has been performed utilizing the monitoring wells, and hydraulic conductivity values have been calculated using the Bouwer and Rice slug test solution. The average hydraulic conductivity was calculated at 2.3×10^4 cm/sec. Using this data and assuming a porosity of 30%, the average seepage velocity was estimated to be 4.7 ft/year.

2.3 Site Contamination

Historical data indicate that at least 1.01 million gallons of JP-4 jet fuel have been discharged to the environment in the vicinity of the BFSa at McGuire AFB. Contamination also exists from a fuel oil spill of unknown volume and from the disposal and storage of tank sludge, fly ash slag, and coal.

Soil samples, both surface and subsurface, have been collected and analyzed for the presence of organic contamination. Benzene, toluene, ethylbenzene, and xylenes (BTEX) as well as semivolatile organic compounds (SVOCs) have been identified in a portion of the soil samples. Table 1 summarizes frequency of detection and reported concentrations of these compounds. Generally, the concentration levels or the frequency of occurrence indicated that the compounds identified did not exceed the New Jersey Department of Environmental Protection and Energy's (NJDEPE) proposed cleanup standards. The data do indicate that the contaminants are those typically associated with fuel spills and are therefore considered site related.

Soil gas samples collected in 1992 showed high BTEX and TPH concentrations, with average BTEX concentrations of 360 ppmv and average TPH concentrations of 54,000 ppmv.

Groundwater samples have been collected from locations upgradient and downgradient of the BFSa. The upgradient monitoring wells included: 08-MW-X20, 08-MW-X23, 08-MW-X24, 08-MW-101, and 08-MW-201 (Figure 4). A total of 20 downgradient wells were sampled to establish the extent of groundwater contamination. Monitoring wells that contained LNAPL were not sampled.

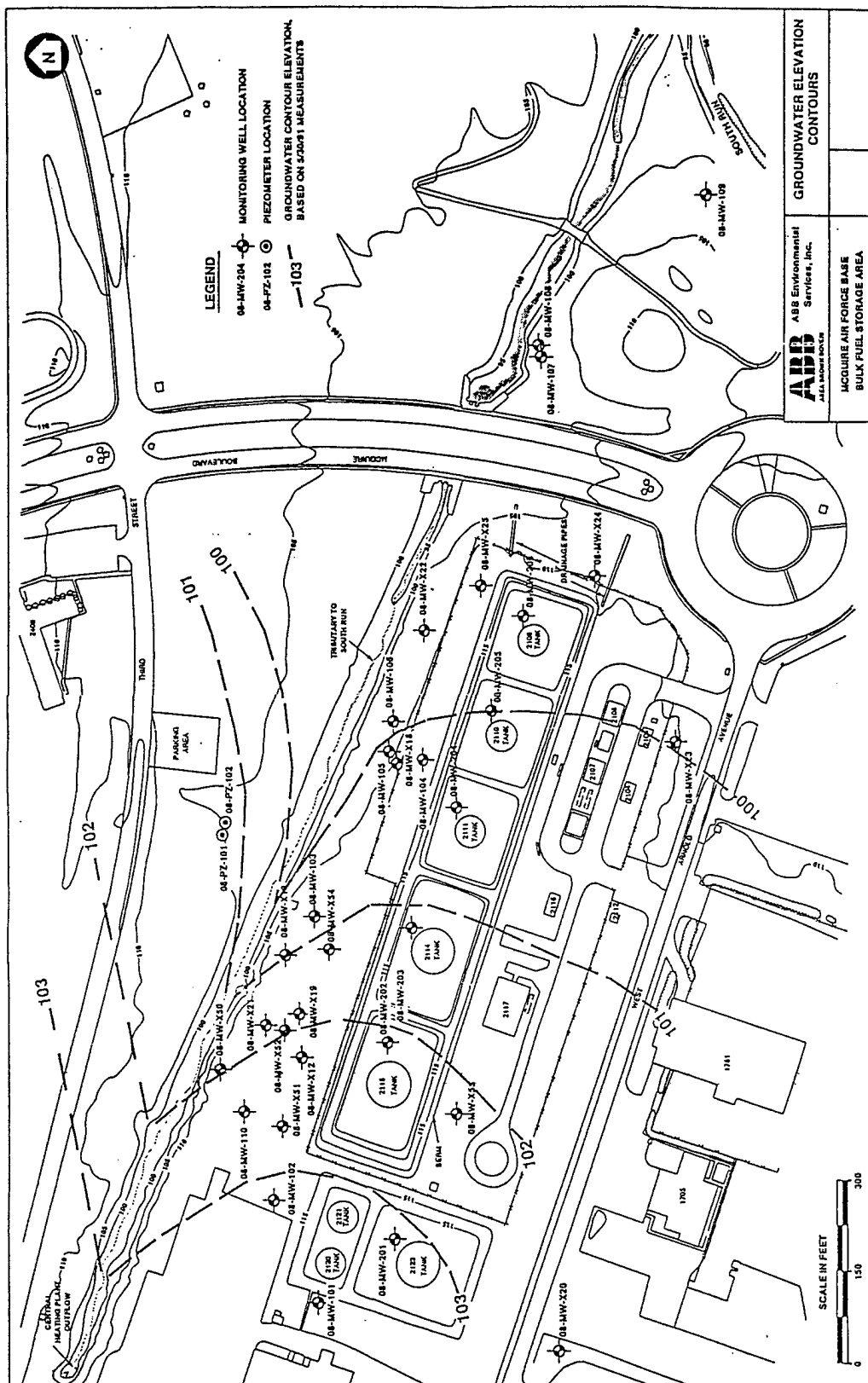


Table 1. Concentrations of BTEX and Selected VOCs in Soil at the BFSA, McGuire AFB, NJ

Compound	Frequency	Average Background Concentration ($\mu\text{g/kg}$)	Average BFSA Concentration ($\mu\text{g/kg}$)
Surface Soil Analyses			
Benzene	9/48	110	360
Toluene	12/48	4.2	1,300
Ethylbenzene	15/48	16	900
Total Xylenes	17/48	90	3,600
Naphthalene	12/48	68	490
2-Methylnaphthalene	3/12	220	2,400
Subsurface Soil Analyses			
Benzene	64/325	14	360
Toluene	65/322	4.2	1,300
Ethylbenzene	84/211	16	900
Total Xylenes	93/322	90	3,600
Naphthalene	48/298	68	490
2-Methylnaphthalene	9/32	220	2,400

Table 2. Concentrations of BTEX and Selected VOCs in Groundwater at the BFSA, McGuire AFB, NJ

Compound	Upgradient Frequency	Downgradient Frequency	Mean Upgradient Concentration ($\mu\text{g/L}$)	Mean Downgradient Concentration ($\mu\text{g/L}$)
Benzene	0/3	10/19	37	510
Toluene	0/3	7/19	37	1,400
Ethylbenzene	0/3	9/19	37	2,200
Total Xylenes	0/3	10/19	37	1,100
Phenol	0/3	7/19	23	21
2-Methylphenol	0/3	5/20	23	18
3-Methylphenol	0/3	7/20	23	54
2,3-Dimethylphenol	0/3	2/20	23	18
Naphthalene	0/3	10/20	23	34
2-Methylnaphthalene	0/3	2/20	23	14
bis(2-ethylhexyl)phthalate	0/3	2/19	410	14

Table 3. Free Product Thicknesses at the BFSA, McGuire AFB, NJ

Monitoring Well	Free Product Thickness (ft)	
	5/30/91	6/22/94
08-MW-X12	4.44	4.69
08-MW-X18	2.46	2.85
08-MW-X19	6.71	5.37
08-MW-X21	3.01	2.46
08-MW-X51	1.61	3.27
08-MW-X54	0.12	0.04

Groundwater summary data for BTEX and SVOCs are presented in Table 2. Given these data, it appears that contamination of the groundwater is due to the fuel releases at the BFSA and affects the groundwater downgradient of the site (Figure 5).

LNAPL measurements have been made at the monitoring points at the BFSA. Product thickness measurements are presented in Table 3. The distribution of LNAPL indicates that the thickest subsurface layer of organic contamination resides north of Tank 2115. It is in this location that the demonstration of the bioslurper technology is expected to take place. One of the existing monitoring wells (08-MW-X12, 08-MW-X19, or 08-MW-X51) is expected to be used for the LNAPL extraction.

The soil, groundwater, and LNAPL characterization of the site around the BFSA has allowed for an estimate of the free product presently existing within the lateral extent of the plume. A total volume of 250,000 to 750,000 gallons of LNAPL is estimated to be present in the subsurface formation below and downgradient of the BFSA. A portion of this volume will be affected during the bioslurper demonstration at the BFSA, McGuire AFB.

3.0 PROJECT ACTIVITIES

The field activities discussed in the following sections are planned for the bioslurper pilot test at McGuire AFB. Additional details about the activities are presented in the overall Test Plan and Technical Protocol. As appropriate, specific sections in the overall Test Plan and Technical Protocol are referenced. Table 4 presents the schedule of activities for the Bioslurper Initiative at McGuire AFB.

3.1 Mobilization to the Site

After the site-specific Test Plan is approved, Battelle staff will mobilize equipment to the site. Some of the equipment will be shipped via air express to McGuire AFB prior to staff arrival. The Base Point-of-Contact (POC) will have been asked in advance to find a suitable holding facility to receive the bioslurper pilot test equipment so that it will be easily accessible to the Battelle staff when they arrive with the remainder of the equipment. The exact mobilization date will be confirmed with the Base POC as far in advance of fieldwork as is possible. The Battelle POC will provide the Base POC with information on each Battelle employee who will be on site. Battelle personnel will be mobilized to the site after confirmation that the shipped equipment has been received by McGuire AFB.

3.2 Site Characterization Tests

3.2.1 Baildown Tests

The baildown test is the primary test for selection of the bioslurper test well. Baildown tests are also useful for the evaluation of actual versus apparent free product thicknesses. Baildown tests will be performed at wells that contain measurable thicknesses of LNAPL to estimate the LNAPL recovery potential at those particular wells. Baildown tests are planned at monitoring wells 08-MW-X12, 08-MW-X19, and 08-MW-X51. In most cases, the well exhibiting the highest rate of LNAPL recovery will be selected for the bioslurper extraction well. A sample of free LNAPL will be collected at this point for analyses of boiling point distribution and BTEX concentration. Detailed procedures for the baildown tests are provided in Section 5.6 of the overall Test Plan and Technical Protocol.

Table 4. Schedule of Bioslurper Pilot Test Activities

Pilot Test Activity	Schedule
Mobilization	Day 1-2
Site Characterization LNAPL/Groundwater Interface Monitoring and Baildown Tests Soil Gas Survey (Limited) Monitoring Point Installation (3 monitoring points) Soil Sampling (BTEX, TPH, physical characteristics)	Day 2-3
System Installation	Day 2-3
Test Startup Skimmer Pump Test (2 days) Bioslurper Pump Test (4 days) Soil Gas Permeability Testing Skimmer Pump Test (continued) In Situ Respiration Test - Air/Helium Injection In Situ Respiration Test - Monitoring Drawdown Pump Test (2 days)	Day 3 Day 3-4 Day 6-9 Day 6 Day 10 Day 10 Day 11-16 Day 11-12
Demobilization/Mobilization	Day 13-14

3.2.2 Soil Gas Survey (Limited)

A small-scale soil gas survey will be conducted to identify the best location for installation of the bioslurping system. The soil gas survey will be conducted in areas where historical site data indicated the highest contamination levels. These areas will be surveyed to select the locations for installation of soil gas monitoring points. Monitoring points will be located in areas that exhibit the following soil gas characteristics.

1. Relatively high TPH concentrations (10,000 ppmv or greater).
2. Relatively low oxygen concentrations (between 0% and 2%).
3. Relatively high carbon dioxide concentrations (depending on soil type, between 2% and 10% or greater).

Additional information on the soil gas survey is provided in Section 5.2 of the overall Test Plan and Technical Protocol.

3.2.3 Monitoring Point Installation

Monitoring points must be installed to determine the radius of influence of the bioslurper system in the vadose zone. A general arrangement of the bioslurping well and monitoring points is shown in Figure 6.

Upon completion of the initial soil gas survey and baildown tests, at least three soil gas monitoring points will be installed (unless existing monitoring points are available for use) to measure soil gas changes that occur during bioslurper operation. These monitoring points should be located in highly contaminated soils within the free-phase plume and should be positioned to allow detailed monitoring of the in situ changes in soil gas composition caused by the bioslurper system. Three monitoring points were previously installed at the site and are located southeast of monitoring well 08-MW-X12. These points will be used if they are located close enough to the selected bioslurper well to allow for proper testing. A schematic diagram of a typical monitoring point is shown in Figure 7. Information on monitoring point installation can be found in Section 4.2.1 of the overall Test Plan and Technical Protocol.

3.2.4 Soil Sampling

Soil samples will be collected from each boring to determine the physical and chemical composition of the soil near the bioslurper test site. Soil samples will be collected from the boreholes advanced for monitoring point installation at two or three locations at the site chosen for the bioslurper test. Generally, samples will be collected from the capillary fringe over the free product.

Soil samples from each boring will be analyzed for BTEX, bulk density, moisture content, particle size distribution, porosity, and TPH. Section 5.5.1 of the overall Test Plan and Technical Protocol contains additional information on field measurements and sample collection procedures for soil sampling.

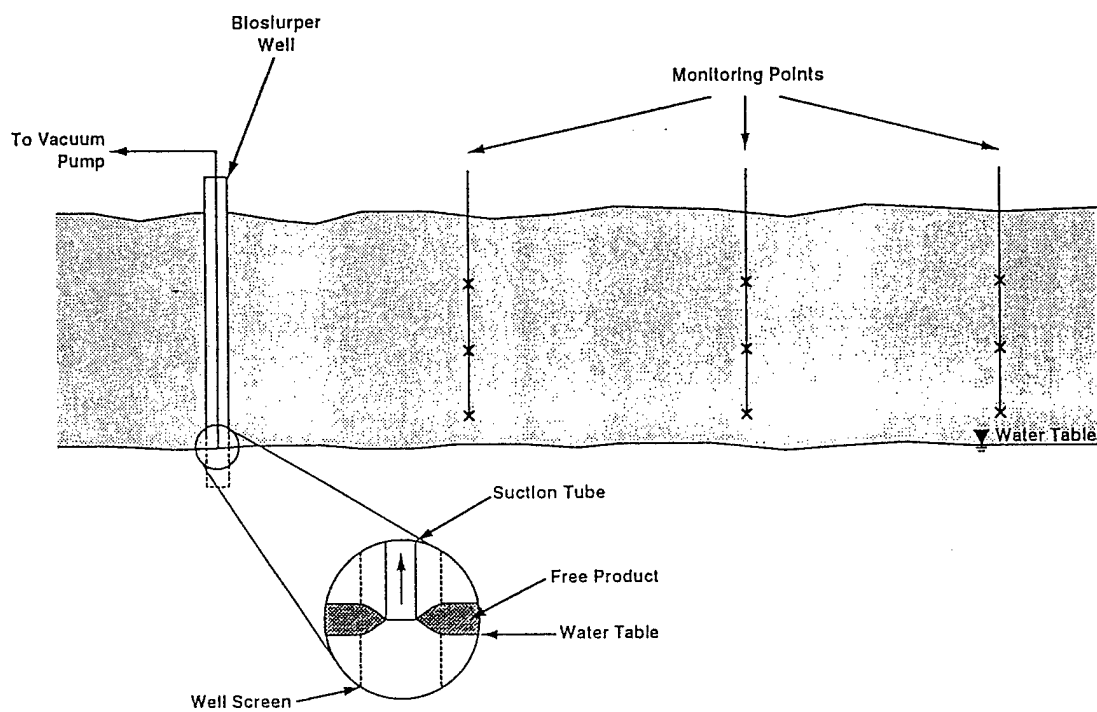


Figure 6. General Bioslurper Well and Monitoring Point Arrangement

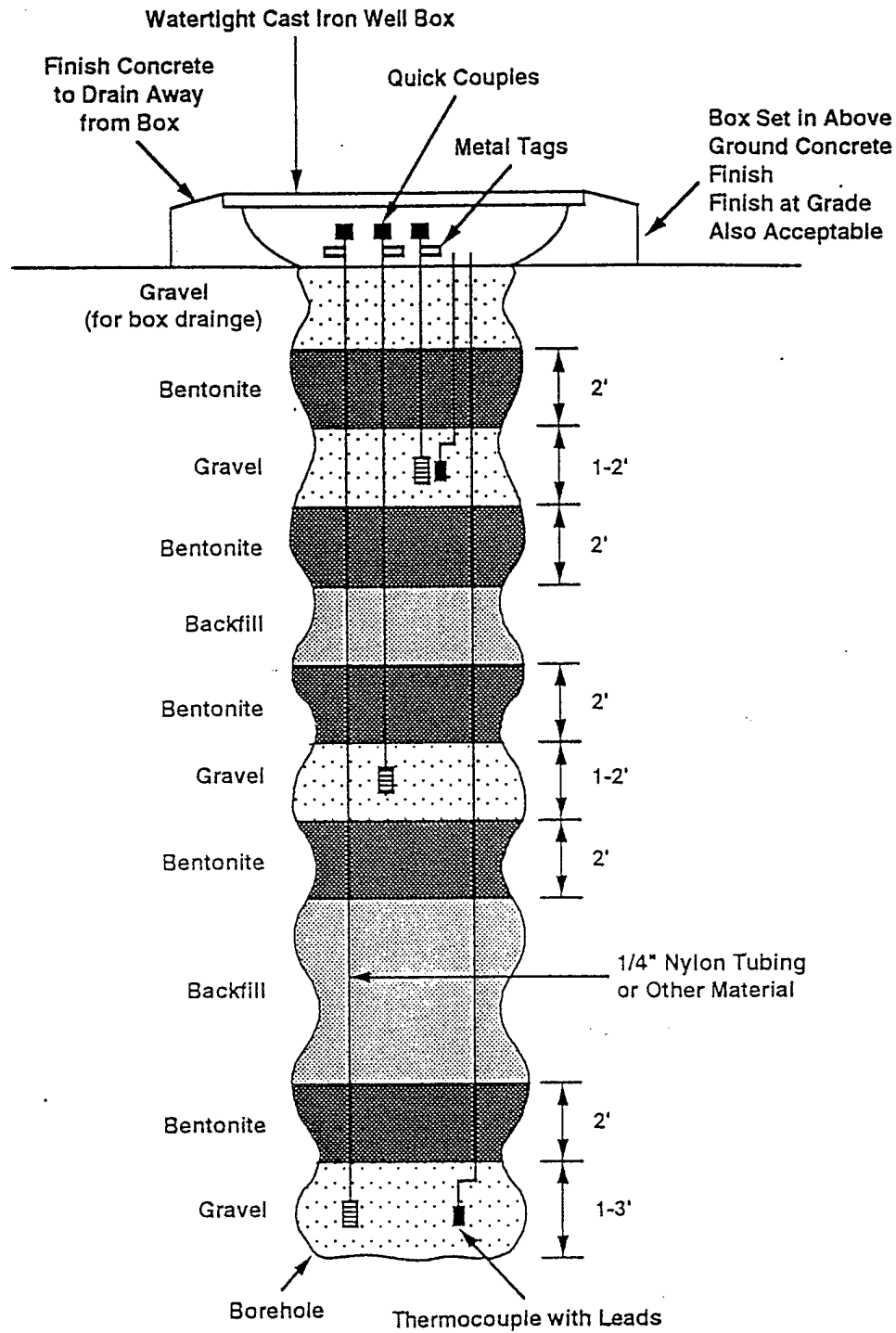


Figure 7. Schematic Diagram of a Typical Monitoring Point

3.3 Bioslurper System Installation and Operation

Once the well to be used for the bioslurper test installation at McGuire AFB has been identified, the bioslurper pump and support equipment will be installed and pilot testing will be initiated.

3.3.1 System Setup

After the preliminary site characterization has been completed and the bioslurper candidate well has been selected, the shipped equipment will be mobilized from the holding facility to the test site, and the bioslurper system will be assembled. Figure 8 shows a flow diagram of the bioslurper process. Figure 9 illustrates a typical bioslurper well that will be used at McGuire AFB.

Before the LNAPL recovery tests are initiated, all relevant baseline field data will be collected and recorded. These data will include soil gas concentrations, initial soil gas pressures, the depth to groundwater, and the LNAPL thickness. Ambient soil and all atmospheric conditions (e.g., temperature, barometric pressure) also will be recorded. All emergency equipment (i.e., emergency shutoff switches and fire extinguishers) will be installed and checked for proper operation at this time.

A clear, level 20- by 10-ft area near the well selected for the bioslurper test installation will be identified to station the equipment required for bioslurper system operation. Additional information on bioslurper system installation is provided in Section 6.0 of the overall Test Plan and Technical Protocol.

3.3.2 System Shakedown

A brief startup test will be conducted to ensure that the system is constructed properly and operates safely. All system components will be checked for problems and/or malfunctions. A checklist will be provided to document the system shakedown.

3.3.3 System Startup and Test Operations

After installation is complete and the bioslurper system is confirmed to be operating properly, the LNAPL recovery tests will be started. The Bioslurper Initiative has been designed to evaluate the effectiveness of bioslurping as an LNAPL recovery test technology relative to conventional gravity-driven LNAPL recovery technologies. The Bioslurper Initiative includes three separate LNAPL recovery tests: (1) a skimmer pump test, (2) a bioslurper pump test, and (3) a drawdown pump test. The three recovery tests are described in detail in Section 7.3 of the overall Test Plan and Technical Protocol.

The bioslurper system operating parameters that will be measured during operation are vapor discharge, aqueous effluent, LNAPL recovery volume rates, vapor discharge volume rates, and groundwater discharge volume rates. Vapor monitoring will consist of periodic monitoring of TPH using hand-held instruments supplemented by two samples collected for detailed laboratory analysis. Two samples of aqueous effluent will be collected for analysis of BTEX and TPH. Recovered LNAPL volume will be recorded using an in-line flow-totalizing meter. The off-gas discharge volume will be measured using a calibrated pitot tube, and the groundwater discharge volume will be recorded using an in-line flow-totalizing meter. Section 8.0 of the overall Test Plan and Technical Protocol describes process monitoring of the bioslurper system.

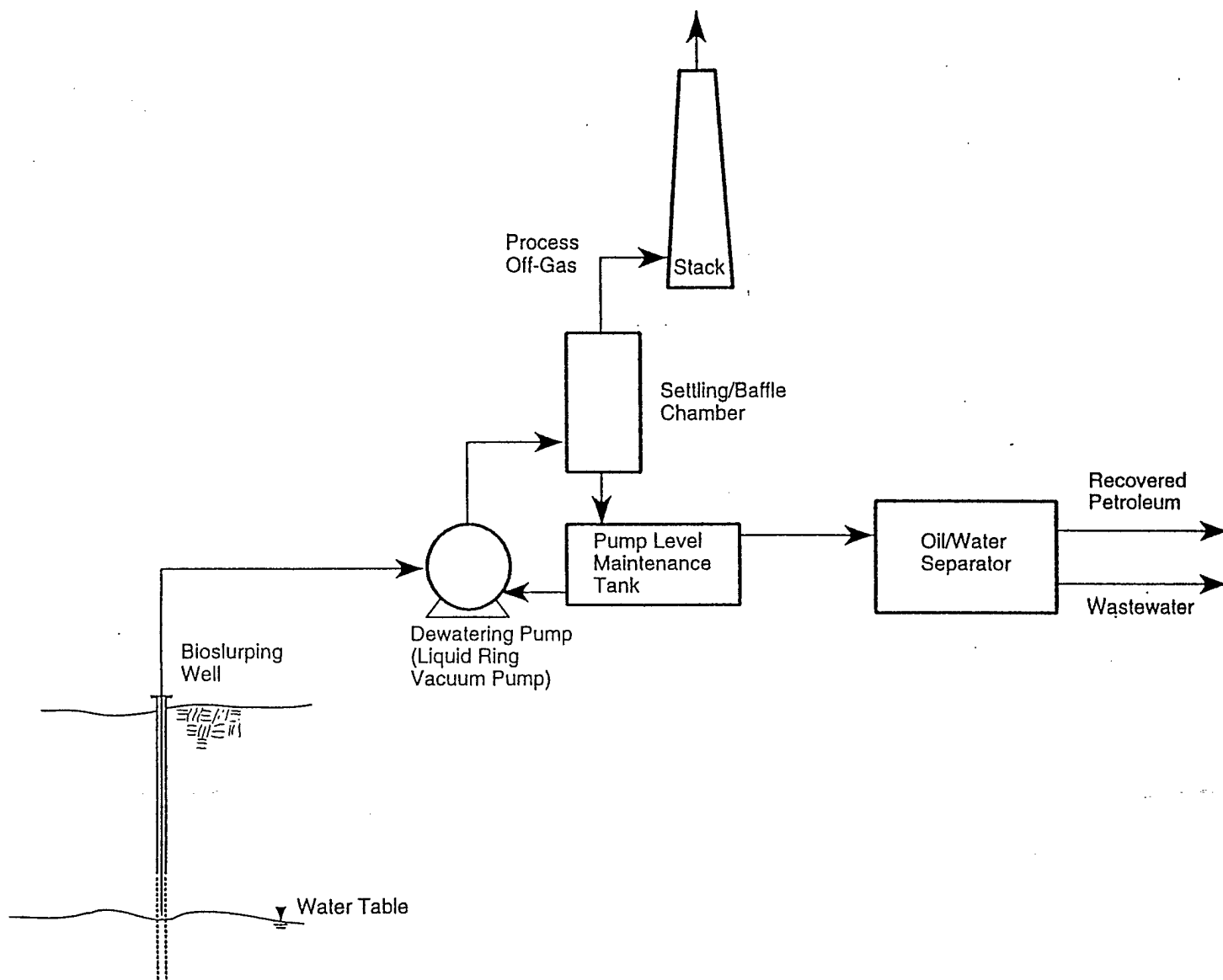


Figure 8. Bioslurper Process Flow at the BFSA, McGuire AFB, NJ

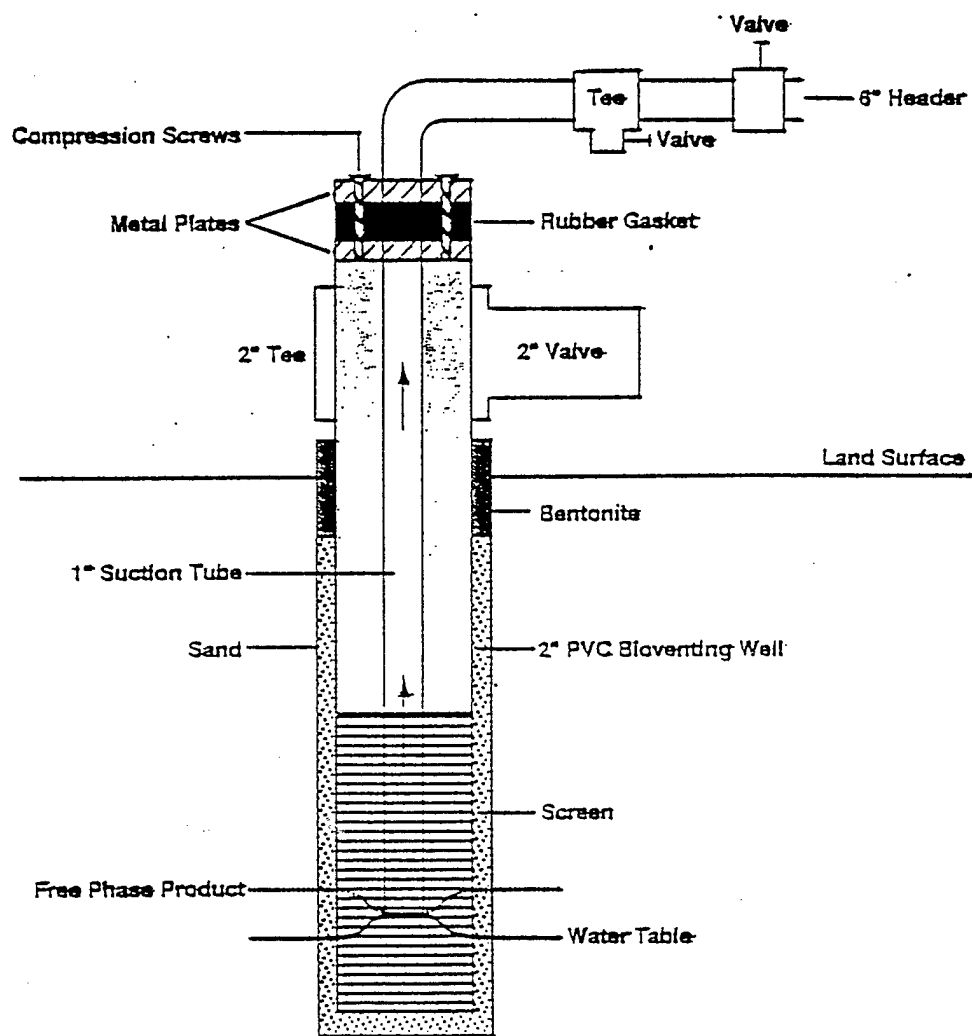


Figure 9. Schematic Diagram of a Typical Bioslurper Well

3.3.4 Soil Gas Profile/Oxygen Radius of Influence Test

Changes in soil gas profiles will be measured before and during the bioslurper pump test. Soil gas will be monitored for concentrations of oxygen, carbon dioxide, and TPH using field instruments. These measurements will be used to determine the oxygen radius of influence of the bioslurper.

3.3.5 Soil Gas Permeability Tests

A soil gas permeability test will be conducted concurrently with startup of the bioslurper pump test. Soil gas permeability data will support the process of estimating the vadose zone radius of influence of the bioslurper system. Soil gas permeability results also will aid in determining the number of wells required if it is decided to treat the site with a full-scale bioslurper system. The soil gas permeability test method is described in Section 5.7 of the overall Test Plan and Technical Protocol.

3.3.6 LNAPL and Groundwater Level Monitoring

During the bioslurper pump test, the LNAPL and groundwater levels will be monitored in a well adjacent to the extraction well if such a well exists. The top of the monitoring well will be sealed from the atmosphere so the subsurface vacuum will be contained. Additional information for the monitoring of fluid levels is provided in Section 4.3.4 of the overall Test Plan and Technical Protocol.

3.3.7 In Situ Respiration Test

An in situ respiration test will be conducted after completion of the bioslurper pilot tests. The in situ respiration test will involve injection of air and helium into selected soil gas monitoring points followed by monitoring changes in concentrations of oxygen, carbon dioxide, TPH, and helium in soil gas at the injection point. Measurement of the soil gas composition typically will be conducted at 2, 4, 6, and 8 hours and then every 4 to 12 hours for about 2 days. Timing of the tests will be adjusted based on the oxygen-use rate. If oxygen depletion occurs rapidly, more frequent monitoring will be required. If oxygen depletion is slow, less frequent readings will be acceptable. The oxygen utilization rate will be used to estimate the biodegradation rate at the site. Further information on the procedures and data collection of the in situ respiration test is provided in Section 5.8 of the overall Test Plan and Technical Protocol.

3.3.8 Extended Testing

The Air Force has the option of extending the operation of the bioslurper system for up to six months if LNAPL recovery rates are promising and long-term vapor and aqueous discharge requirement have been established. If extended testing is to be performed, the Air Force will need to provide electrical power for long-term operation of the bioslurper pump. Disposition of all generated wastes and routine operation and maintenance of the system will be the Air Force's responsibility. Battelle will provide technical support during the extended testing operation.

3.4 Demobilization

Once all necessary tests have been completed at the McGuire AFB site, the equipment will be disassembled by Battelle staff. The equipment then will be moved back to the holding facility, where it will remain until its next destination is determined. Battelle staff will receive this information and will be responsible for shipment of the equipment to the next site before they leave McGuire AFB.

4.0 BIOSLURPER SYSTEM DISCHARGE

4.1 Vapor Discharge Disposition

Battelle expects that the operation of the bioslurper test system at McGuire AFB will require a waiver or a point source air release registration and may require some additional permits. However, because of the short duration of the bioslurper pilot test, it can be assumed that the concentrations of TPH released to the atmosphere will be approximately 46 lb/day and benzene will be <0.1 lb/day without treatment. This value is based on the average discharge rates at three bioslurper test sites (Johnston Atoll, Travis AFB, and Wright-Patterson AFB) that are contaminated with a similar type of fuel as that found at the BFSa. The discharge value may vary depending on concentrations in soil gas and the permeability of the soil. The data for benzene and TPH discharge levels for 6 previous bioslurper sites are presented in Table 5. The relatively large TPH discharge level at Travis AFB is partially due to the extraction rate. This extraction rate is the maximum rate a 3-hp pump can achieve and may be lower at McGuire AFB due to the permeability of the soil. The vapor stream generated by the bioslurper system can be discharged directly to the atmosphere because of the short duration of the test and the low concentrations of benzene and TPH. A short-term (5 to 6-day pumping) waiver to operate as specified above is requested (the air permit is provided in Appendix B).

To ensure the safety and regulatory compliance of the bioslurper system, field soil gas screening instruments will be used to monitor vapor discharge concentration. The volume of vapor discharge will be monitored daily using air flow instruments. If state regulatory requirements will not permit the expected amount of organic vapor discharge to the atmosphere, the Base POC should inform AFCEE and Battelle so that alternative plans can be made prior to mobilization to the site. Table 6 presents information typically required to complete an air release registration form.

4.2 Aqueous Influent/Effluent Disposition

The flowrate of groundwater pumped by the bioslurper will be less than 5 gpm. However, it may be necessary in New Jersey to obtain a groundwater pumping waiver or registration permit. If one is required, the Base POC will inform Battelle of the necessary steps in obtaining the waiver or permit.

Operation of the bioslurper system will generate an aqueous waste discharge that will be passed through a bag filter, an oil/water separator, hydrophobic clay drums, and activated carbon drums (Figure 7). Table 7 provides effluent data for sites where groundwater has been treated in this manner. Sites not listed did not receive any treatment other than an oil/water separator. The intention of Battelle staff will be to dispose of the treated wastewater by discharge directly to the Fort Dix Sewage Treatment Plant.

Table 5. Benzene and TPH Vapor Discharge Levels at Previous Bioslurper Test Sites

Site Location	Fuel Type	Extraction Rate (scfm)	Benzene (ppmv)	TPH (ppmv)	Benzene Discharge (lb/day)	TPH Discharge (lb/day)
Andrews AFB	No. 2 Fuel Oil	8.0	16	2,000	0.0010	0.20
Site 1, Bolling AFB	No. 2 Fuel Oil	4.0	0.20	153	0.00030	0.0090
Site 2, Bolling AFB	Gasoline	21	370	70,000	2.3	470
Johnston Atoll	Jet Fuel	10	0.60	975	0.0017	5.7
Travis AFB	Jet Fuel	20	100	10,800	0.58	130
Wright-Patterson AFB	Jet Fuel	3.0	ND	595	0	1.0

ND = Not detected.

Table 6. Air Release Summary Information

Data Item	Air Release Information
Contractor Point-of-Contact	Jeff Kittel, (614) 424-6122
Contractor address	Battelle, 505 King Avenue, Columbus, OH 43201
Estimated total quantity of petroleum product to be recovered	To be determined
Description of petroleum product to be recovered	JP-4 jet fuel
Planned date of test start	To be determined
Test duration	9-10 days (active pumping)
Maximum expected volatile organic compound level in air	~46 lb/day TPH, <0.1 lb/day benzene
Stack height above ground level	10 ft

Table 7. Effluent Groundwater Concentrations of Benzene and TPH After Treatment at Previous Bioslurper Test Sites¹

Site Location	Fuel Type	Benzene (mg/L)	TPH (mg/L)
Andrews AFB	No. 2 Fuel Oil	0.096	270
Travis AFB	Jet Fuel	1.0	17

¹ Groundwater effluent at Bolling AFB, Johnston Atoll, and Wright-Patterson AFB were discharged with less treatment, and are therefore not presented in this table.

4.3 Free-Product Recovery Disposition

The bioslurper system will recover free-phase product from the pilot tests performed at McGuire AFB. Recovered free product will be turned over to the Base for disposal and/or recycling. The volume of free product recovered from the Base will not be known until the tests have been performed. The maximum recovery rate for this system is 5 gpm, but the actual rate of LNAPL recovery likely will be much lower.

5.0 SCHEDULE

The schedule for the bioslurper fieldwork at McGuire AFB will depend on approval of the project Test Plan. Battelle will determine a definitive schedule as soon as possible after approval is received. Battelle will have two to three staff members on site for approximately 2 weeks to conduct all necessary pilot testing. At the conclusion of the field testing at McGuire AFB, all staff will return their Base passes. Battelle staff will remove all bioslurper field testing equipment from the Base before they leave the site.

6.0 PROJECT SUPPORT ROLES

This section outlines some of the major functions of personnel from Battelle, McGuire AFB, and AFCEE during the bioslurper field test.

6.1 Battelle Activities

The obligations of Battelle in the Bioslurper Initiative at McGuire AFB will be to supply the staff and equipment necessary to perform all the tests on the bioslurper system. Battelle also will provide technical support in the areas of water and vapor discharge permitting, digging permits, staff support during the extended testing period, and any other technical areas that need to be addressed.

6.2 McGuire AFB Support Activities

To support the necessary field tests at McGuire AFB, the Base must be able to provide the following:

- a. Any digging permits and utility clearances that need to be obtained prior to the initiation of the fieldwork. Any underground utilities should be clearly marked to reduce the chance of utility damage and/or personal injury during soil gas probe and possible well installation. Battelle will not begin field operations without these clearances and permits.
- b. The Air Force will be responsible for obtaining Base and site clearance for the Battelle staff that will be working at the Base. The Base POC will be furnished with all necessary information on each staff member at least one week prior to field startup.
- c. Access to the local sanitary sewer must be furnished so that Battelle staff can discharge the bioslurper aqueous effluent directly to the Fort Dix Sewage Treatment Plant.
- d. Regulatory approval, if required, must be obtained by the Base POC prior to startup of the bioslurper pilot test. As stated previously, it is likely that a waiver or permit to allow air releases or a point source air release registration will be required for emissions of approximately 46 lb/day of TPH and <0.1 lb/day benzene without treatment (the air permit is provided in Appendix B). A waiver for pumping and discharging groundwater at a rate of 5 gpm may be required. The Base POC will obtain all necessary Base permits prior to mobilization to the site. Battelle will provide technical assistance in preparing regulatory approval documents.
- e. The Base also will be responsible for the disposition of all waste generated from the pilot testing. Such waste includes any soil cuttings generated from drilling, and all aqueous wastestreams produced from the bioslurper tests. All free product recovered from the bioslurper operation will be disposed of or recycled by the Base. Battelle will provide technical assistance in disposing of the waste generated from the bioslurper pilot test.
- f. Before field activities begin, the Health and Safety Plan will be finalized with information provided by the Base POC. Table 8 is a checklist for the information required to complete the Health and Safety Plan. All emergency information will be obtained by the Site Health and Safety office before operations begin.

6.3 AFCEE Activities

The AFCEE POC will act as a liaison between Battelle and McGuire AFB staff. The AFCEE POC will ensure that all necessary permits are obtained and the space required to house the bioslurper field equipment is found.

Table 8. Health and Safety Information Checklist

Emergency Contacts	Name	Telephone Number
Burlington County Hospital		(609) 267-0700
Fire Department	Emergency Switchboard	911/(609) 724-3151
Ambulance and Paramedics	Emergency Switchboard	911/(609) 724-4000
Police Department	Emergency Switchboard	911/(609) 724-2001
EPA Emergency Response Team	Switchboard	(800) 424-8802
Program Contacts		
Air Force	Patrick Haas	(210) 536-4314
Battelle	Jeff Kittel	(614)424-6122
	Eric Drescher	(614) 424-3088
McGuire AFB	King Mak	(609) 724-3323
Other		
Emergency Routes		
Hospital (maps provided in Appendix C)		
Other		

The following is a listing of Battelle, AFCEE, and McGuire AFB staff who can be contacted in case of emergency and/or for required technical support during the Bioslurper Initiative tests at McGuire AFB.

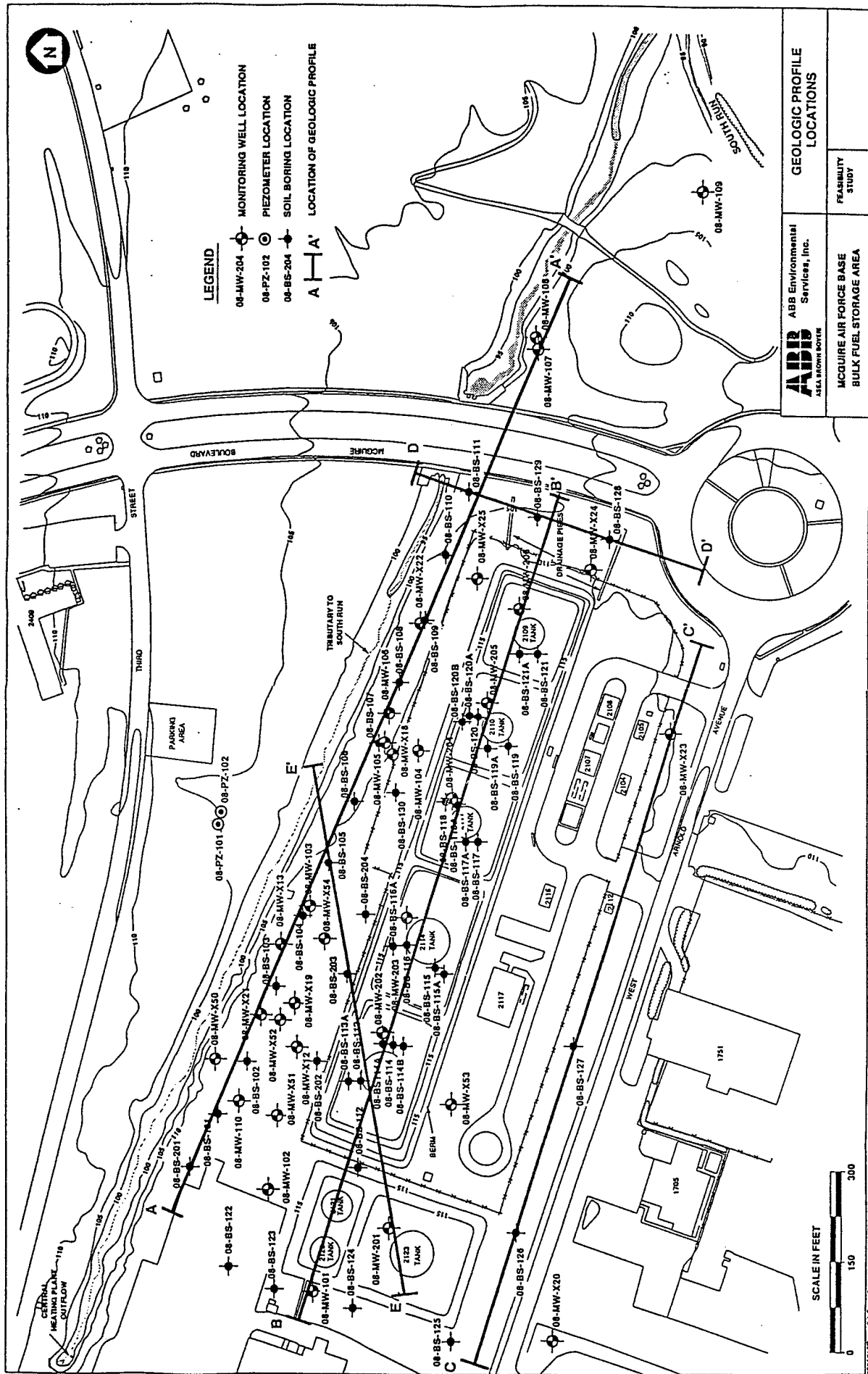
Battelle POCs	Jeff Kittel	(614) 424-6122
	Eric Drescher	(614) 424-3088
AFCEE POC	Patrick Haas	(210) 536-4314
McGuire AFB POC	King Mak/Sgt. Evans	(609) 724-3323
Regulatory POCs		

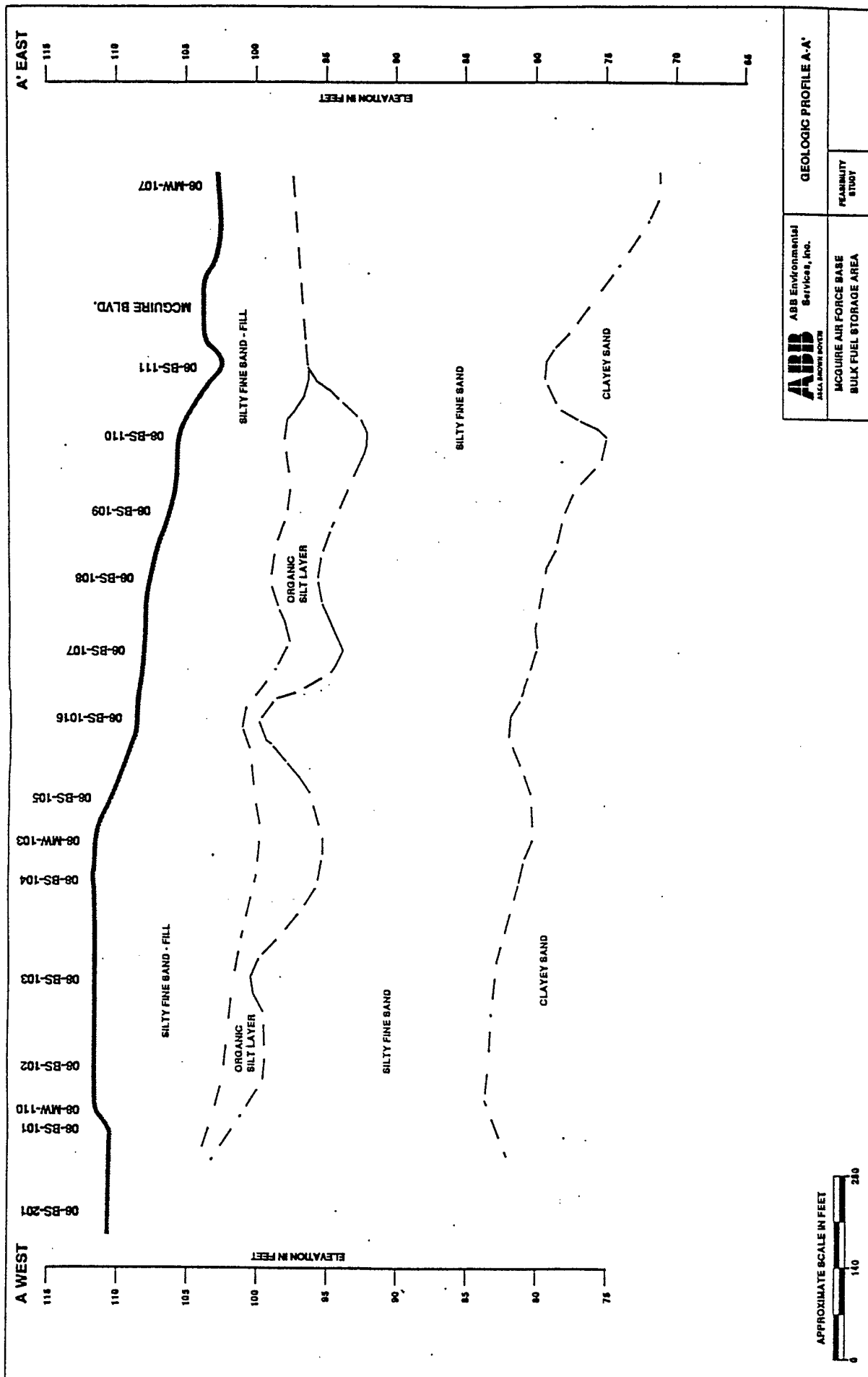
7.0 REFERENCE

Battelle. 1995. *Test Plan and Technical Protocol for Bioslurping*. Prepared by Battelle Columbus Operations for the U.S. Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas.

APPENDIX A

**GEOLOGIC CROSS-SECTIONAL PROFILES, GEOTECHNICAL DATA,
AND WELL INSTALLATION LOGS FOR THE BFS, MCGUIRE AFB, NJ**





B' EAST



B WEST

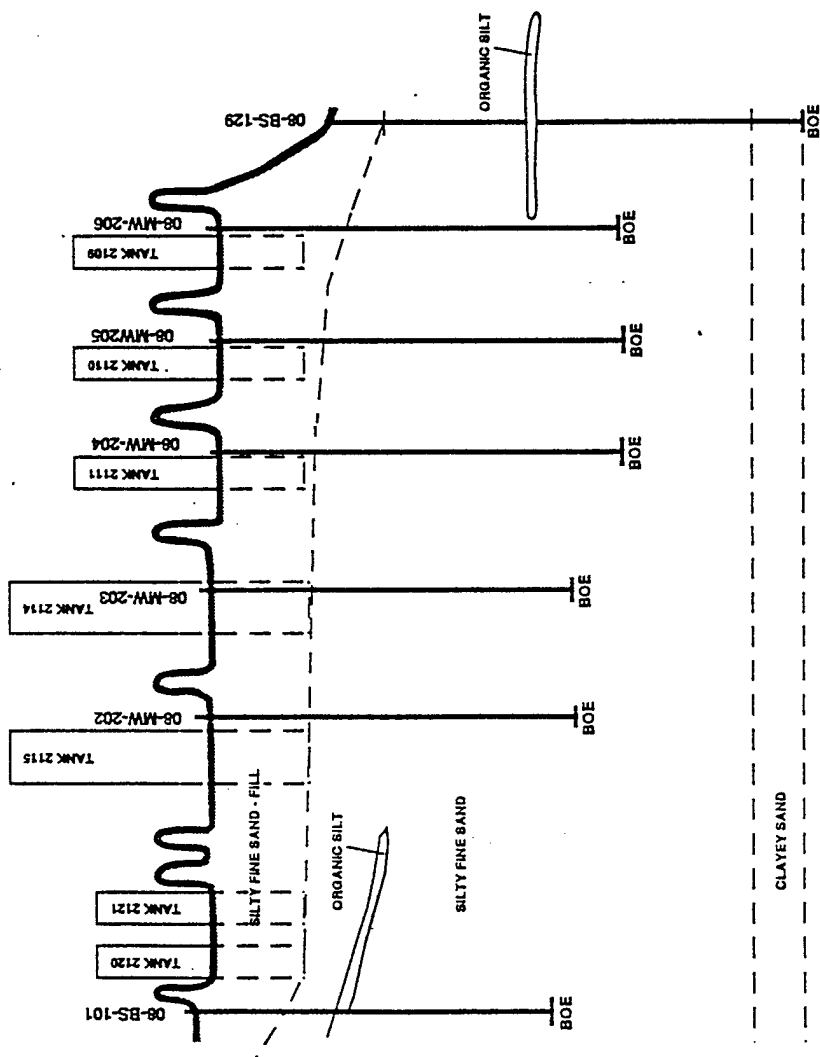
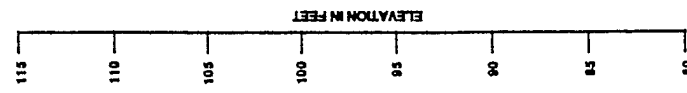
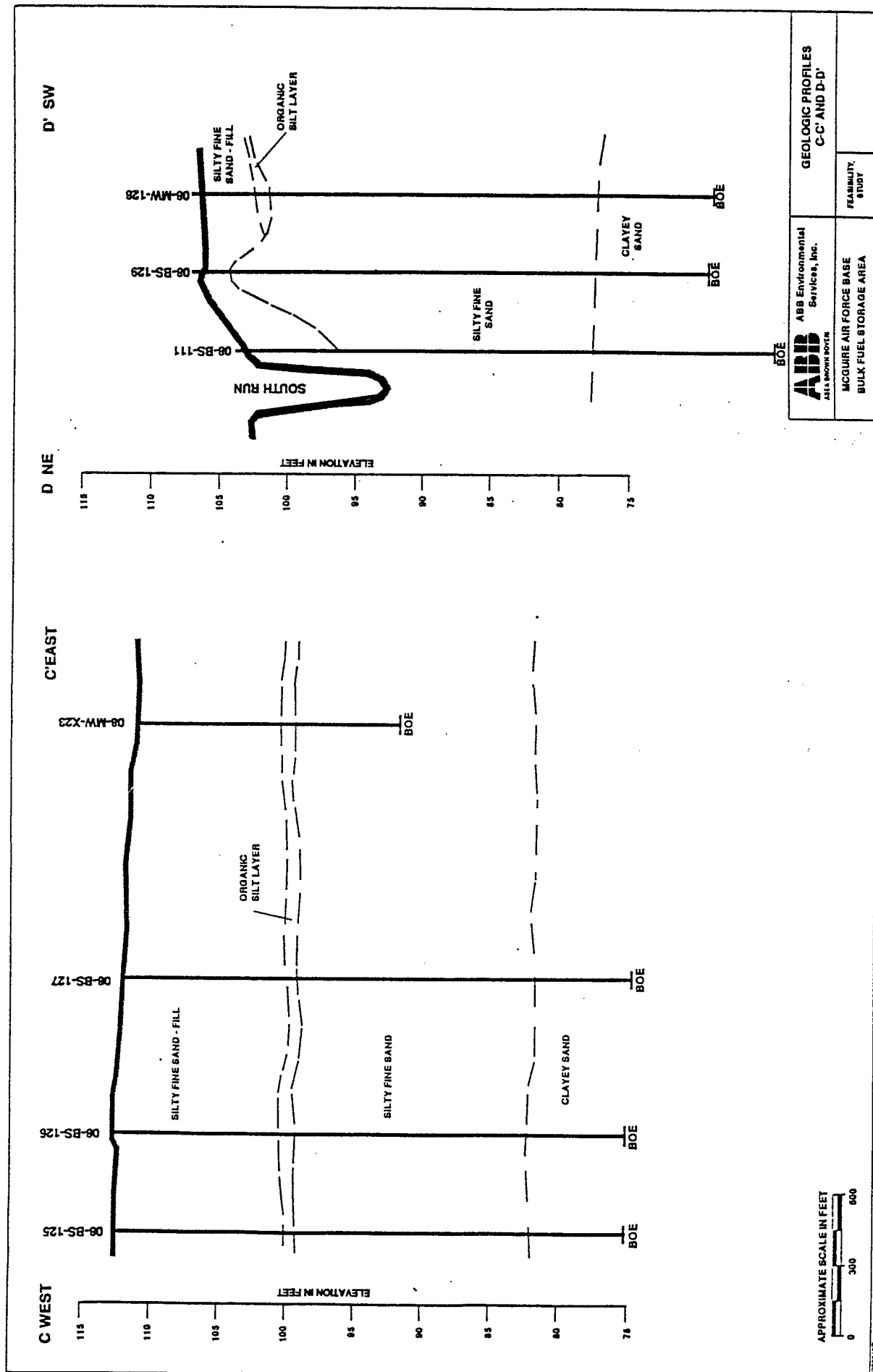
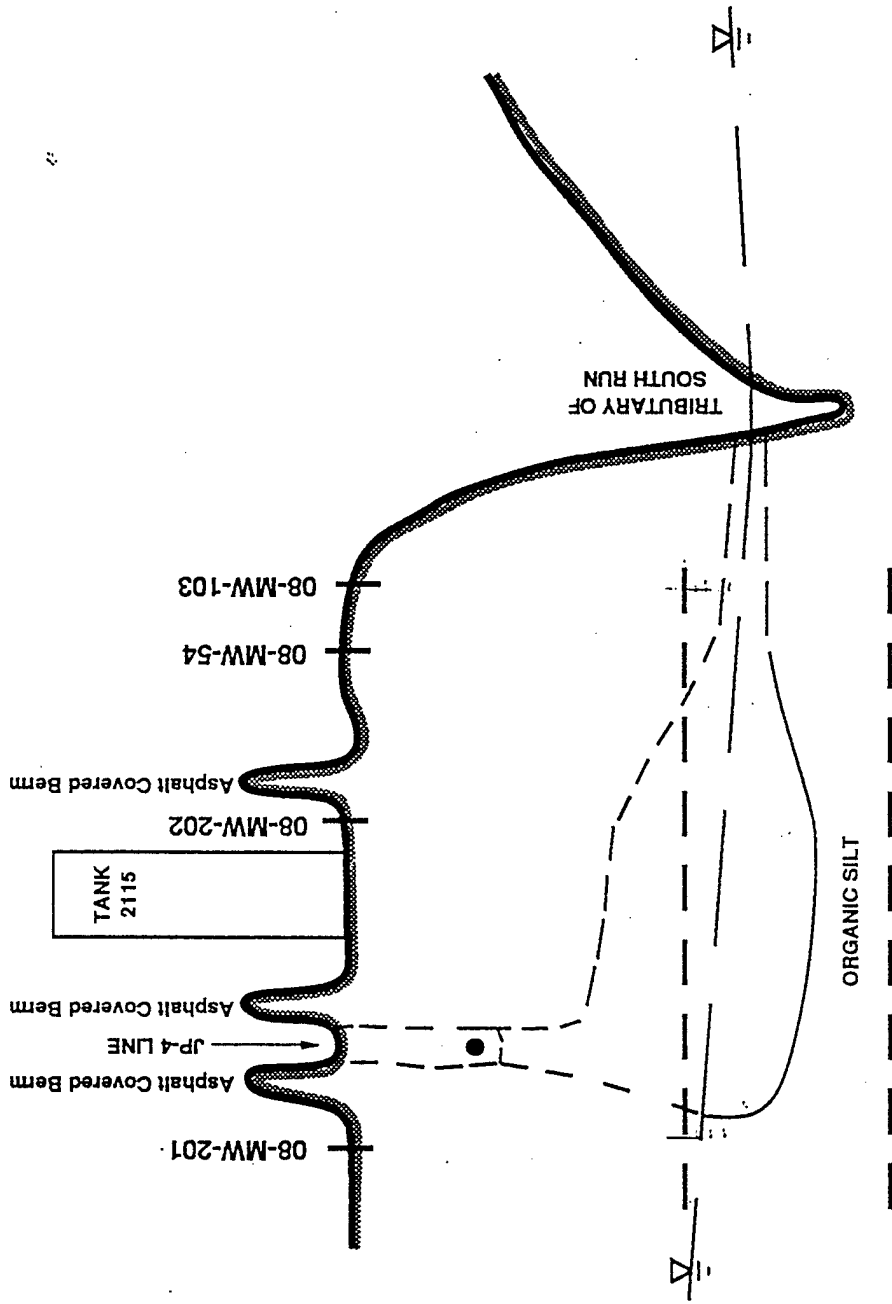
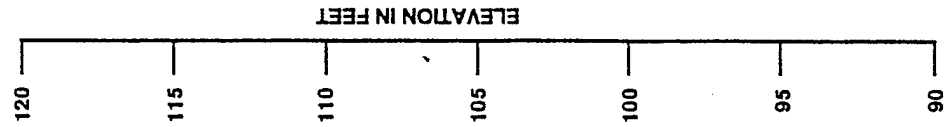


ABB Environmental Services

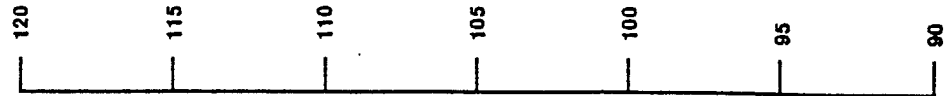
REF: DOIC PROFILE B-B'

APPROXIMATE SCALE IN FEET





ELEVATION IN FEET



GEOLOGIC PROFILE
E-E'

FEASIBILITY
STUDY

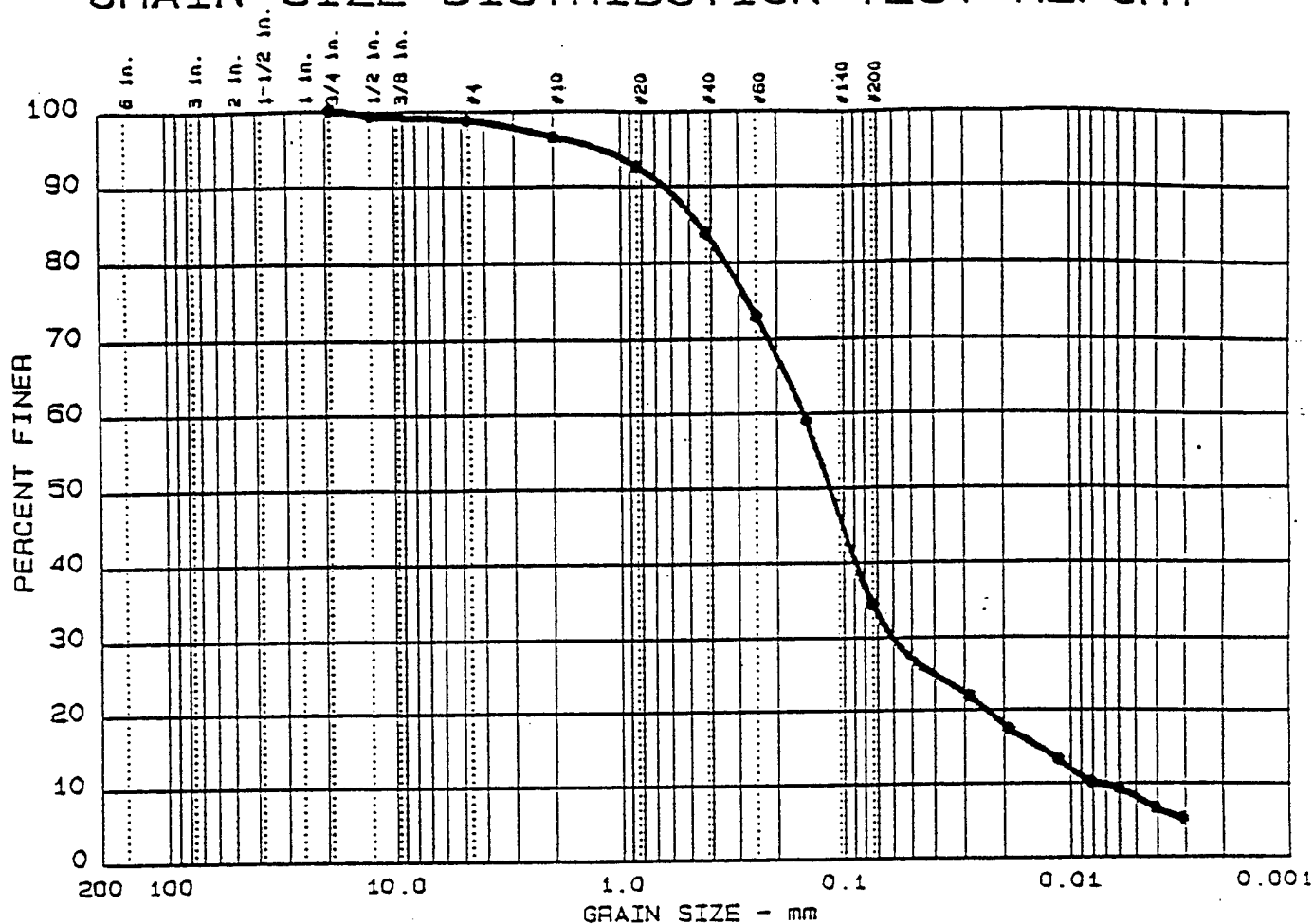
MCGUIRE AIR FORCE BASE
BULK FUEL STORAGE AREA

MCGUIRE AIRFORCE BASE
WRIGHTSTOWN, NEW JERSEY
SUMMARY OF UNIT WEIGHT DETERMINATIONS

LAB NO.	SAMPLE IDENTIFICATION	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	BULK (MOIST) DENSITY (pcf)
1209.001	08BS20100801XX	21.5	106.5	129.4
1209.002	08BS20100801XX	21.5	107.5	130.6
1209.003	08BS20400801XX	40.1	76.5	107.2
1209.004	08BS20400801XX	37.3 *	80.5	110.6
1230.001	04SD20100001XX	27.3	88.7	112.9
1230.002	04SD20200001XX	30.3	86.2	112.3
1230.003	04SD20300001XX	54.8	62.3	96.4
1230.004	04SD20100001XX	49.5	65.5	97.9
	g			

* MINOR LEAKAGE OF WATER PAST FOIL AND TAPE SEAL NOTED UPON RECEIPT OF SAMPLE. RESULTS MAY BE INFLUENCED BY MOISTURE LOSS.

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
3	0.0	1.3	64.4	26.2	8.1

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
		0.45	0.15	0.12	0.061	0.0141	0.0079	3.09	19.5

MATERIAL DESCRIPTION	USCS	AASHTO
BROWN SAND, Some Silt, tr clay & grvl, ORGANICS		

Project No.: G040.004
 Project: MCGUIRE AIR FORCE BASE
 Location: 04SD20300001XX

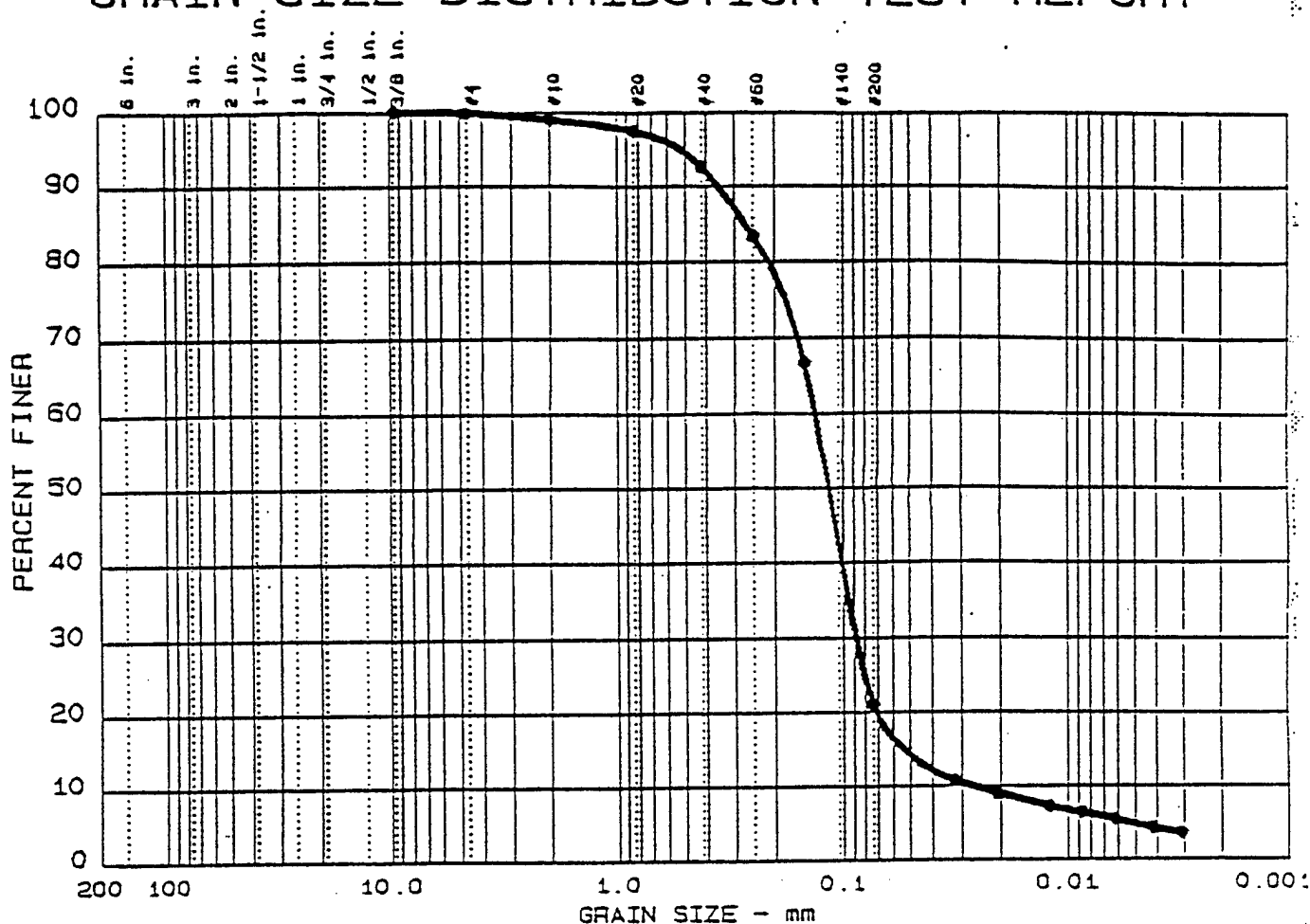
Date: MAY 21, 1992

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC

Remarks:
 CLIENT: ABB ENVIROMENTAL SERVICES
 WATER CONTENT: 49.3%
 LAB NO. 1230.003

Figure No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
4	0.0	0.2	78.7	16.3	4.8

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
		0.27	0.13	0.12	0.088	0.0531	0.0272	2.13	4.9

MATERIAL DESCRIPTION	USCS	AASHTO
BROWN SAND, Little Silt. tr clay & grvl. ORGNCS		

Project No.: G040.004

Project: MCGUIRE AIR FORCE BASE

Location: 08SD020100001XX

Date: MAY 21, 1992

Remarks:

CLIENT: ABB ENVIROMENTAL
SERVICES

WATER CONTENT: 50.0%

LAB NO. 1230.004

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC

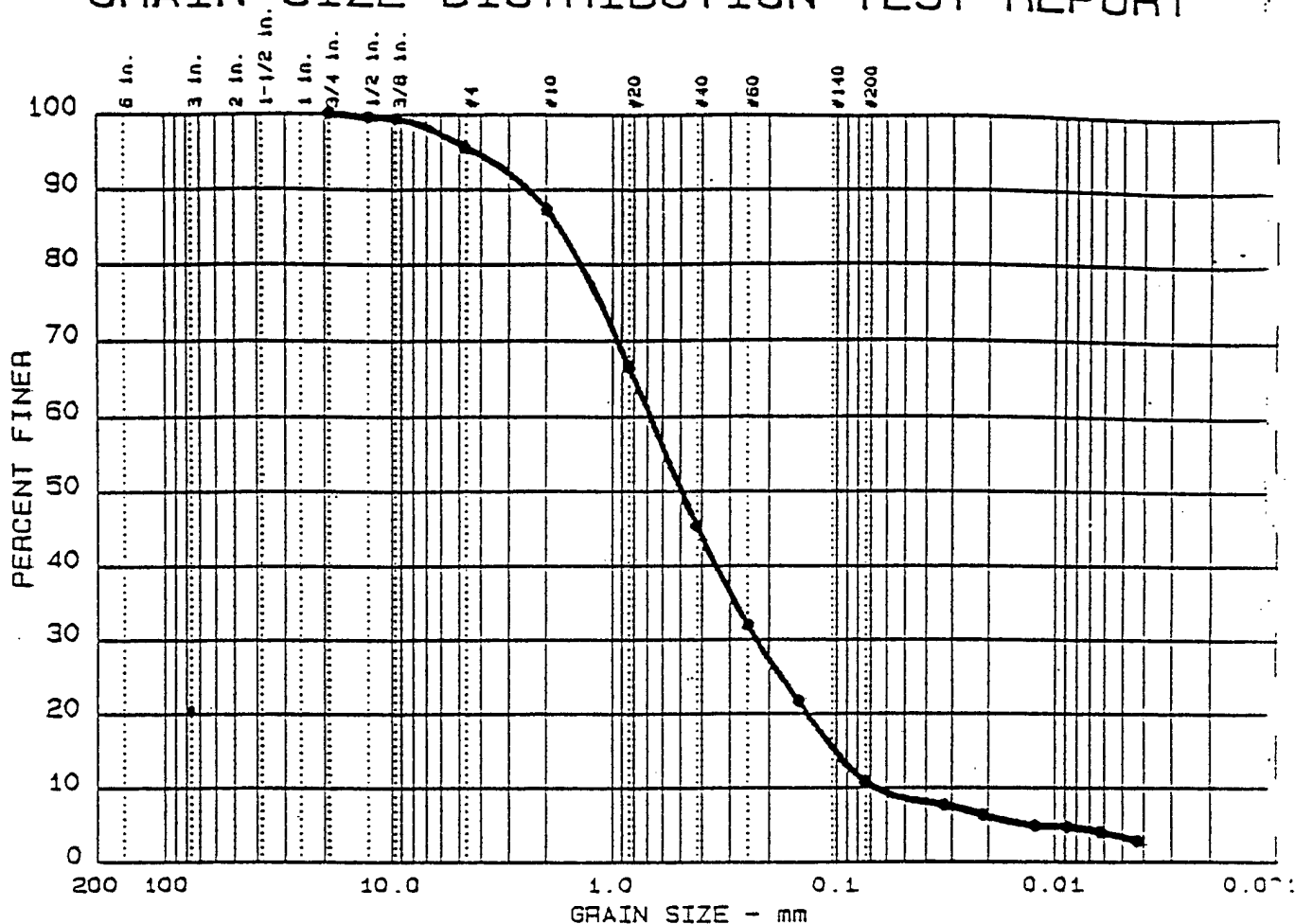
Figure No. 1

Grain size distribution plot showing Percent Finer versus Grain Size (mm). The curve indicates a well-graded material.

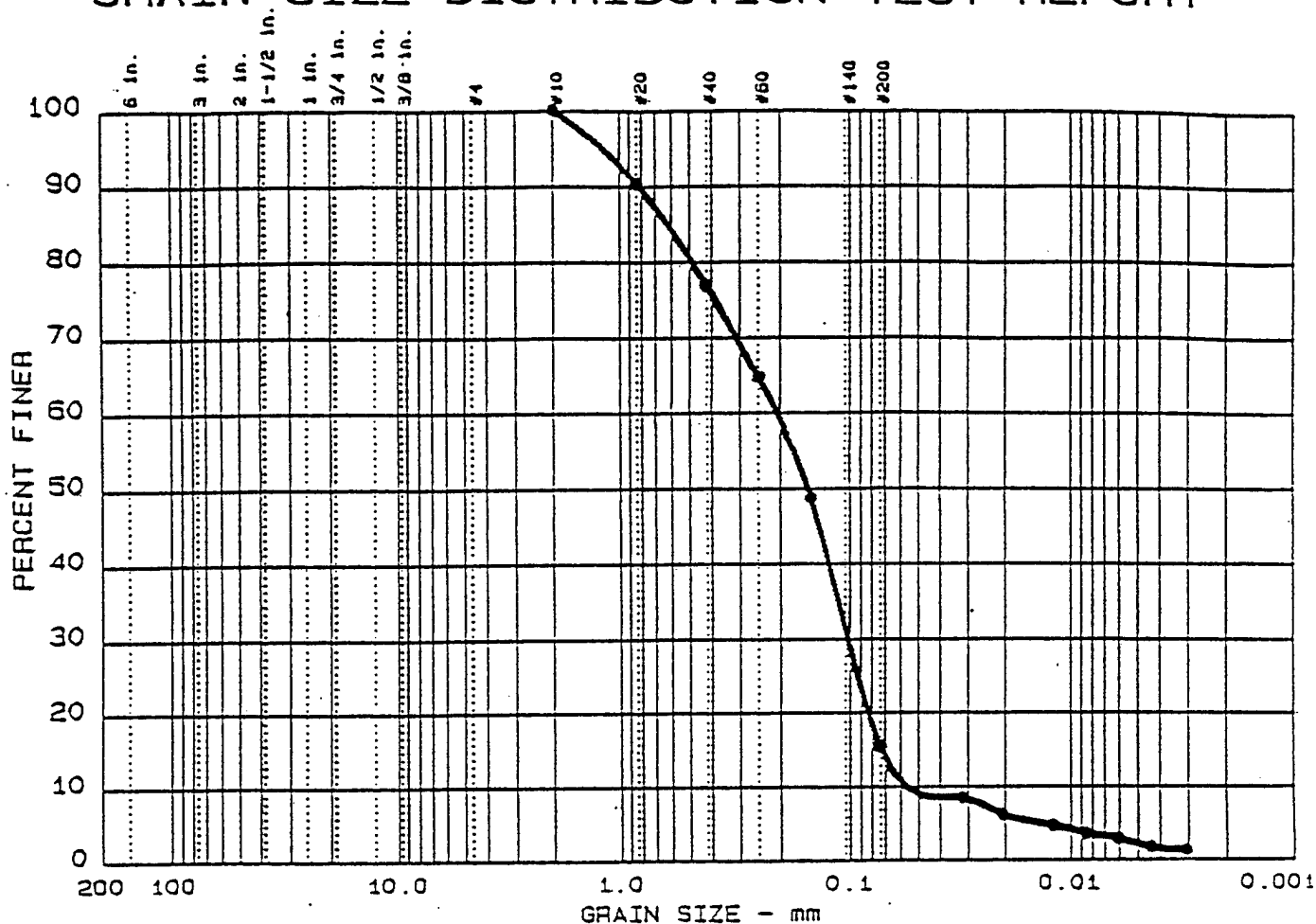
Grain Size (mm)	Percent Finer (%)
200	100
100	100
50	100
25	100
12.5	100
6.3	100
3.15	100
1.6	95
0.85	88
0.425	72
0.25	50
0.15	32
0.075	21
0.0475	13
0.025	8
0.015	6
0.0075	4
0.00475	3
0.0025	2

Project No.: G040.004 Project: MCGUIRE AIR FORCE BASE ◆ Location: 04SD20100001XX	Remarks: CLIENT: ABB ENVIRONMENTAL SERVICES WATER CONTENT: 22.3% LAB NO. 1230.001
Date: MAY 21, 1992	
GRAIN SIZE DISTRIBUTION TEST REPORT EMPIRE SOILS INVESTIGATIONS, INC	
	Figure No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



GRAIN SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
1	0.0	0.0	84.5	13.3	2.2

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
		0.62	0.21	0.15	0.102	0.0724	0.0569	0.89	3.6

MATERIAL DESCRIPTION	USCS	AASHTO
BLACK SAND. Little Silt, tr clay. ORGANICS		

Project No.: G040.004

Project: McGUIRE AIR FORCE BASE WRIGHTSTOWN NJ

Location: 08BS20100801XX

Date: APRIL 29, 1992

Remarks:

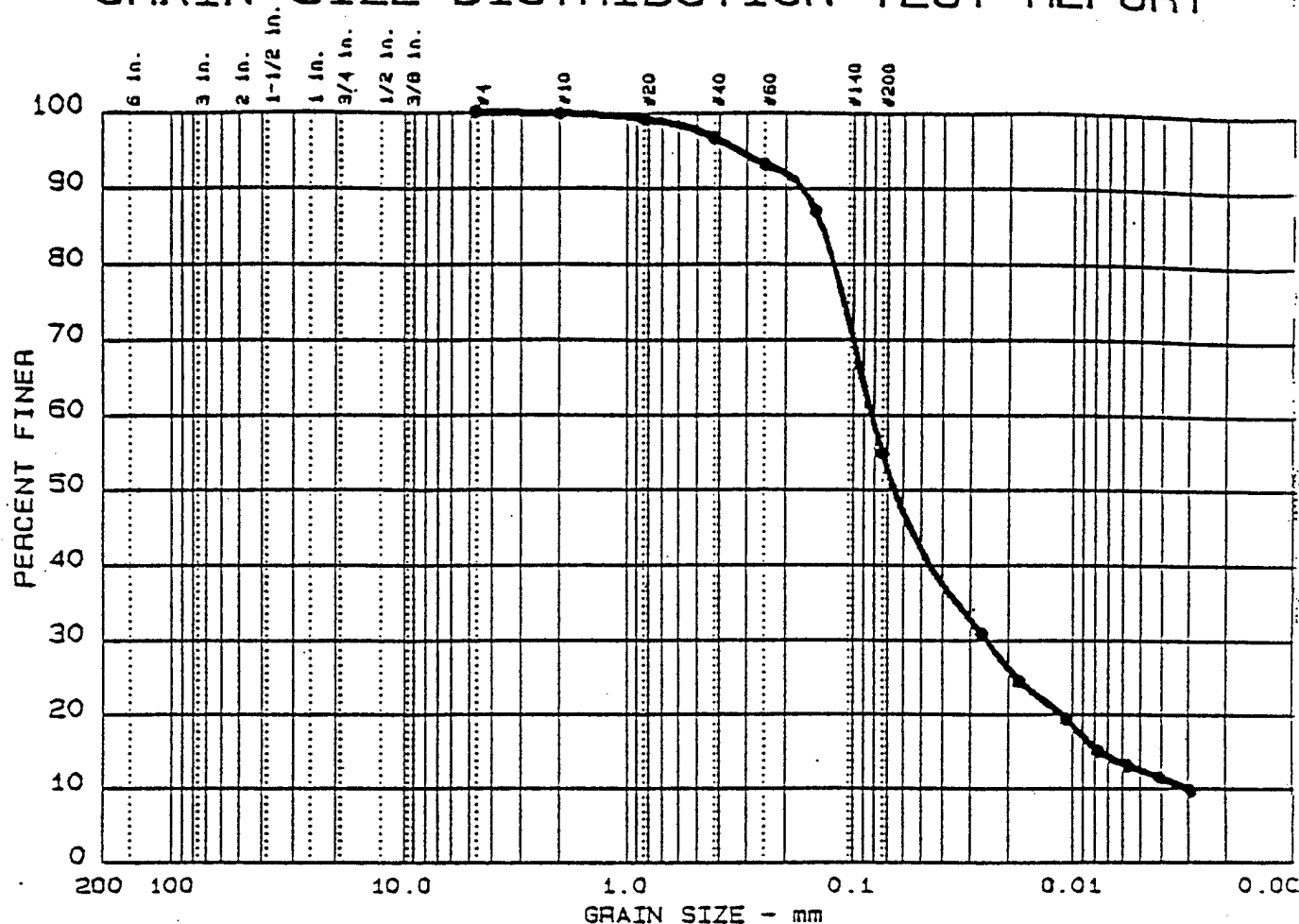
CLIENT: ABB ENVIRONMENTAL SERVICES, INC.

LAB NO. 1209.001

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC

Figure No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
2	0.0	0.0	45.2	42.4	12.4

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
		0.14	0.08	0.07	0.025	0.0076	0.0031	2.51	27.0

MATERIAL DESCRIPTION	USCS	AASHTO
◆ BROWN SAND AND SILT, Little Clay, ORGANICS		

Project No.: G040.004

Project: McGUIRE AIR FORCE BASE WRIGHTSTOWN NJ

◆ Location: 08BS20400801XX

Date: APRIL 29, 1992

Remarks:

CLIENT: ABB ENVIRONMENTAL SERVICES, INC.

LAB NO. 1209.003

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC

Figure No. 1

ABB ENVIRONMENTAL SERVICES, Inc.

08BS101

Project McGUIRE AIR FORCE BASE RI/FS			Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAp			Logged By NWH/CFR	Checked By	Ground Elev 111.32
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name STEVE KOVALESKY	Rig Type ATV	Start Date 01/10/91	Finish Date 01/12/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Casing Size N/A	Auger Size 4.25"
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 14.00 - 01/12/91		Piez. Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USGS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
5	S-1 1.8/2.0		8/10/33/24	43		0.0-1.3: Black organics, coal or degraded fuel.	ML		97.8	75.0		F
	S-2 1.8/2.0		10/20/22/28	42		1.3-2.0: Tan SILT; dry; medium dense.	SM		174.0	174.0		F
	S-3 1.8/2.0		12/12/25/70	37		2.0-2.5: Brown Silty fine SAND; some black organics; dry; dense.	SM		256.0	261.0		L
	S-4 2.0/2.0		6/6/50/50	56		2.5-4.0: Tan fine SAND; poorly graded; dry; medium dense.	GM		8.8	249.0		F
	S-5 0.6/1.6		20/12/10/8	22		Tan and gray to black fine SAND and SILT; heavily stained; top 0.6 foot very wet.	GM		337.0	171.0		L
18	S-6 1.3/2.0		12/16/16/18	32		6.0-8.4: Black SILT; heavily stained; Sandy Gravel; wet.	SM		40.0	243.0		F
	S-7 0.8/2.0		4/9/11/13	20		8.4-8.8: Black stained PEAT; some rootlets; dry.	SM		4.3	68.0		F
15	S-8 1.4/2.0		8/12/16/16	28		8.8-9.3: Black stained CLAY; little fine to medium Sand; dry.	SM		7.3	4.3		F
	S-8 1.5/2.0					Gray SILT and SAND; trace Gravel; trace organic matter; moist.						
						Gray Silty fine SAND; moist.						
						Similar to S-7; wet.						
28	S-9 1.5/2.0		6/6/8/16	14		Similar to S-8.	SM		0.6	2.6		F
25	S-10 2.0/2.0		10/13/16/16	29		25.0-26.3: Similar to S-8.	SC		BKG	2.9		F
						26.3-27.0: Green to gray Clayey fine to medium SAND; wet.						
38	S-11 2.0/2.0		10/12/16/18	28		Similar to S-10; white shell fragments.	SC		BKG	BKG		F
35	S-12 2.0/2.0		7/14/21/22	35		Similar to S-11.	SC	1	BKG	BKG		F
48						BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS102

Project

McGUIRE AIR FORCE BASE RI/FS

Site

McGUIRE AFB

Project

6622

Client

HAZWRAP

Logged By
SJC/BCM

Checked By

Ground

111.1

Drilling Contractor

MATHES OF NEW JERSEY

Driller's Name

MIKE LOGAN

Rig Type

D-50

Start Date

02/11/91

Finish

02/1

Drilling Method

Hollow Stem Auger

Protection Level

MOD. D

P.I.D. (eV)

10.2

Casing Size

N/A

Auger

4.25"

Soil Drilled (ft)

38.0

Rock Drilled (ft)

N/A

Ttl Depth (ft)

38.0

Depth to Water (ft)-Date

8.20 - 02/12/91

Piez. Boring

☐ ☒

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FEET)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM		
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL
0	S-1 1.7/2.0		18/21/30/22	51		0.0-0.3: TOPSOIL	SM		BKG	0.2	
1.7	S-2 1.7/2.0		12/21/18/24	39		0.3-1.0: Tan Silty fine to medium SAND; damp. 1.0-1.4: Black Coal Ash.	SM		BKG	0.2	
3.4	S-3 1.8/2.0		6/8/12/21	20		1.4-1.7: Brown Silty fine SAND; damp. Rust to olive-green Silty fine SAND; mottled; damp. Similar to S-2.	SM		BKG	0.2	
5.1	S-4 1.2/2.0		6/36/28/10	64		6.0-6.3: Brown fine SAND; trace coarse Sand; trace Silt; moist to wet.	SP		BKG	102.5	
6.3	S-5 0.7/2.0		5/10/6/3	16		6.3-6.6: Black Coal Ash in coarse SAND. 6.6-7.2: White to gray GRAVEL; angular; dry.	SW		BKG	262.0	
7.0	S-6 0.6/2.0		1/2/3/2	5		Black stained SAND; well graded; wet; loose. Brown Silty SAND; trace subrounded Gravel; trace roots; wet.	SM		BKG	144.9	
7.6	S-7 1.6/2.0		4/6/5/8	11		12.0-12.9: Black organic fine Silty SAND; damp; loose.	SM		BKG	4.5	
9.2	S-8 1.4/2.0		6/5/5/8	10		12.9-13.6: Gray fine Silty SAND; 1/4 inch Silt seam at 13.1 feet; wet; loose.	SM		BKG	1.5	
10.6	S-9 1.3/2.0		5/8/10/14	18		14.0-14.5: Gray SAND; trace coarse Gravel; well graded; wet; loose.	SM		BKG	157.4	
11.9						14.5-15.4: Dark gray Silty fine SAND; wet; dense. Similar to S-8.					
15.0	S-10 1.4/2.0		5/7/7/8	14		Similar to S-8.	SM		BKG	1.5	
16.4	S-11 0.9/2.0		3/6/8	14		Similar to S-8.	SM		BKG	0.8	
17.3	S-12 1.5/2.0		5/4/7	11		Dark gray medium to fine Clayey SAND; trace Silt; shell fragments; wet.	SC		BKG	1.7	
18.8	S-13		5/7/11/17	18		Similar to S-12; some cemented Sand grains to 3/4 inch; wet.	SC	1	BKG	1.4	
38.0						BOTTOM OF EXPLORATION AT 38.0 FEET NOTES: 1. Boring backfilled with high solids bentonite grout.					

ABB ENVIRONMENTAL SERVICES, Inc.						08BS103						
Project McGUIRE AIR FORCE BASE RI/FS						Site McGUIRE AFB		Project No. 6623-04				
Client HAZWRAP						Logged By SJC		Checked By Ground Elev 111.90				
Drilling Contractor MATHES OF NEW JERSEY				Driller's Name MIKE LOGAN		Rig Type D-50		Start Date 02/10/91				
Drilling Method Hollow Stem Auger				Protection Level MOD. D		P.I.D. (eV) 10.2		Casing Size N/A				
Soil Drilled (ft) 37.0		Rock Drilled (ft) N/A		Ttl Depth (ft) 37.0		Depth to Water (ft)-Date 11.60 - 02/10/91		Piez. Boring Well ☐ ☒ ☐				
DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
5	S-1 1.5/2.0		6/18/23/29	41		0.0-1.0: Tan fine SAND; some Silt; roots; damp. 1.0-2.3: Black Coal Ash.	SM		BKG	1.0		L F
	S-2 1.2/2.0		16/19/27/37	46		2.3-2.6: Rust to red fine to medium SAND; cemented; damp.	SP-SM		BKG	0.5		
	S-3 1.6/2.0		10/12/21/28	33		2.6-9.5: Green to brown to black Silty fine SAND; moist.	SM		BKG	0.8		F
	S-4 2.0/1.6		20/18/18/19	36			SM		BKG	2.6		
	S-5 1.5/1.5		9/6/6	12			SM		BKG	0.5		L F
15	S-6 1.8/2.0		12/11/11/11	22		11.0-12.3: Olive-green to black Silty fine SAND; some wood; damp.	SM		BKG	2.1		L F F
	S-7 1.5/1.5		6/9/11	20		12.3-12.8: Black organic SILT; some roots; moist.	SM		BKG	0.5		F
	S-8 1.5/1.5		19/23/26	49		Gray Silty fine SAND; wet; layers of brown organic Silt from 13.5 to 13.8 feet and 14.1 to 14.5 feet. Similar to S-7; Silt layer from 14.8 to 15.4 feet.	SM		BKG	13.1		
20	S-9 1.5/1.5		6/9/12	21		Dark gray Silty fine SAND; trace medium Sand; dilatant; wet.	SM		BKG	0.3		L
25	S-10 1.5/1.5		6/9/14	23		Dark brown fine Sandy SILT; wet.	ML		BKG	0.8		F
30	S-11 2.0/2.0		4/6/7/9	13		Green to gray fine to medium Clayey SAND; some shell fragments; wet.	SC		BKG	0.2		
35	S-12 2.0/2.0		10/12/21/14	33		Similar to S-11.	SC	1	BKG	0.4		L F
40	BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Boring backfilled with high solids bentonite grout.											

ABB ENVIRONMENTAL SERVICES, Inc.

08BS104

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04
Client HAZWAP		Logged By SJC	Checked By	Ground Elev 112.23
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 02/09/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Finish Date 02/09/91
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 7.00 - 02/09/91	Piez. Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC./RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
0	S-1		2/6/6/8	12		0.0-0.5: TOPSOIL	SM		BKG	0.1		
1.2/2.0	S-2		6/12/17/20	29		0.5-2.3: Black Coal Ash.	SM		BKG	0.1		
1.4/2.0	S-3		12/17/10/11	27		2.3-3.4: Green to brown rusty Silty fine SAND; damp.	SM		BKG	0.1		
1.7/2.0	S-4		6/8/5/4	13		Similar to S-2; layer coal ash 4.0 to 4.2 feet.	SM		BKG	0.1		
1.5/2.0	S-5		2/4/4/10	8		Tan, green to black Silty fine SAND; moist.	SM		BKG	0.3		
1.3/2.0	S-6					Similar to S-4; fuel odor.	SM		BKG	153.5		
0.4/1.5	S-7		22/25/22/33	47		Brown to black Silty fine SAND; wood fragments; moist; fuel odor; coal ash layer at 10.0 to 10.1 feet.	SM		BKG	306.0		
0.4/2.0	S-8		19/23/36	59		11.5-15.3: Black oily WOOD and fine SAND; wet; fuel odor.	SM		BKG	511.0		
1.0/1.5	S-9		17/20/13	33			SM		BKG	500.0		
1.2/1.5						15.3-16.2: Gray Silty fine SAND; wet; strong fuel odor.	SM		BKG	497.0		
2.0	S-10		17/23/35	58			SM		BKG	447.0		
1.5/1.5						Dark gray Silty fine SAND; dilatant; wet; strong fuel odor.	SM		BKG	447.0		
2.5	S-11		4/8/9	17			SM		BKG	511.0		
1.5/1.5						Similar to S-10.	SM		BKG	511.0		
3.0	S-12		9/11/13/13	24			SC		BKG	521.0		
2.0/2.0						30.0-30.5: Similar to S-10.	SC		BKG	521.0		
						30.5-32.0: Green fine to medium Clayey SAND; some fossil fragments; wet.	SC		BKG	521.0		
3.5	S-13		5/5/19/20	24			SC		BKG	491.0		
2.0/2.0						Similar to S-12.	SC	1	BKG	491.0		
4.0						BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS105

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04	
Client HAZWRAp		Logged By SJC		Checked By Ground Elev 110.73	
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN		Rig Type D-50	
Drilling Method Hollow Stem Auger		Protection Level MOD. D		Start Date 02/08/91	
Soil Drilled (ft) 37.0		Rock Drilled (ft) N/A		Finish Date 02/08/91	
Ttl Depth (ft) 37.0		Depth to Water (ft)-Date 12.70 - 02/08/91		Auger Size 4.25"	
				Piez. Boring Well ☐ ☒ ☐	

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE WELL	DIAGRAM	LAB TESTS
0	S-1 1.7/2.0		3/5/5/10	10		0.0-0.2: TOPSOIL					BKG	0.1		
0.2	S-2 1.3/2.0		10/12/26/23	38		0.2-1.3: Coal Ash; Silt seam at 0.8 foot.	SM				BKG	0.1		
1.3	S-3 1.5/2.0		10/9/11/12	20		1.3-2.8: Orange Silty fine SAND; iron staining; layer of coal ash at 2.0 to 2.2 feet.	SM				BKG	0.6		L
2.8	S-4 1.2/1.6		9/12/13/16	25		2.8-8.3: Olive-green Silty fine SAND; damp; layer of black organic Silt at 6.2 to 6.4 feet.	SM				BKG	0.3		
8.3	S-5 1.3/2.0		4/5/4/7	9		8.3-12.7: Olive-green to brown to black organic SILT; some wood; roots; fine Sand laminae.	SM				BKG	1.0		
12.7	S-6 2.0/2.0		4/7/7/10	14			SM				BKG	0.1		L
15.0	S-7 1.5/2.0		10/35/47	82		12.7-15.0: Gray fine-Silty SAND; some black organic Silt with wood; wet.	SM				BKG	0.1		L
15.0	S-8 1.0/2.0		1/4/15	19			SM				BKG	9.0		
28.0	S-9 1.5/1.5		18/25/33	58		Dark gray Silty fine SAND; wet.	SM				BKG	0.3		F
25.0	S-10 1.5/1.5		18/25/33	58		Similar to S-9; Silt laminae.	SM				BKG	0.3		
30.0	S-11 1.5/1.5		9/12/13/16	25		30.0-30.5: Dark brown SILT; some fine Sand; wet.	SC				BKG	0.1		F
30.5						30.5-32.0: Green fine to medium Clayey SAND; fossiliferous.								
35.0	S-12 2.0/2.0		9/11/14/204	25		Similar to S-11.	SC	1			BKG	0.3		L
48.0						BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Boring backfilled with high solids bentonite grout.								

ABB ENVIRONMENTAL SERVICES, Inc.

08BS106

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAp		Logged By SJC	Checked By	Ground Elev 109.12
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 02/08/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Finish Date 02/08/91
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 10.40 - 02/08/91	Piez. Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. RPM			DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL		
0.0-0.3	S-1 1.5/2.0		9/12/16/20	28		TOPSOIL	SM		BKG	0.1			F
0.3-1.5	S-2 1.5/2.0		1/7/23/23	30		Tan to green Silty fine SAND; mottled; trace Gravel; black laminae; damp; fuel odor.	SM		BKG	0.6			F
1.5-2.0	S-3 1.4/2.0		10/11/19/21	30		2.0-8.2: Green Silty fine SAND; trace medium Sand; damp; fuel odor.	SM		BKG	2.0			F
8.2-9.0	S-4 1.4/2.0		11/14/14/23	28			SM		29.4	BKG			F
9.0-12.5	S-5 1.6/2.0		9/13/29/30	42		Black to brown SILT; little fine Sand; damp.	SM		BKG	0.1			F
12.5-15.2	S-6 1.5/1.5		1/5/5	10		Gray Silty fine SAND; trace medium Sand; wet.	SM		BKG	0.3			F
15.2-16.0	S-7 1.5/1.5		13/20/27	47			SM		BKG	0.6			F
26.0-27.0	S-8 1.5/1.5		3/5/6	11		Gray SAND; well graded.	SP		BKG	0.3			L
27.0-28.0	S-9 1.5/1.5		14/20/35	55			SM		BKG	0.3			L
28.0-29.0	S-10 1.5/1.5		9/12/16	28		Brown SILT; little fine Sand; trace Clay; wet.	OL		BKG	0.1			
29.0-30.0	S-11 2.0/2.0		5/5/10/17	15		25.0-26.0: Similar to S-10.	SC		BKG	0.3			
30.0-31.0						26.0-27.0: Green fine Clayey SAND; little medium Sand; fossiliferous.							
31.0-32.0	S-12 2.0/2.0		10/12/14/20	26		Similar to S-11; little Silt.	SC		BKG	0.1			
32.0-33.0	S-13 2.0/2.0		9/12/15/19	27		Similar to S-12.	SC	1	BKG	0.1			L
BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: L. Boring backfilled with high solids bentonite grout.													

ABB ENVIRONMENTAL SERVICES, Inc.

08BS107

Project McGUIRE AIR FORCE BASE RI/FS			Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAp			Logged By CEO	Checked By	Ground Elev 108.60
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 02/07/91	Finish Date 02/07/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Casing Size N/A	Auger Size 4.25"
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 13.00 - 02/07/91		
			Piez. Boring Well ☐ ☒ ☐		

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPH		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
	S-1		12/12/16/22	28		Brown Silty fine SAND; black laminae throughout.	SM	1	115.0	334.0		F
	S-2		12/21/25/40	46		2.0-2.3: Black oil stained SAND; well graded; wet.	SP		8.4	195.9		L
5	S-3		23/15/15/22	30		2.3-10.7: Green to tan to black Silty fine SAND; mottled; trace medium Sand; Gravel layer at 4.0 to 4.3 feet; black laminae; moist.	SM		1.6	9.3		F
	S-4		16/24/23/24	47			SM		BKG	2.3		F
	S-5		10/12/7/12	19			SM		BKG	2.0		
18	S-6		6/7/7	14		10.7-14.5: Layers of green Silty fine SAND and black organic SILT with roots and wood; layers	SM		3.2	131.0		L
	S-7		3/4/16	20		approximately 0.3 to 0.7 foot thick; wet below 13.0 feet.	OL		3.2	19.3		L
	S-8		13/20/28	48			SM		BKG	0.6		F
15	S-9		3/5/8	13		Tan to gray Silty fine SAND; trace medium Sand; wet.	SM		BKG	0.3		
20	S-10		3/6/8/9	14		Gray SAND; well graded; trace Gravel; wet.	SP		BKG	0.8		
25	S-11		16/19/30/40	49		25.0-25.9: Brown to light gray Silty fine SAND; little- medium Sand; trace coarse Sand; wet.	SM		BKG	1.0		F
						25.9-27.0: Dark green to black Clayey fine SAND; trace medium Sand; wet.						
38	S-12		9/16/22/30	38		Light green Clayey fine SAND; fossiliferous; wet.	SC			0.1		
35	S-13		10/14/20/29	34		Similar to S-12.	SC	2	BKG	BKG		L F
48						BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Recovery/penetration not recorded. 2. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS108

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04
Client HAZWARP		Logged By SJC	Checked By	Ground Elev 108.10
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 02/07/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Finish Date 02/07/91
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 10.00 - 02/07/91	Piez. Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT.)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D.		DIAGRAM	LAB TESTS
									P. I. METER FIELD SCAN	P. I. METER HEAD SPACE WELL		
	S-1		4/9/13/16	22		0.0-0.4: TOPSOIL	SM		BKG	BKG		
	S-2		6/13/26/26	39		0.4-10.8: Brown to green Silty fine SAND; trace medium and coarse Sand; black laminae; Silt layers; Sand layers; damp; fuel odor.	SM	1	2.4	7.4		
5	S-3		12/12/12/18	24			SM		2.4	12.6		
	S-4		14/19/21/29	40			SM		0.8	0.8		L
	S-5		2/3/4/4	7			SM		BKG	0.3		F
10	S-6		1/4/4/10	8		10.8-15.5: Layers of gray Silty fine SAND and black organic SILT 0.2 to 1.7 feet thick.	SM		BKG	0.6		L
	S-7		7/8/8/10	16			OL		BKG	0.3		F
15	S-8		7/11/12/15	23			SM		BKG	0.3		
20	S-9		9/11/12/12	23		Brown SILT; some fine to medium Sand; damp.	ML		BKG	0.3		
25	S-10		1/3/7/7	10		25.0-25.4: Similar to S-9. 25.4-27.0: Dark green Silty fine SAND; little medium Sandy brown Silt laminae throughout.	SM		BKG	0.1		
30	S-11		14/17/18/22	35		Green to gray fine to medium Clayey SAND; some Silt; fossiliferous clusters of calcified Sand.	SC		BKG	0.3		
35	S-12		13/18/26/33	44		Similar to S-11.	SC	2	BKG	0.1		L
40						BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Recovery/penetration not recorded. 2. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS109

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAp		Logged By SJC	Checked By	Ground Elev 106.86
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 02/04/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Finish Date 02/04/91
Soil Drilled (ft) 37.0		Rock Drilled (ft) N/A	Ttl. Depth (ft) 37.0	Depth to Water (ft)-Date 11.70 - 02/04/91
		Piez. Boring Well ☐ ☒ ☐		

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM			DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL		
	S-1		6/10/20	30		0.0-1.0: TOPSOIL	SM	1	BKG	23.3			L
	S-2		18/20/24	44		1.0-8.5: Olive-green to dark brown Silty fine SAND.	SM		BKG	21.3			F
	S-3		9/15/19/19	34			SM		BKG	9.5			
5	S-4		9/14/15/14	29			SM		0.9	6.1			L
	S-5		4/8/8/8	16			SM		0.3	3.0			F
10	S-6		6/8/13/17	21		8.5-14.5: Layers of gray Silty fine SAND and black organic SILT; rootlets and bioturbation; wet below 12.0 feet.	OL		BKG	1.1			L
	S-7		11/8/14	22			SM		BKG	1.1			L
	S-8		12/18/14/12	32			OL		BKG	0.7			
15													
20													
25	S-9		4/6/8	10		Dark brown to light gray Silty fine SAND; some roots and bark.	SM		BKG	0.7			
28													
30	S-10		3/8/8/8	16		Black fine SAND; some medium Clayey Sand; some Silt; trace roots; wet.	SC		BKG	0.7			
32													
35	S-11		6/15/18/21	33		Green to dark green fossiliferous fine to medium SAND; wet.	SC		BKG	0.7			
38													
40	S-12		1/13/17/21	30		Similar to S-11.	SC	2	BKG	0.7			
42													
45													
48						BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Penetration/recovery not recorded. 2. Boring backfilled with high solids bentonite grout.							

ABB ENVIRONMENTAL SERVICES, Inc.

08BS110

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No: 6623-04
Client HAZWRAP		Logged By BBJ	Checked By	Ground Elev 106.07
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 01/29/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Finish Date 01/29/91
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 8.40 - 01/29/91	Piez. Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D.		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
0	S-1 1.8/2.0		10/21/35/35	56		0.0-0.2: TOPSOIL	SM	1		0.6		
2	S-2 1.7/2.0		10/12/21/23	33		0.2-8.6: Tan to black stained Silty fine SAND; trace medium to coarse Sand; Gravel layer at 1.2 to 2.0 feet; wood fragments at 0.9, 2.0, and 7.5 feet; moist.	SM			2.8		
4	S-3 1.9/2.0		10/14/18/21	32			SM			0.0		
6	S-4 2.0/2.0		13/15/10/9	25			SM			0.9		
8	S-5 1.5/1.5		3/6/12	18			SM			2.0		
10	S-6 1.5/1.5		3/5/10	15		8.6-15.0: Layered brown SILT with sticks and roots; brown to black stained Silty fine SAND.	SM			0.4		
12	S-7 1.6/2.0		4/4/4/8	8			OL			1.2		
14	S-8 2.0/2.0		3/3/4/5	7			SM			0.9		
20	S-9 1.8/2.0		7/7/9/15	16		Brown SAND; well graded; some fine Gravel; brown organic Silt in bottom of spoon; wet.	SP			BKG		
25	S-10 2.0/2.0		12/16/17/22	33		Green to black Clayey fine SAND; little medium Sand; wet.	SC			BKG		
30	S-11 2.0/2.0		9/11/12/22	23		30.0-31.1: Similar to S-10. 31.1-32.0: Light green Clayey fine SAND; moist; very stiff.	SC			BKG		
35	S-12 2.0/2.0		12/18/27/30	46		Similar to S-11 (31.1-32.0); fossiliferous.	SC	2		BKG		
40						BOTTOM OF EXPLORATION AT 37.0 FEET						
						NOTES: 1. PI field scan not recorded. 2. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS111

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04	
Client HAZWRAP		Logged By SJC		Checked By Ground Elev 103.04	
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN		Rig Type D-50	
Drilling Method Hollow Stem Auger		Protection Level MOD. D		Start Date 01/15/91	
Soil Drilled (ft) 37.0		Rock Drilled (ft) N/A		Ttl Depth (ft) 37.0	
		Depth to Water (ft)-Date 7.50 - 01/15/91		Piez. Boring Well ☐ ☒ ☐	

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.T.D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE WELL	DIAGRAM	LAB TESTS
5	S-1 1.0/2.0		5/10/21/35	31		Brown SAND; well graded; moist.	SP				BKG	BKG		L
	S-2 0.0/2.0		3/7/9/16	16		No Recovery	SP				BKG	BKG		
	S-3 0.3/2.0		4/4/6/4	10		Brown SAND; well graded; moist.	SP				BKG	BKG		
	S-4 0.0/2.0		5/9/8/10	17		6.0-16.0: Layers of dark brown organic SILT and brown to gray Silty fine SAND; wet below 7.5 feet.	OL				BKG	0.4		L
	S-5 1.0/2.0		5/5/9	14			SM				BKG	0.4		F
10	S-6 1.5/2.0		17/28/15	43			SM				BKG	0.4		
	S-7 1.5/1.5		17/28/15	43			SM				BKG	0.4		F
15	S-8 2.0/2.0		4/7/10/7	17			SM				BKG	1.2		L
20	S-9 2.0/2.0		3/7/10/10	17		20.0-21.0: Brown to gray Silty fine SAND; wet. 21.0-22.0: Dark green Clayey fine SAND; damp.	SC				BKG	0.8		
25	S-10		10/25/28/28	53		Dark green Clayey fine SAND; shell fragments; dense.	SC				BKG	BKG		
30	S-11		15/25/27/22	52		Light green Clayey fine SAND; trace medium Sand; shell fragments.	SC				BKG	BKG		
35	S-12		14/28/28/36	56		Similar to S-11.	SC	1			BKG	BKG		L
40						BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Boring backfilled with high solids bentonite grout.								

ABB ENVIRONMENTAL SERVICES, Inc.

08BS112

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04	
Client HAZWRAP		Logged By SJC		Checked By Ground Elev 113.02	
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN		Rig Type D-50	
Drilling Method Hollow Stem Auger		Protection Level MOD. D		Start Date 02/11/91	
Soil Drilled (ft) 27.0		Rock Drilled (ft) N/A		Ttl Depth (ft) 27.0	
				Depth to Water (ft)-Date 9.00 - 02/11/91	
				Piez. Boring Well ☐ ☒ ☐	

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM			DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL		
0	S-1 1.6/2.0		4/6/10/14	16		0.0-0.3: TOPSOIL	SM		BKG	10.2			F
1.5	S-2 1.5/2.0		10/12/15/18	27		0.3-0.8: Brown Silty fine SAND.	SM		BKG	13.7			L
3.0	S-3 1.7/2.0		4/14/14/14	28		0.8-1.1: Coal Ash.	SM		BKG	2.8			L
4.5	S-4 1.4/2.0		4/7/8/10	15		1.1-1.6: Rust to olive-green Silty fine SAND; mottled.	SM		BKG	3.0			
6.0	S-5 1.2/2.0		3/4/3/6	7		2.0-2.5: Black Coal Ash and gray fine SAND.	SM		BKG	1.0			
7.5	S-6 0.9/1.5		3/11/11	22		2.5-12.3: Light gray to green to brown to stained black Silty fine SAND; some Silt laminae; wet below 9.0 feet.	SM		BKG	1.2			
9.0	S-7 1.5/1.5		24/33/34	67			SM		BKG	0.7			
10.5	S-8 2.0/2.0		21/33/35/33	68		12.3-12.4: Black organic SILT.	SM		BKG	0.2			F
12.0						12.4-15.0: Dark gray to black Silty fine SAND; some black Silt laminae; some fine to medium Sand laminae; wet.							L
21.0	S-9 2.0/2.0		4/5/9/16	14		Similar to S-8.	SM		BKG	0.4			
26.0	S-10		4/6/12/18	18		Similar to S-8.	SM	1	BKG	0.4			F
27.0													L
30.0						BOTTOM OF EXPLORATION AT 27.0 FEET							
35.0						NOTES:							
40.0						1. Boring backfilled with high solids bentonite grout.							

ABB ENVIRONMENTAL SERVICES, Inc.

08BS122

Project McGUIRE AIR FORCE BASE RI/FS			Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAP			Logged By SJC	Checked By	Ground Elev 113.44
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 02/11/91	Finish Date 02/12/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Casing Size N/A	Auger Size 4.25"
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 8.00 - 02/12/91		Piez. Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/Rqd (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE WELL	DIAGRAM	LAB TESTS
0	S-1 1.3/2.0		12/18/26/24	44		0.0-16.0: Tan to gray to black Silty fine SAND; layer black Coal Ash at 0.3 to 0.5 foot; layers Silt at 2.3 to 2.4 feet, 3.5 to 3.7 feet, and 10.3 to 10.7 feet.	SM				BKG	BKG		L
1.7	S-2 1.7/2.0		21/27/27/31	54			SM				BKG	3.4		L
3.4	S-3 1.2/2.0		8/12/18/22	30			SM				BKG	0.3		F
5.1	S-4 1.7/2.0		17/18/71/21	89			SM				BKG	0.3		F
6.8	S-5 1.5/1.5		15/12/15	27			SM				BKG	BKG		L
8.5	S-6 1.2/1.5		7/7/15	22		Dark gray Silty fine SAND; wet.	SM				BKG	BKG		F
10.2	S-7 2.0/2.0		29/33/44/46	77			SM				BKG	BKG		F
11.9	S-8 1.5/1.5		13/17/23	40			SM				BKG	BKG		F
13.6	S-9 1.5/1.5		29/33/47	80			SM				BKG	BKG		F
15.3	S-10 1.5/1.5		29/34/34	68			SM				BKG	BKG		F
23.4	S-11 2.0/2.0		12/14/10/8	34		Similar to S-10; medium to coarse Sand layer at 28.4 to 28.6 feet.	SM				BKG	BKG		
31.5	S-12 2.0/2.0		17/21/25/38	46		Dark green Clayey fine to medium SAND; fossiliferous; wet; dense.	SC				BKG	BKG		
35.6	S-13 2.0/2.0		19/22/30/30	52		Similar to S-12.	SC	1			BKG	BKG		L F
37.0	BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Boring backfilled with high solids bentonite grout.													

ABB ENVIRONMENTAL SERVICES, Inc.

08BS123

Project McGUIRE AIR FORCE BASE RI/FS			Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAP			Logged By BBJ	Checked By	Ground Elev 113.35
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 01/10/91	Finish Date 01/11/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Casing Size N/A	Auger Size 4.25"
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 12.00 - 01/10/91		Piez Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE WELL	DIAGRAM	LAB TESTS
0	S-1 1.7/2.0		6/14/32/35	46		0.0-0.3: TOPSOIL	SM		BKG	BKG				L
1.7	S-2 2.0/2.0		22/26/29/33	55		0.3-10.5: Tan to rust to black stained Silty fine SAND; Sand laminae; Silt laminae; damp.	SM		BKG	BKG				
3.7	S-3 1.8/2.0		11/19/19/19	38			SM		BKG	BKG				
5.5	S-4 1.8/2.0		11/30/39/20	69			SM		BKG	BKG				
7.3	S-5 2.0/2.0		3/7/11/19	18					BKG	BKG				F
9.3	S-6 2.0/2.0		15/18/25/30	43		10.5-16.0: Layered brown Silty fine SAND and dark brown organic SILT; damp to wet.	SM		BKG	BKG				L
11.3	S-7 1.5/1.5		3/21/51	72			OL		BKG	BKG				F
12.8	S-8 2.0/2.0		15/15/20/25	35			SM		BKG	BKG				F
28.3	S-9 2.0/2.0		7/11/17/20	28		Dark brown Silty fine SAND; wet.	SM		BKG	BKG				F
25.3	S-10 2.0/2.0		4/3/5/4	8		25.0-25.9: Dark brown SILT; Sand laminae; dilatent; wet. 25.9-27.0: Brown Silty fine SAND.	ML SM		BKG	BKG				
36.3	S-11 1.5/1.5		3/13/19	32		Gray Clayey SILT; firm.	ML		BKG	BKG				L
36.8	S-12 1.5/1.5		3/15/50	65		Blue-gray Silty fine SAND.	SM	1	BKG	BKG				F
48						BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Boring backfilled with high solids bentonite grout.								

ABB ENVIRONMENTAL SERVICES, Inc.

08BS124

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAP		Logged By BBJ	Checked By	Ground Elev 113.32
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 01/10/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Finish Date 01/10/91
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 12.00 - 01/10/91	Piez. Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
0.0	S-1 2.0/2.0		12/20/20/21	40		0.0-3.3: Rust colored fine SAND; little medium Sand; rootlets; heavy oil staining.	SP		BKG	30.0		L
3.3	S-2 1.9/2.0		16/18/19/20	37		3.3-11.3: Gray to rust Silty fine SAND; dry to moist.	SM		2.0	30.0		L
6.6	S-3 1.8/2.0		9/17/19/10	36			SP		BKG	BKG		F
9.9	S-4 2.0/2.0		17/19/24/24	43			SM		0.5	BKG		
13.2	S-5 2.0/2.0		6/4/6/7	10			SM		BKG	BKG		
16.5	S-6 1.8/2.0		5/4/15/37	19			SM		BKG	BKG		
19.8	S-7		20/24/74/55	98		11.3-16.0: Layers of gray Silty fine SAND and black organic SILT; moist to wet.	OL	1	BKG	BKG		L
23.1	S-8		11/26/20/17	46			SM OL		BKG	BKG		L F
26.4												
29.7	S-9 2.0/2.0		6/9/11/3	20		Brown Silty fine SAND; wet.	SM		BKG	BKG		F
33.0	S-10 1.5/2.0		3/4/3/6	7		Similar to S-9.	SP		BKG	BKG		
36.3	S-11		1/4/6/20	10		Green to gray Clayey fine SAND; little medium Sand; wet.	SC		BKG	BKG		
39.6	S-12					Similar to S-11.	SC	2 3	BKG	BKG		
42.9						BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Recovery/penetration not recorded for S-7, S-8, S-11, and S-12. 2. No blow counts recorded for S-12. 3. Boring backfilled with high solids bentonite grout.						
46.2												

ABB ENVIRONMENTAL SERVICES, Inc.

08BS125

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04
Client HAZWAP		Logged By BBJ/SJC	Checked By Ground Ele	112.13
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 01/11/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Finish Date 01/12/91
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 13.30 - 01/12/91	Piez. Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
0-5	S-1 2.0/2.0		4/8/10/10	16		0.0-12.4: Gray to tan to rust Silty fine SAND; some medium and coarse Sand layers; trace thin Silt laminae; dry to moist.	SM		BKG	BKG		L
5-10	S-2 1.8/2.0		9/9/11/19	20			SM-SP		BKG	BKG		
10-15	S-3 2.0/2.0		9/21/50/56	71			SP-SM		BKG	BKG		
15-20	S-4 1.0/1.5		17/51/41	98			SM		BKG	BKG		L
20-25	S-5 1.5/1.5		3/9/17	26			SP-SM		BKG	BKG		F
25-30	S-6 1.4/2.0		3/15/7/9	22			SM		BKG	BKG		
30-35	S-7 2.0/2.0		7/18/33/35	51		12.4-16.0: Layered dark brown to gray Silty fine SAND and dark brown organic SILT; moist to wet.	SM		BKG	BKG		L
35-40	S-8 2.0/2.0		5/10/15/22	25			OL SM		BKG	BKG		
40-45	S-9 1.5/2.0		1/5/9/19	14		Dark brown to gray Silty fine SAND; wet.	SM		BKG	BKG		L
45-50	S-10 1.8/2.0		5/10/10/15	20		Similar to S-9; thin laminae of medium Sand.	SM-SP		BKG	BKG		
50-55	S-11					Gray to green fossiliferous Clayey fine SAND; damp; dense.	SC	1	BKG	BKG		
55-60	S-12 1.8/2.0		10/38/38/25	68		Similar to S-11.	SC	2	BKG	BKG		
60-65						BOTTOM OF EXPLORATION AT 37.0 FEET						
65-70						NOTES: 1. No blow counts or recovery recorded for S-11. 2. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS126

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAP		Logged By SJC	Checked By	Ground Elev 112.10
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 01/12/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Finish Date 01/13/91
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 9.00 - 01/13/91	Piez. Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM		WELL HEAD SPACE	DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER			
0	S-1 1.3/2.0		9/17/28/21	45		0.0-1.0: TOPSOIL 1.0-8.0: Tan to brown Silty fine SAND; damp.	ML-SM		BKG	BKG			
5	S-2 1.7/2.0		14/7/14/21	21			SP		BKG	BKG			
	S-3 1.2/2.0		8/18/19/24	37			SM		BKG	BKG			
	S-4 1.7/2.0		12/25/29/32	54			SM		BKG	BKG			
10	S-5 1.5/1.5		8/8/9	17		8.0-16.0: Tan to gray Silty fine SAND; organic Silt laminae and Clay laminae; roots and pine needles; damp to wet.	SM		BKG	BKG			
	S-6 1.2/1.5		8/7/9	16			SM		BKG	BKG			L
	S-7 1.5/1.5		12/51/28	79			OL		0.5	BKG			F
15	S-8 1.5/1.5		4/40/20	60			SM		0.8	BKG			F
20	S-9		7/18/23/32	41		Dark gray to brown fine SAND; laminated; moist.	SP	1	1.5	BKG			
25	S-10		4/8/12/23	20		Dark brown Silty fine SAND; moist.	SM		0.8	BKG			F
30	S-11		5/9/10/15	19		Gray to green Clayey fine SAND; trace medium Sand; damp.	SC		0.5	BKG			
35	S-12 2.0/2.0		9/10/28/40	38		Similar to S-11.	SC	2	0.2	BKG			L
40						BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Recovery/penetration not recorded for S-9, S-10, S-11, and S-12. 2. Boring backfilled with high solids bentonite grout.							

ABB ENVIRONMENTAL SERVICES, Inc.

08BS127

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAP		Logged By SJC	Checked By	Ground Elev 111.61
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 01/13/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Finish Date 01/13/91
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 14.00 - 01/13/91	Piez Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE	WELL	DIAGRAM	LAB TESTS
5	S-1 1.2/2.0		8/10/22/30	32		TOPSOIL; Silty fine SAND.	SM				BKG	BKG			L
	S-2 1.6/2.0		22/28/36/37	62		2.0-12.2: Tan to orange to dark brown Silty fine SAND; Silt laminae; trace Gravel layers; Sand laminae; damp.	SP				BKG	BKG			L
	S-3 1.5/2.0		8/19/18/20	37			SP-SM				BKG	BKG			F
	S-4 1.5/1.5		12/15/17	33			SM				BKG	BKG			
	S-5 1.5/1.5		8/11/21	32			SM				BKG	0.3			
18	S-6 1.5/1.5		7/15/21/30	36			SM-SP				BKG	BKG			
	S-7 1.5/1.5		8/11/19	30		12.2-16.0: Dark brown to gray Silty fine SAND; organic Silt layers.	SM				BKG	0.7			L
15	S-8 2.0/2.0		20/35/27/31	62			OL				BKG	0.9			F
							SM								F
28	S-9 2.0/2.0		3/5/11/15	16		Dark brown Silty fine SAND; wet.	SM				BKG	0.4			
25	S-10 2.0/2.0		5/5/5/5	10		Similar to S-9; little medium Sand.	SM				BKG	0.7			
38	S-11 2.0/2.0		5/9/9/15	18		Blue-green Clayey fine fossiliferous SAND; wet.	SC				BKG	1.0			
35	S-12 2.0/2.0		H/4/9/13	13		Similar to S-11.	SC	1			BKG	0.3			L
48						BOTTOM OF EXPLORATION AT 37.0 FEET NOTES: 1. Boring backfilled with high solids bentonite grout.									

ABB ENVIRONMENTAL SERVICES, Inc.

08PZ101

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04	
Client HAZWRAP		Logged By BCM		Checked By Ground Elev 105.76	
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name STEVE KOVALESKY		Rig Type ATV	
Drilling Method Hollow Stem Auger		Protection Level MOD. D		Start Date 01/13/91	
Soil Drilled (ft) 15.0		Rock Drilled (ft) N/A		Finish Date 01/13/91	
Ttl Depth (ft) 15.0		Depth to Water (ft)-Date 4.11 - 05/30/91		Piez. Boring Well ☐ ☐ ☒	
P.I.D. (eV) 10.2		Casing Size N/A		Auger Size 4.25"	

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FE)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM	PI METER FIELD SCAN	PI METER HEAD SPACE	WELL	DIAGRAM	LAB TESTS
5						No samples taken - see 08PZ102 for soil descriptions.								
10														
15														
20														
25														
30														
35														
40														
45														
50														
55														
60														
65														
70														
75														
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95														
100														
105														
110														
115														
120														
125														
130														
135														
140														
145														
150														
15.0						BOTTOM OF EXPLORATION AT 15.0 FEET								

ABB ENVIRONMENTAL SERVICES, Inc.

08PZ102

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project # 6623-0
Client HAZWRAP		Logged By CFR	Checked By	Ground # 105.42
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name STEVE KOVALESKY	Rig Type ATV	Start Date 01/13/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.L.D. (eV) 10.2	Finish Date 01/13/91
Soil Drilled (ft) 57.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 57.0	Depth to Water (ft)-Date 4.30 - 05/30/91	Piez. Boring Well ☒ ☐ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM			DIAGRAM
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL	
5	S-1 1.8/2.0		4/4/4/5	8		0.0-0.2: TOPSOIL 0.2-2.0: Gray Silty fine SAND; damp.	SM		BKG	BKG		
10	S-2 1.8/2.0		5/5/5/7	10		Similar to S-1 (0.2-2.0); wet.	SM		BKG	BKG		
15	S-3 1.5/2.0		3/4/10/9	14		Similar to S-2.	SM		BKG	BKG		
20	S-4 1.6/2.0		3/4/8/8	12		Similar to S-3.	SM		BKG	BKG		
25	S-5 2.0/2.0		4/7/10/30	17		20.0-21.5: Similar to S-3. 21.5-22.0: Green to gray Clayey fine SAND; fossiliferous; wet; dense.	SM SC		BKG	BKG		
30	S-6 2.0/2.0		8/18/28/30	46		Similar to S-5 (21.5-22.0).	SC		BKG	BKG		
35	S-7 2.0/2.0		5/20/30/30	50		Similar to S-5 (21.5-22.0).	SC		BKG	BKG		
40	S-8 2.0/2.0		10/15/19/25	34		Similar to S-5 (21.5-22.0).	SC		BKG	BKG		
45	S-9 2.0/2.0		4/10/12/26	22		Similar to S-5 (21.5-22.0).	SC		BKG	BKG		
50	S-10 1.5/2.0		3/5/13/15	18		Similar to S-5 (21.5-22.0).	SC		BKG	BKG		
55	S-11 1.5/2.0		6/25/30/36	55		Similar to S-5 (21.5-22.0); little cementation at 51.2 to 51.5 feet.	SC		BKG	BKG		
60	S-12 1.7/2.0		14/18/32/36	50		Similar to S-5 (21.5-22.0).	SC		BKG	BKG		
65						BOTTOM OF EXPLORATION AT 57.0 FEET						
70												
75												

ABB ENVIRONMENTAL SERVICES, Inc.

08MW102

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAP		Logged By SJC	Checked By	Ground Elev. 113.35
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name STEVE KOVALESKY		Rig Type CME-75
Drilling Method Hollow Stem Auger		Protection Level MOD. D		Start Date 02/18/91
		P.I.D. (eV) 10.2		Finish Date 02/18/91
Soil Drilled (ft) 25.0		Rock Drilled (ft) N/A		Ttl Depth (ft) 25.0
		Depth to Water (ft)-Date 10.71 - 05/30/91		Piez. Boring Well ☐ ☐ ☒

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM			DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL		
0	S-1 0.5/2.0		10/10/8/12	18		Brown fine SAND and TOPSOIL.	SP		BKG	20.0			
1.5	S-2 1.5/2.0		13/15/15/13	30		2.0-10.0: Tan to brown to green Silty fine SAND; Sand laminae; black laminae; moist; fuel odor.	SM		BKG	47.2			F
3.0	S-3 2.0/2.0		2/6/7/10	13			SM		1.9	12.3			
4.5	S-4 1.7/2.0		2/5/5/5	10			SM		BKG	12.2			
6.0	S-5 1.3/2.0		4/3/4/3	7			SM		BKG	6.0			
7.5	S-6 1.8/2.0		1/2/1/4	3		10.0-10.8: Gray Silty fine SAND; brown Silt layers; moist; fuel odor.	SM		BKG	24.5			
9.0	S-7 2.0/2.0		4/8/12/19	20		10.8-16.0: Gray to brown to black Silty fine SAND; wet; sulphur odor.	SM		BKG	2.2			F
10.5	S-8 2.0/2.0		2/7/15/13	22			SM		BKG	5.3			L
21.0	S-9 2.0/2.0		1/1/5/9	6		Dark gray to black Silty fine SAND; brown Silt layers; wet.	SM		BKG	25.6			
24.0	S-10 2.0/2.0		2/2/3/5	5		Dark brown fine SAND; some Silt; trace medium Sand; wet.	SP		BKG	1.6			
25.0						BOTTOM OF EXPLORATION AT 25.0 FEET							
38.0													
36.0													

ABB ENVIRONMENTAL SERVICES, Inc.

08MW103

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No. 6623-04	
Client HAZWRAAP		Logged By SJC		Checked By Ground Elev 112.19	
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MKKE LOGAN		Rig Type D-50	
Drilling Method Hollow Stem Auger		Protection Level MOD. D		Start Date 02/12/91	
				Finish Date 02/13/91	
Soil Drilled (ft) 27.0		Rock Drilled (ft) N/A		Ttl Depth (ft) 27.0	
				Depth to Water (ft)-Date 11.53 - 05/30/91	
				Piez. Boring Well ☐ ☐ ☒	

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM		WELL HEAD SPACE	DIAGRAM	LAB TESTS
									PI METER	FIELD SCAN			
	S-1 2.0/2.0		8/5/4/4	9		0.0-0.9: Tan fine SAND and TOPSOIL. 0.9-2.1: Coal Ash.	SP		BKG	BKG			
	S-2 2.0/2.0		13/13/19/21	32		2.1-8.0: Tan to brown to rust to olive-green Silty fine SAND; moist.	SM		BKG	BKG			
5	S-3 1.6/2.0		5/7/8/8	15			SM		BKG	BKG			
	S-4 1.2/2.0		4/4/4/4	8			SM		BKG	BKG			
18	S-5 1.3/2.0		6/4/6/4	10		8.0-13.7: Black to olive-green SILT; mottled; some fine Sand; moist.	ML		BKG	0.3			
	S-6 2.0/2.0		2/2/2/10	4			ML		BKG	BKG			
	S-7 1.5/2.0		6/11/14	25			ML		4.3	3.1			L F
15	S-8 1.0/1.5		9/10/11	21		13.7-15.0: Black medium to coarse SAND; some wood; strong fuel odor.	SW		26.4	140.7			
28	S-9 2.0/2.0		9/10/11/11	21		Black Silty fine SAND; wet; strong fuel odor.	SM		271.0	337.0			F
25	S-10 2.0/2.0		4/4/5/4	9		Similar to S-9.	SM		197.0	311.0			F
						BOTTOM OF EXPLORATION AT 27.0 FEET							
38													
35													

ABB ENVIRONMENTAL SERVICES, Inc.

08MW104

Project McGUIRE AIR FORCE BASE RI/FS			Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAP			Logged By SJC	Checked By	Ground Ele. 112.05
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name STEVE KOVALESKY	Rig Type CME-75	Start Date 02/20/91	Finish Date 02/20/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.L.D. (eV) 10.2	Casing Size N/A	Auger Size 8.25"
Soil Drilled (ft) 27.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 27.0	Depth to Water (ft)-Date 12.11 - 05/30/91		Piez. Boring Well ☐ ☐ ☒

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FEET)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM			DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL		
5	S-1 1.7/2.0		3/3/7/10	10		Tan to green fine SAND and TOPSOIL.	SM		BKG	BKG			
	S-2 1.8/2.0		7/11/12/13	23		2.0-12.3: Tan to green to gray Silty fine SAND; trace medium Sand; some black fine Sand laminae; moist.	SM		BKG	BKG			
	S-3 2.0/2.0		4/7/5/8	12			SM		BKG	BKG			
	S-4 2.0/2.0		2/5/10/9	15			SM		BKG	BKG			
	S-5 2.0/2.0		2/7/7/8	14			SM		BKG	BKG			
18	S-6 1.9/2.0		1/1/2/3	3			SM		BKG	BKG			
	S-7 2.0/2.0		1/8/3/8	11		12.3-16.0: Layered black organic SILT; wood fragments; gray Silty SAND; well graded; damp to wet.	OL		BKG	BKG			
15	S-8 2.0/2.0		12/8/10/3	18			SM		BKG	BKG			
28	S-9 1.1/2.0		WOH/1/2/8	3		Dark gray Silty fine SAND; wet.	SM		BKG	BKG			
25	S-10 1.7/2.0		1/1/3/5	4		Dark Gray well-graded SAND, trace fine Gravel; wet.	SP		BKG	BKG			
38						BOTTOM OF EXPLORATION AT 27.0 FEET							
35													

ABB ENVIRONMENTAL SERVICES, Inc.

08MW106

Project McGUIRE AIR FORCE BASE RI/FS			Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAP			Logged By SJC	Checked By	Ground Elev. 108.22
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name STEVE KOVALESKY		Rig Type CME-75	Start Date 02/19/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D		P.I.D. (eV) 10.2	Finish Date 02/20/91
Soil Drilled (ft) 27.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 27.0	Depth to Water (ft)-Date 8.54 - 05/30/91		Piez Boring Well ☐ ☐ ☒

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (ft)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
5	S-1 1.2/2.0		2/2/4/5	6		Tan fine SAND and TOPSOIL.	SM		BKG	BKG		
	S-2 2.0/2.0		5/6/9/9	15		2.0-12.4: Green to black fine SAND; little Silt; little medium Sand; trace wood; black Sand laminae; fuel odor.	SP		BKG	BKG		F
	S-3 1.8/2.0		4/5/6/10	11			SP		BKG	BKG		F
	S-4 1.8/2.0		3/6/5/4	11			SP		BKG	5.5		F
10	S-5 0.2/2.0	WOH					SP		BKG	BKG		F
	S-6 1.7/2.0	WOH/WOH 1/1		1			SP		BKG	23.8		F
	S-7 1.7/2.0	WOH/WOH 2/2		2		12.4-13.6: Black organic SILT; wood fragments.	SP OL		BKG	BKG		F
15	S-8 2.0/2.0	WOH/2/3/5		5		13.6-16.0: Tan to dark brown Silty fine SAND; some roots; damp.	SM		BKG	3.8		F
20	S-9 1.3/2.0	2/6/3/7		9		Gray fine to medium SAND; wet.	SP		BKG	19.8		F
25	S-10 1.8/2.0	WOR/1/2/3		3		25.0-25.4: Tan fine SAND; little medium Sand; little Silt; wet.	SP SC		BKG	BKG		F
30						25.4-26.8: Green fine to medium Clayey SAND, trace fossil fragments; tan fine Sand laminae; wet.						
35						BOTTOM OF EXPLORATION AT 27.0 FEET						

ABB ENVIRONMENTAL SERVICES, Inc.						08MW107								
Project McGUIRE AIR FORCE BASE RI/FS						Site McGUIRE AFB		Project No. 6623-04						
Client HAZWRAP						Logged By CFR		Checked By Ground Elev 103.60						
Drilling Contractor MATHES OF NEW JERSEY				Driller's Name STEVE KOVALESKY		Rig Type ATV		Start Date 01/14/91						
Drilling Method Hollow Stem Auger				Protection Level MOD. D		P.I.D. (eV) 10.2		Casing Size N/A						
Soil Drilled (ft) 57.0		Rock Drilled (ft) N/A		Ttl Depth (ft) 57.0		Depth to Water (ft)-Date 9.45 - 05/30/91		Piez. Boring Well ☐ ☐ ☒						
DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM	PI METER FIELD SCAN	PI METER HEAD SPACE	WELL	DIAGRAM	LAB TESTS
0-5	S-1 1.8/2.0		4/5/20/22	25		0.0-0.4: TOPSOIL 0.4-2.0: Brown to gray Silty fine SAND; damp.	SM		BKG	BKG				
5-18	S-2 1.5/1.5		8/12/18	30		Tan to gray Silty fine SAND; trace wood fragments; damp.	SM		BKG	0.3				
18-15	S-3 1.5/1.5		5/5/8	13		Gray to dark gray Silty fine SAND; little Clay; Silt laminae; damp.	SM		BKG	BKG				
15-28	S-4 1.5/1.5		4/5/8	13		Similar to S-3; wet.	SM		BKG	BKG				F
28-25	S-5 1.8/2.0		4/4/6/8	10		Similar to S-4.	SM		BKG	BKG				
25-38	S-6 2.0/2.0		3/6/8/13	14		Dark gray fine to medium SAND; trace Silt; wet.	SP		BKG	BKG				
38-35	S-7 2.0/2.0		6/10/14/20	24		30.0-30.2: Similar to S-6. 30.2-32.0: Green fine to medium Clayey SAND; fossil fragments; wet.	SP SC		BKG	BKG				
35-48	S-8 2.0/2.0		8/12/21/28	33		Similar to S-7 (30.2-32.0).	SC		BKG	BKG				
48-45	S-9 2.0/2.0		4/10/20/55	30		Similar to S-7 (30.2-32.0).	SC		BKG	BKG				
45-58	S-10 2.0/2.0		15/25/25/40	50		Similar to S-7 (30.2-32.0).	SC		BKG	BKG				
58-55	S-11 2.0/2.0		8/20/30/30	50		Similar to S-7 (30.2-32.0).	SC		BKG	BKG				
55-68	S-12 2.0/2.0		2/4/16/3	20		55.0-55.6: Similar to S-7 (30.2-32.0). 55.6-57.0: Dark gray fine to medium Clayey SAND; fossiliferous; wet.	SC		BKG	BKG				L
						BOTTOM OF EXPLORATION AT 57.0 FEET								

ABB ENVIRONMENTAL SERVICES, Inc.

08MW108

Project McGUIRE AIR FORCE BASE RI/FS		Site McGUIRE AFB		Project No 6623-04	
Client HAZWRAP		Logged By LNT		Checked By Ground Ele	
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name STEVE KOVALESKY		Rig Type ATV	Start Date 01/23/91
Drilling Method Hollow Stem Auger		Protection Level MOD: D		P.I.D. (eV) 10.2	Finish Date 01/23/91
Soil Drilled (ft) 25.0		Rock Drilled (ft) N/A		Ttl Depth (ft) 25.0	Depth to Water (ft)-Date 7.06 - 05/30/91
				Piez. ☐	Boring ☐
				Well ☒	

DEPTH(Feet)	SAMPLE NO. & RECOVERY / PENETRATION(FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE WELL	DIAGRAM	LAB TESTS
5						See 08-MW-107 for complete soil descriptions.								
10														
15	S-1 1.9/2.0		6/6/12/11	18		Dark brown fine Silty SAND.	SM				BKG	BKG		
20														
25														
						BOTTOM OF EXPLORATION AT 25.0 FEET								

ABB ENVIRONMENTAL SERVICES, Inc.						08MW109					
Project McGUIRE AIR FORCE BASE RI/FS						Site McGUIRE AFB			Project No. 6623-04		
Client HAZWRAP						Logged By BBJ		Checked By		Ground Elev 101.92	
Drilling Contractor MATHES OF NEW JERSEY				Driller's Name STEVE KOVALESKY		Rig Type ATV		Start Date 01/23/91		Finish Date 01/24/91	
Drilling Method Hollow Stem Auger				Protection Level MOD. D		P.I.D. (eV) 10.2		Casing Size N/A		Auger Size 4.25"	
Soil Drilled (ft) 22.0		Rock Drilled (ft) N/A		Ttl Depth (ft) 22.0		Depth to Water (ft)-Date 10.92 - 05/30/91			Piez. Boring Well ☐ ☐ ☒		

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM		PI METER HEAD SPACE WELL	PI METER	DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER				
0.5/2.0	S-1		WOH/6/16/10	22		Brown SILT and TOPSOIL.	OL		BKG	BKG				L
1.5/1.5	S-2		9/11/17	28		Brown SILT; some fine Sand; some medium to coarse Sand; some wood fragments; moist.	OL		BKG	0.3				
1.5/1.5	S-3		10/9/11	20		Brown Silty fine SAND; some coarse Sand layers; trace wood fragments; wet.	SM		BKG	BKG				L
2.0/2.0	S-4		3/10/10/10	20		Similar to S-3.	SM		BKG	0.5				
2.0/2.0	S-5		3/5/7/4	12		20.0-21.8: Similar to S-3.	SM SC		BKG	0.5				F
21.8-22.0: Green to black Clayey fine SAND.														
BOTTOM OF EXPLORATION AT 22.0 FEET														
25														

ABB ENVIRONMENTAL SERVICES, Inc.						08MW110																								
Project McGUIRE AIR FORCE BASE RI/FS						Site McGUIRE AFB		Project No. 6623-04																						
Client HAZWRAP						Logged By BCM		Checked By Ground Elev 112.34																						
Drilling Contractor MATHES OF NEW JERSEY			Driller's Name STEVE KOVALESKY			Rig Type CME-75		Start Date 02/12/91																						
Drilling Method Hollow Stem Auger			Protection Level MOD. D			P.I.D. (eV) 10.2		Casing Size N/A																						
Soil Drilled (ft) 26.0		Rock Drilled (ft) N/A		Ttl Depth (ft) 26.0		Depth to Water (ft)-Date 9.80 - 05/30/91		Piez. Boring Well ☐ ☐ ☒																						
DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D.			DIAGRAM	LAB TESTS																	
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL																			
5 10 15	S-1 1.6/2.0	4/4/5/6	9	9	0.0-0.7: Tan fine SAND and TOPSOIL. 0.7-2.0: Coal Ash.	SP		BKG	302				F																	
	S-2 1.5/2.0													6/8/10/15	18	2.0-8.0: Brown to gray fine SAND; black stained layers; moist; fuel odor.	SP	327	197			F								
	S-3 1.5/2.0																						2/7/8/8	15	8.0-11.0: Olive Silty fine SAND; wood fragments.	SM	652	272		L
	S-4 1.2/2.0																													
	S-5 1.5/2.0	2/3/2/5	5		SM	548	217		F																					
	S-6 1.7/2.0	2/2/5/8	7		SM	554	268		L																					
	S-7 1.2/2.0	3/6/4/1	10		SM	609	301		F																					
	S-8 1.5/1.5	1/3/9	12		SM	10	74		F																					
20	S-9 1.3/2.0	1/3/5/5	8		Dark gray Silty fine SAND; wet; loose.	SM		1.5	235			F																		
25	S-10	WOH/2/3/6	5		Similar to S-9.	SP-SM		2.2	30			F																		
BOTTOM OF EXPLORATION AT 26.0 FEET																														

APPENDIX B

**AIR PERMIT FOR OPERATION OF THE BIOSLURPER PILOT TEST
AT THE BFSA, MCGUIRE AFB, NJ**

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ATTACHMENT TO AIR POLLUTION CONTROL PERMIT
TO CONSTRUCT, INSTALL OR ALTER CONTROL APPARATUS
OR EQUIPMENT AND CERTIFICATE TO OPERATE CONTROL
APPARATUS OR EQUIPMENT
FOR

Applicant: McGuire Air Force Base
Location: Bulk Fuel Storage Area (BFSA)
West Arnold Avenue
McGuire AFB, Burlington County
BNSR Log Number: 01-95-4474
Stack Designation: Bioslurping Field Test

1. This equipment shall not cause any air contaminant, including an air contaminant detectable by the sense of smell, to be present in the outdoor atmosphere in such quantity and duration which is, or tends to be, injurious to human health or welfare, animal or plant life or property, or would unreasonably interfere with the enjoyment of life or property, except in areas over which the owner or operator has exclusive use or occupancy.
2. All volatile organic compounds (VOC, as defined by N.J.A.C. 7:27-16.1) and toxic substances (TXS, as defined by N.J.A.C. 7:27-17.1) emissions from the vapor extraction point shall be directed through the control device as presented in the application.
3. Both VOC and TXS shall be monitored to ensure proper operation of the control device. Any thermal oxidizer, catalytic oxidizer, or internal combustion engine utilized shall not operate at less than the temperature as specified on the application and not less than manufacturer's specifications. Any carbon adsorption unit utilized shall be monitored to ensure that breakthrough from the final canister has not occurred. If breakthrough of the final carbon unit is detected, the carbon shall be replaced or the pilot test shall be terminated immediately.
4. The operation shall cease if total VOC emissions exceed 0.5 pounds per hour or TXS emissions exceed 0.1 pounds per hour.
5. This approval shall be used for the purposes of an "Environmental Improvement Pilot Test" as defined in N.J.A.C. 7:27-8.2. The length of the pilot test shall not exceed the time listed in the application.
6. The results of the monitoring, as described in the application, shall be recorded. These results must be kept by the applicant for a minimum of 5 years. A summary of these results and the BNSR log number as referenced above must be submitted with any subsequent air permit application for this soil remediation project.

Page 2 of 2

7. The applicable Regional Field Office, shall be notified at least 72-hours prior to the actual testing in order that representatives of these offices may be scheduled to observe the conduct of the tests.
8. The Department issues this permit on the basis of the equipment descriptions and operating procedures presented in the Application. If the final design and operation of the equipment differ from those presented, this Permit approval is invalid.
9. As a condition of this Permit, the Applicant shall comply with all terms and conditions of any Administrative Consent Order related to this Permit.
10. The approval of this pilot test shall not be considered as Departmental acceptance of the proposed process for remediation purposes. Permits and certificates issued under N.J.A.C. 7:27-8 are based on emissions of air contaminants only and do not in any way relieve the Applicant from the obligation to obtain necessary permits from other governmental agencies.



State of New Jersey

Christine Todd Whitman
Governor

Department of Environmental Protection

Robert C. Shinn, Jr.
Commissioner

October 12, 1995

King Mak
McGuire Air Force Base
305 SPTG/CEV, 3400 Broidy Rd.
McGuire AFB, NJ 08641-5303

Plant Location: McGuire AFB
County: Burlington
Applicant's Designation of Stack: Bioslurping Field Test
Application Log #: 01954474
Approval Date: 10/10/95
Approval Status Code: 51

**PERMIT TO CONSTRUCT, INSTALL OR ALTER CONTROL APPARATUS OR
EQUIPMENT**

This permit is being issued under the authority of chapter 106, P.L. 1967 (N.J.S.A. 26:2C-9.2). You may construct, install, or alter the control apparatus or equipment as indicated on the application referenced above.

The Status of this approval is referenced above. Please see page 2 of this letter for the explanation of the status code.

The duration of this permit is explained in the conditions attached to this document.

If you have any questions regarding this document, please write to the Bureau of New Source Review at the above address. Questions regarding Certificates to Operate should be directed to the Regional Office.

Approved by: _____

Chief

cc: BNSR File
Regional Office

VEM-045 (2/95)

Page 2

NJ DEP REGIONAL OFFICESMETROPOLITAN REGIONAL ENFORCEMENT

Bureau of Enforcement Operations
2 Babcock Place
West Orange, New Jersey 07052
(201) 669-3935

Covers Counties of: Bergen, Essex,
Hudson & Union

NORTHERN REGIONAL ENFORCEMENT

Bureau of Enforcement Operations
1259 Route 46
Parsippany-Troy Hills, N.J. 07054
(201) 299-7700

Covers Counties of: Hunterdon, Morris,
Somerset, Sussex,
Passaic & Warren

CENTRAL REGIONAL ENFORCEMENT

Bureau of Enforcement Operations
Rte. 130, Horizon Center, Bldg. 300
Robbinsville, New Jersey
Mailing Address: CN 407, Trenton, NJ 08625-0407
(609) 584-4100

Covers Counties of: Burlington, Mercer,
Middlesex,
Monmouth & Ocean

SOUTHERN REGIONAL ENFORCEMENT

Bureau of Enforcement Operations
The Paint Works Corporate Center
20 East Clementon Road/3rd Floor
Gibbsboro, N.J. 08026
(609) 346-8071

Covers Counties of: Atlantic, Camden,
Cape May,
Cumberland, Salem
& Gloucester

NJ DEP - MINOR SOURCE COMPLIANCE

Rte. 130, Horizon Center, Bldg. 300
Robbinsville, New Jersey
Mailing Address: CN 407, Trenton, NJ 08625-0407
(609) 584-4240

Covers all counties statewide.

CERTIFICATE STATUS CODES:

01 -	Temporary Operating Certificate
05 -	Five Year Operating Certificate
51 -	Conditional — Temporary (See Condition Checked)
55 -	Five Year Conditional (See Condition Checked)

ALL PERMIT AND CERTIFICATE APPROVALS ARE SUBJECT TO THE PROVISION THAT:

This equipment shall not cause any air contaminant, including an air contaminant detectable by the sense of smell, to be present in the outdoor atmosphere in such quantity and duration which is, or tends to be, injurious to human health or welfare, animal or plant life or property, or would unreasonably interfere with the enjoyment of life or property, except in areas over which the owner or operator has exclusive use or occupancy.

CONDITIONS THAT WILL APPLY:

- ☐ No visible emissions, exclusive of condensed water vapor.
- ☐ No person shall cause, suffer, allow or permit particles to be emitted from this stack or chimney into the outdoor air, the shade or appearance of which is greater than 10% opacity, exclusive of visible condensed water vapor.
- ☒ Special conditions (see attached)

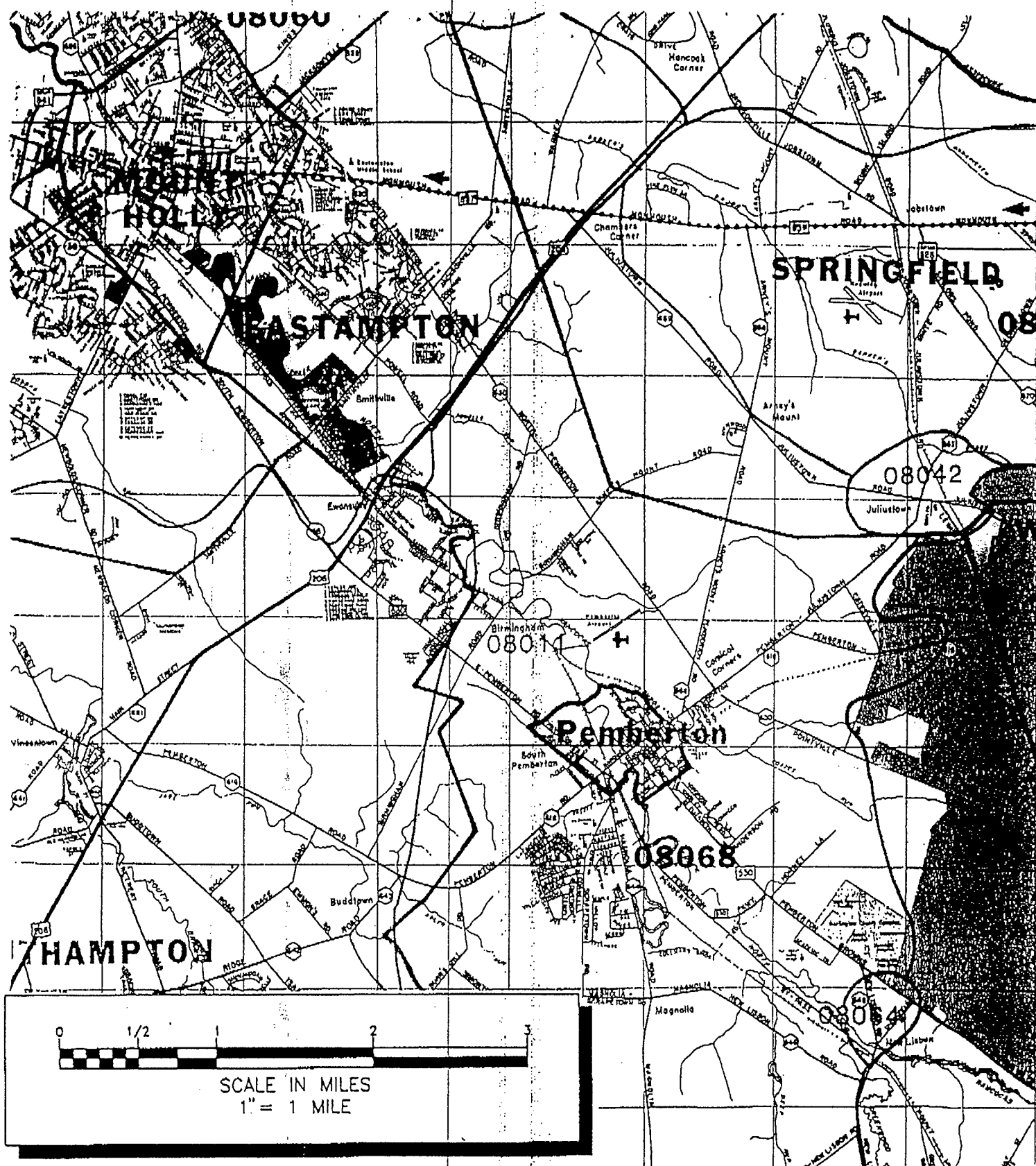
NOTE:

☐ If this item is checked this Operating Certificate is not approved for start up.

APPENDIX C

MAP SHOWING LOCATION OF BURLINGTON COUNTY HOSPITAL

AFCEE-17/15FEB95/U4



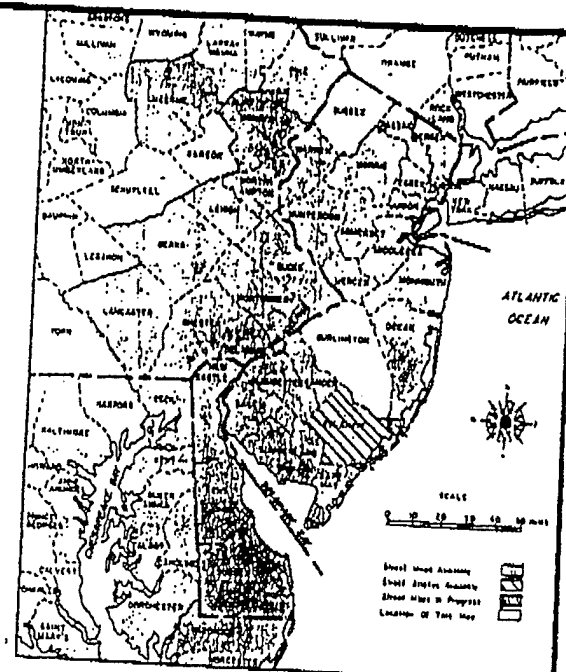
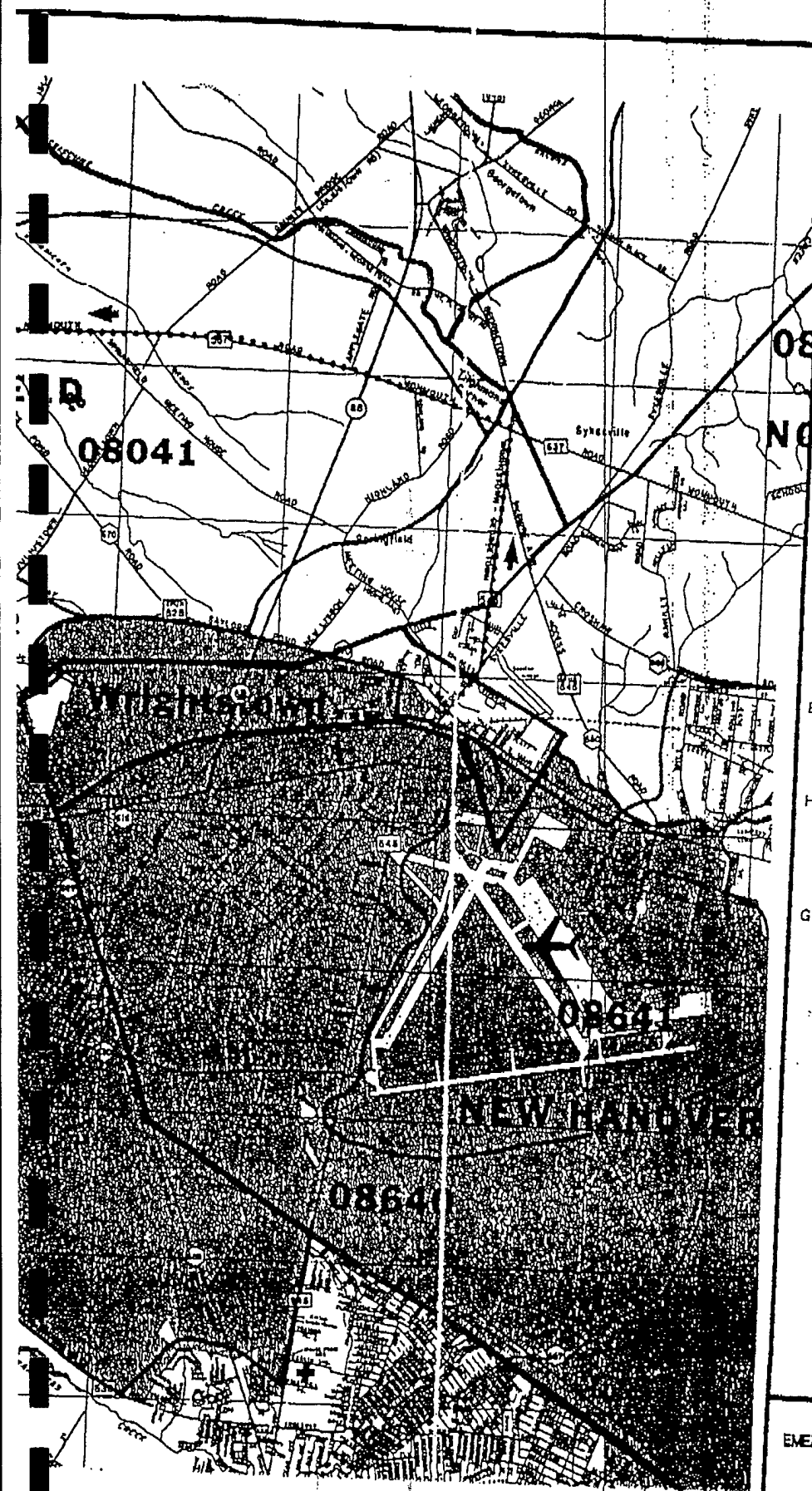
SOURCE: ALFRED B. PATTON, INC.; BURLINGTON COUNTY, N.J. STREET MAP



HQ/AFCEE/ERD

ROUTE TO HOSPITAL MAP - BURLIN
MCGUIRE AFB - INSTALLATION F

SCOPING DOCL



LEGEND:

BOUNDARIES:

- STATE LINE
- COUNTY LINE
- TOWNSHIP & BOROUGH LINE

HIGHWAY MARKERS:

- INTERSTATE ROUTE (75)
- U.S. ROUTE (13)
- STATE ROUTE (70)
- COUNTY ROUTE (578) (641)

GENERAL & CULTURAL FEATURES:

- STATE PARK
- COUNTY & MUNICIPAL PARK
- AIRPORT (1)
- BATONA TRAIL (Approximate Location)
- CEMETERY (1)
- CITY — BOROUGH
- GOLF COURSE — COUNTRY CLUB
- GOVERNMENT FACILITY
- HOSPITAL — MEDICAL CENTER (+)
- INDUSTRIAL PARK
- MILITARY RESERVATION
- SHOPPING CENTER
- STATE FOREST
- WILDLIFE MANAGEMENT AREA

ZIP CODES:

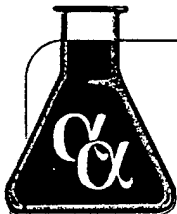
- BOUNDARY LINE
- DELIVERY 08010
- NON-DELIVERY 08048
- COUNTY COURTHOUSE *

EMERGENCY ROUTE TO HOSPITAL



UPLINGTON COUNTY HOSPITAL
ON RESTORATION PROGRAM

APPENDIX B
LABORATORY ANALYTICAL REPORTS



Alpha Analytical, Inc.

255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
(702) 355-1044
FAX: 702-355-0406
1-800-283-1183

Boise, Idaho
(208) 336-4145

2505 Chandler Avenue, Suite 1
Las Vegas, Nevada 89120
(702) 498-3312
FAX: 702-736-7523
1-800-283-1183

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#: G462201-30D0201
Phone: (614) 424-6122
Attn: Al Pollack

Alpha Analytical Number: BMI111795-01

Client I.D. Number: MG-F-1

Date Sampled: 11/12/95

Date Received: 11/17/95

Compound	Method	Concentration ug/Kg	Detection Limit ug/Kg	Date Analyzed
Benzene	8240	1,600,000	360,000	10/22/95
Toluene	8240	13,000,000	360,000	10/22/95
Total Xylenes	8240	18,000,000	360,000	10/22/95
Ethylbenene	8240	2,900,000	360,000	10/22/95
C-range Compounds	Method	Percentage of Total	Detection Limit (Not Applicable)	Date Analyzed
C07<	GC/FID	26.4	NA	11/20/95
C08	GC/FID	13.2	NA	11/20/95
C09	GC/FID	10.8	NA	11/20/95
C10	GC/FID	8.8	NA	11/20/95
C11	GC/FID	9.5	NA	11/20/95
C12	GC/FID	10.9	NA	11/20/95
C13	GC/FID	10.0	NA	11/20/95
C14	GC/FID	6.3	NA	11/20/95
C15>	GC/FID	4.1	NA	11/20/95

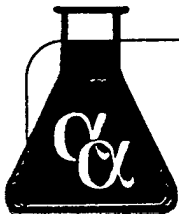
Approved by:

Roger L. Scholl

Roger L. Scholl, Ph.D.
Laboratory Director

Date:

11/30/95



Alpha Analytical, Inc.

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Sparks, Nevada 89431
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1-800-283-1183

Boise, Idaho
(208) 336-4145

Las Vegas, Nevada
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6199
Attn:

Sampled: 11/10/95 Received: 11/17/95 Analyzed: 11/22/95

Matrix: [X] Soil [] Water [] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Purgeable
Quantitated As Gasoline
BTXE - Benzene, Toluene, Xylenes, Ethylbenzene

Methodology: TPH - Modified 8015/DHS LUFT Manual/BLS-191
BTXE - Method 624/8240

Results:

Client ID/ Lab ID	Parameter	Concentration	Detection Limit
MG-S-1	TPH (Purgeable)	58	10 mg/Kg
/BMI111795-02	Benzene	120	20 ug/Kg
	Toluene	290	20 ug/Kg
	Total Xylenes	1,900	20 ug/Kg
	Ethylbenzene	300	20 ug/Kg
MG-S-2	TPH (Purgeable)	ND	10 mg/Kg
/BMI111795-03	Benzene	33	20 ug/Kg
	Toluene	61	20 ug/Kg
	Total Xylenes	390	20 ug/Kg
	Ethylbenzene	61	20 ug/Kg
MG-S-3	TPH (Purgeable)	360	200 mg/Kg
/BMI111795-04	Benzene	ND	400 ug/Kg
	Toluene	1,200	400 ug/Kg
	Total Xylenes	10,000	400 ug/Kg
	Ethylbenzene	1,600	400 ug/Kg

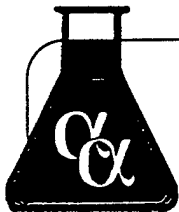
ND - Not Detected

Approved by:

Roger L. Scholl
Roger L. Scholl, Ph.D.
Laboratory Director

Date:

11/30/95



Alpha Analytical, Inc.

255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
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Boise, Idaho
(208) 336-4145

Las Vegas, Nevada
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6199
Attn:

Sampled: 11/16/95 Received: 11/17/95 Analyzed: 11/22/95

Matrix: [] Soil [X] Water [] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Purgeable
Quantitated As Gasoline
BTXE - Benzene, Toluene, Xylenes, Ethylbenzene

Methodology: TPH - Modified 8015/DHS LUFT Manual/BLS-191
BTXE - Method 624/8240

Results:

Client ID/ Lab ID	Parameter	Concentration	Detection Limit
MG-OWS-1	TPH (Purgeable)	47	25 mg/L
/BMI111795-05	Benzene	4,000	50 ug/L
	Toluene	9,400	50 ug/L
	Total Xylenes	6,700	50 ug/L
	Ethylbenzene	1,100	50 ug/L
MG-Discharge-1	TPH (Purgeable)	38	25 mg/L
/BMI111795-06	Benzene	3,600	50 ug/L
	Toluene	8,600	50 ug/L
	Total Xylenes	6,100	50 ug/L
	Ethylbenzene	1,000	50 ug/L

ND - Not Detected

Approved by:

Roger L. Scholl
Roger L. Scholl, Ph.D.
Laboratory Director

Date:

11/30/95

Laboratory
Analysis Report



Sierra
Environmental
Monitoring, Inc.

ALPHA ANALYTICAL
255 GLENDALE AVENUE, SUITE 21
SPARKS NV 89431

Date : 12/05/95
Client : ALP-855
Taken by: CLIENT
Report : 14971
PO# :

Page: 1

Sample	Collected		MOISTURE	DENSITY	POROSITY	PARTICLE SIZE		
	Date	Time	CONTENT %	G/CM3	%	DISTRIBUTION		
BMI111795-02 - MG-S-1	11/10/95	:	21.7	1.21	54.3	78/15/7 *		
BMI111795-03 - MG-S-2	11/10/95	:	24.5	1.36	48.7	88/5/7 *		
BMI111795-04 - MG-S-3	11/10/95	:	26.1	1.29	51.3	82/10/8 *		

Approved By: 

This report is applicable only to the sample received by the laboratory. The liability of the laboratory is limited to the amount paid for this report. This report is for the exclusive use of the client to whom it is addressed and upon the condition that the client assumes all liability for the further distribution of the report or its contents.

William F. Pillsbury
President

1135 Financial Blvd.
Reno, NV 89502
Phone (702) 857-2400
FAX (702) 857-2404

John C. Seher
Manager

Laboratory
Analysis Report



Sierra
Environmental
Monitoring, Inc.

ALPHA ANALYTICAL
255 GLENDALE AVENUE, SUITE 21
SPARKS NV 89431

Date :
Client : ALP-855
Taken by: CLIENT
Report : 14971
PO# :

Page: 2

* PERCENT SAND / SILT / CLAY

This report is applicable only to the sample received by the laboratory. The liability of the laboratory is limited to the amount paid for this report. This report is for the exclusive use of the client to whom it is addressed and upon the condition that the client assumes all liability for the further distribution of the report or its contents.

William F. Pillsbury
President

1135 Financial Blvd.
Reno, NV 89502
Phone (702) 857-2400
FAX (702) 857-2404

John C. Seher
Manager



Sierra
Environmental
Monitoring, Inc.

December 4, 1995

TO: Alpha Analytical
FROM: Sierra Environmental Monitoring, Inc.
RE: Particle Size Distribution Analysis for Samples:

SEM 9511-0501	AAI	BMI111795-02	MG-S-1
SEM 9511-0502	AAI	BMI111795-03	MG-S-2
SEM 9511-0503	AAI	BMI111795-04	MG-S-3

As per your request, we have performed particle size analysis on the samples submitted to our laboratory. Test results are as follows:

	BMI111795-01	BMI111795-02	BMI111795-03
% Sand	78	88	82
% Silt	15	5	10
% Clay	7	7	8

The sample was passed through a #10 sieve prior to analysis as per procedure. All results are based on oven dry sample weights.

We appreciate this opportunity to provide our laboratory testing services. If you have any questions or require further testing, please feel free to contact us at your convenience.

Sincerely,
SIERRA ENVIRONMENTAL MONITORING, INC.

John Seher
Laboratory Manager

1135 Financial Blvd.
Reno, NV 89502
Phone (702) 857-2400
FAX (702) 857-2404

William F. Pillsbury
President

John C. Seher
Manager

Billing Information:

Name _____
Address _____
City, State, Zip _____
Phone Number, ✓ _____



Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
Phone (702) 355-1044
Fax (702) 355-0406

Page # 1 of 1[illegible]

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

*Kev: AQ - Aqueous
SO - Soil
WA - Waste
OT - Other

SO - Soil

WA - Waste

OT - Other

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9511170

Work Order Summary

CLIENT: Mr. Eric Dreschler
Battelle Memorial Institute
505 King Avenue
Columbus, OH 43201

BILL TO: Same

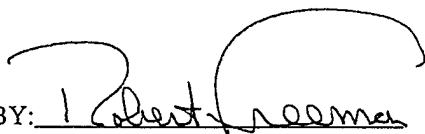
PHONE: 614-424-3753
FAX: 614-424-3667
DATE RECEIVED: 11/17/95
DATE COMPLETED: 11/30/95

INVOICE # 8850
P.O. #
PROJECT # G462201-30A0401 Bioslurper
AMOUNT\$: \$810.49

<u>FRACTION #</u>	<u>NAME</u>	<u>TEST</u>	<u>RECEIPT</u>	
			<u>VAC./PRES.</u>	<u>PRICE</u>
01A	MG-LRP Reservoir-1	TO-3	0.2 psi	\$120.00
02A	MG-LRP Reservoir-2	TO-3	0.2 psi	\$120.00
03A	MG-LRP Stack-1	TO-3	0 "Hg	\$120.00
04A	MG-LRP Stack-2	TO-3	0.2 psi	\$120.00
05A	MG-ICE Stack-1	TO-3	0.5 "Hg	\$120.00
06A	MG-ICE Stack-2	TO-3	0.5 "Hg	\$120.00
07A	Lab Blank	TO-3	NA	NC

Misc. Charges	1 Liter Summa Canister Preparation (6) @ \$10.00 each.	\$60.00
	Shipping (11/7/95)	\$30.49

CERTIFIED BY:


Laboratory Director

DATE:

11/30/95

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA 95630
(916) 985-1000 • (800) 985-5955 • FAX (916) 985-1020

AIR TOXICS LTD.

SAMPLE NAME: MG-LRP Reservoir-1

ID#: 9511170-01A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6112706	Date of Collection:	11/15/95
Dil. Factor:	2000	Date of Analysis:	11/27/95

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	2.0	6.5	47	150
Toluene	2.0	7.7	460	1800
Ethyl Benzene	2.0	8.8	25	110
Total Xylenes	2.0	8.8	78	340

TOTAL PETROLEUM HYDROCARBONS

GC/FID

(Quantitated as Jet Fuel)

File Name:	6112706	Date of Collection:	11/15/95
Dil. Factor:	2000	Date of Analysis:	11/27/95

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	20	130	70000	450000
C2 - C4** Hydrocarbons	20	37	10000	18000

*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: MG-LRP Reservoir-2

ID#: 9511170-02A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6112707	Date of Collection: 11/15/95		
Dil. Factor:	2000	Date of Analysis: 11/27/95		
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	2.0	6.5	390	1300
Toluene	2.0	7.7	460	1800
Ethyl Benzene	2.0	8.8	27	120
Total Xylenes	2.0	8.8	86	380

TOTAL PETROLEUM HYDROCARBONS

GC/FID

(Quantitated as Jet Fuel)

File Name:	6112707	Date of Collection: 11/15/95		
Dil. Factor:	2000	Date of Analysis: 11/27/95		
	Det. Limit	Det. Limit	Amount	Amount
Compound	(ppmv)	(uG/L)	(ppmv)	(uG/L)
TPH* (C5+ Hydrocarbons)	20	130	63000	410000
C2 - C4** Hydrocarbons	20	37	8900	16000

*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: MG-LRP Stack-1

ID#: 9511170-03A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6112708	Date of Collection:	11/15/95
Dil. Factor:	2.0	Date of Analysis:	11/27/95

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.002	0.006	0.021	0.068
Toluene	0.002	0.008	0.12	0.46
Ethyl Benzene	0.002	0.009	0.011	0.048
Total Xylenes	0.002	0.009	0.053	0.23

TOTAL PETROLEUM HYDROCARBONS

GC/FID

(Quantitated as Jet Fuel)

File Name:	6112708	Date of Collection:	11/15/95
Dil. Factor:	2.0	Date of Analysis:	11/27/95

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	0.020	0.13	5.8	38
C2 - C4** Hydrocarbons	0.020	0.037	0.38	0.70

*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: MG-LRP Stack-2

ID#: 9511170-04A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6112709	Date of Collection:	11/15/95
Dil. Factor:	2.0	Date of Analysis:	11/27/95

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.002	0.006	0.044	0.14
Toluene	0.002	0.008	0.17	0.65
Ethyl Benzene	0.002	0.009	0.017	0.075
Total Xylenes	0.002	0.009	0.056	0.25

TOTAL PETROLEUM HYDROCARBONS

GC/FID

(Quantitated as Jet Fuel)

File Name:	6112709	Date of Collection:	11/15/95
Dil. Factor:	2.0	Date of Analysis:	11/27/95

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	0.020	0.13	13	84
C2 - C4** Hydrocarbons	0.020	0.037	0.83	1.5

*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: MG-ICE Stack-1

ID#: 9511170-05A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6112711	Date of Collection:	11/15/95
Dil. Factor:	4.1	Date of Analysis:	11/27/95

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.004	0.013	Not Detected	Not Detected
Toluene	0.004	0.016	Not Detected	Not Detected
Ethyl Benzene	0.004	0.018	Not Detected	Not Detected
Total Xylenes	0.004	0.018	Not Detected	Not Detected

TOTAL PETROLEUM HYDROCARBONS

GC/FID

(Quantitated as Jet Fuel)

File Name:	6112711	Date of Collection:	11/15/95
Dil. Factor:	4.1	Date of Analysis:	11/27/95

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	0.041	0.27	1.1	7.1
C2 - C4** Hydrocarbons	0.041	0.075	0.17	0.31

*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: MG-ICE Stack-2

ID#: 9511170-06A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6112712	Date of Collection:	11/15/95
Dil. Factor:	2.0	Date of Analysis:	11/27/95

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.002	0.006	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	Not Detected	Not Detected

TOTAL PETROLEUM HYDROCARBONS

GC/FID

(Quantitated as Jet Fuel)

File Name:	6112712	Date of Collection:	11/15/95
Dil. Factor:	2.0	Date of Analysis:	11/27/95

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	0.020	0.13	1.4	9.1
C2 - C4** Hydrocarbons	0.020	0.037	0.23	0.42

*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#: 9511170-07A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6112705	Date of Collection:	NA
Dil. Factor:	1.0	Date of Analysis:	11/27/95

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:	6112705	Date of Collection:	NA
Dil. Factor:	1.0	Date of Analysis:	11/27/95

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	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

APPENDIX C
OPERATIONAL DATA FOR THE ICE

V.R.SYSTEMS INC.

MODEL V3 S/N 182
PERMIT NO.

ENGINE RPM	TEMPERATURE COOLANT OIL EXHAUST	OIL PSI	POSITIONS CARB. BYPASS	WELL FLOW CFM-VAC.H2O	BATTERY VOLTS	DUTY CYCLE	PERCENT OXYGEN	AUXILIARY FUEL CFM THOUSANDS-UNITS	ENGINE HOURS
11/12/95 12:32:03	UNIT 182								
100 2447.	162.F 163.F	916.F	47. 20.8 -0.6	38. -3.	14.3	38.5	0.623	2.59 21	463 185.
11/12/95 12:33:11	UNIT 182								
100 2290.	162.F 163.F	928.F	47. OVRNG -0.7	53. -3.	14.5	39.5	0.621	1.88 21	465 185.
11/12/95 12:54:11	UNIT 182								
100 2263.	162.F 164.F	924.F	47. -0.2 13.5	116. -5.	14.5	40.2	0.620	2.08 21	510 186.
11/12/95 13:50:37	UNIT 182								
100 2235.	163.F 167.F	924.F	47. -0.2 13.5	116. -4.	14.4	38.3	0.623	2.06 21	630 187.
11/12/95 20:03:33	UNIT 182								
100 2254.	164.F 167.F	921.F	47. -0.4 13.5	116. -1.	14.1	40.7	0.619	2.09 22	415 193.
11/13/95 09:24:48	UNIT 182								
100 2223.	163.F 168.F	930.F	47. -0.5 13.8	117. 0.	14.2	39.3	0.621	2.06 24	103 206.

VACUUM ENHANCED TEST

11/12/95 11:16

TO

11/16/95 13:15

ICE RESULTS

(VR times ^{ahead} ~~over~~ 67 1 hour)

UNDEP/ANST

11/13/95 11:37:38 UNIT 182																
100	2250.	162.F	170.F	932.F	47.	-0.7	13.9	117.	0.	14.2	40.5	0.619	2.06	24	386	208.
11/13/95 11:43:41 UNIT 182																
100	2239.	163.F	170.F	934.F	47.	-0.7	13.9	117.	0.	14.1	42.1	0.616	2.06	24	399	208.
11/13/95 12:00:00 UNIT 182																
100	2220.	163.F	171.F	933.F	47.	-0.7	13.9	118.	0.	13.9	41.6	0.617	2.07	24	433	209.
11/13/95 12:58:11 UNIT 182																
100	2243.	163.F	172.F	937.F	47.	-0.8	14.0	118.	0.	13.9	42.9	0.614	2.09	24	556	210.
11/13/95 13:00:00 UNIT 182																
100	2261.	163.F	173.F	938.F	47.	-0.8	14.0	118.	1.	13.8	43.3	0.613	2.08	24	560	210.
11/13/95 14:00:00 UNIT 182																
100	2246.	164.F	173.F	938.F	47.	-0.8	14.0	118.	0.	13.8	42.3	0.615	2.08	24	688	211.
11/13/95 14:02:44 UNIT 182																
100	1766.	162.F	171.F	924.F	47.	OVRNG	3.6	73.	2.	13.9	42.3	0.615	1.80	24	693	211.
11/13/95 14:03:33 UNIT 182																
100	1770.	161.F	169.F	901.F	47.	OVRNG	3.6	72.	2.	13.9	45.5	0.609	1.46	24	695	211.
11/13/95 14:04:39 UNIT 182																
100	1705.	161.F	168.F	887.F	47.	OVRNG	2.2	68.	2.	13.7	45.3	0.609	1.39	24	696	211.
11/13/95 14:05:45 UNIT 182																
100	1582.	161.F	166.F	873.F	47.	OVRNG	0.8	64.	2.	13.8	43.5	0.613	1.26	24	698	211.
11/13/95 14:07:24 UNIT 182																
100	1589.	160.F	163.F	853.F	47.	OVRNG	0.8	63.	2.	13.8	45.3	0.609	1.19	24	700	211.
11/13/95 14:09:09 UNIT 182																
100	1604.	160.F	162.F	841.F	47.	OVRNG	0.8	64.	2.	13.8	45.2	0.610	1.20	24	702	211.
11/13/95 14:11:51 UNIT 182																
100	1606.	160.F	159.F	840.F	47.	OVRNG	0.8	64.	2.	13.8	46.9	0.606	1.22	24	705	211.
11/13/95 14:12:19 LIMIT 302 OIL PSI 28. LOW OIL PSI SD UNIT 182																
11/13/95 14:12:20 LIMIT 414 ENG TMR OVRNG ENGINE FAILED ALARM UNIT 182																
JESTART AT: 11/13/95 14:15:40 (11/13/95 14:14:20) S5245 V2.23 .																
11/13/95 14:15:43 UNIT 182																
100	0.	179.F	138.F	535.F	0.	-2.2	-25.0	0.	-394.	0.0	0.1	0.700	0.00	24	706	211.
JESTART AT: 11/13/95 14:16:35 (11/13/95 14:16:12) S5245 V2.23 .																
11/13/95 14:16:38 UNIT 182																

ESTART AT: 11/13/95 14:17:22 (11/13/95 14:18:33) S5245 V2.23 .
11/13/95 14:17:25 UNIT 182
100 . 0. 175.F 145.F 508.F 8. -2.1 -25.0 0. -393. 0.0 0.1 0.700 0.00 24 706 211.
ESTART AT: 11/13/95 14:17:53 (11/13/95 14:17:31) S5245 V2.23 .
11/13/95 14:17:56 UNIT 182
100 0. 173.F 141.F 481.F 100. -2.0 -25.0 0. -393. 0.0 0.1 0.700 0.00 24 706 211.
ESTART AT: 11/13/95 14:18:48 (11/13/95 14:18:13) S5245 V2.23 .
11/13/95 14:18:51 UNIT 182
100 0. 170.F 144.F 485.F 8. -2.0 -25.0 0. -393. 0.0 0.1 0.700 0.00 24 706 211.
ESTART AT: 11/13/95 14:20:05 (11/13/95 14:19:11) S5245 V2.23 .

V.R.SYSTEMS INC.

MODEL V3 S/N 182
PERMIT NO.

ENGINE RPM	TEMPERATURE COOLANT OIL EXHAUST	OIL PSI	POSITIONS CARB. BYPASS	WELL FLOW CFM-VAC.H2O	BATTERY VOLTS	DUTY CYCLE	PERCENT OXYGEN	AUXILIARY FUEL CFM THOUSANDS-UNITS	ENGINE HOURS
11/13/95 14:20:08 UNIT 182									
100	0. 166.F 138.F 467.F	23.	-2.1 -25.0	0. -393.	0.0	0.1	0.700	0.00	211.
RESTART AT: 11/13/95 14:20:44 (11/13/95 14:20:20) S5245 V2.23 .									
11/13/95 14:20:47 UNIT 182									
100	0. 166.F 133.F 437.F	100.	-1.9 -25.0	0. -392.	0.0	0.1	0.700	0.00	211.
RESTART AT: 11/13/95 14:22:00 (11/13/95 14:21:07) S5245 V2.23 .									
11/13/95 14:22:03 UNIT 182									
100	0. 164.F 135.F 450.F	9.	-2.0 -25.0	0. -392.	0.0	0.1	0.700	0.00	211.
RESTART AT: 11/13/95 14:22:53 (11/13/95 14:22:19) S5245 V2.23 .									
11/13/95 14:22:56 UNIT 182									
100	0. 165.F 139.F 449.F	13.	-2.0 -25.0	0. -392.	0.0	0.1	0.700	0.00	211.
RESTART AT: 11/13/95 14:26:42 (11/13/95 14:23:16) S5245 V2.23 .									
11/13/95 14:26:45 UNIT 182									
100	0. 159.F 117.F 349.F	22.	-2.0 -25.0	0. -391.	0.0	0.1	0.700	0.00	211.
RESTART AT: 11/13/95 14:29:44 (11/13/95 14:27:04) S5245 V2.23 .									
11/13/95 14:29:47 UNIT 182									
100	0. 156.F 112.F 319.F	7.	-2.0 -25.0	0. -391.	0.0	0.1	0.700	0.00	211.
RESTART AT: 11/13/95 14:31:37 (11/13/95 14:30:14) S5245 V2.23 .									
11/13/95 14:31:40 UNIT 182									
100	0. 155.F 116.F 315.F	8.	-2.0 -25.0	0. -391.	0.0	0.1	0.700	0.00	211.
RESTART AT: 11/13/95 14:35:56 (11/13/95 14:32:40) S5245 V2.23 .									
11/13/95 14:35:59 UNIT 182									
100	0. 150.F 97.F 273.F	0.	-1.9 -25.0	0. -391.	0.0	0.1	0.700	0.00	211.
RESTART AT: 11/13/95 15:10:56 (11/13/95 14:36:31) S5245 V2.23 .									
11/13/95 15:10:59 UNIT 182									
100	0. 116.F 63.F 136.F	29.	-25.0 -25.0	0. -388.	0.0	0.1	0.700	0.00	211.
11/13/95 15:12:30 UNIT 182									
100	692. 114.F 109.F 247.F	41.	7.4 -0.7	0. -1.	12.7	99.9	0.500	0.00	211.
11/13/95 15:15:02 UNIT 182									
100	1838. 130.F 120.F 552.F	47.	23.3 -0.6	0. -0.	14.4	10.8	0.678	0.00	211.
RESTART AT: 11/13/95 16:26:04 (11/13/95 16:26:04) S5245 V2.23 .									
11/13/95 18:36:04 LIMIT 110 BATTERY 0.0 LOW BATT. VOLT ALARM 707 UNIT 182									
11/13/95 18:36:04 LIMIT 414 ENG TMR 4451. ENGINE FAILED ALARM UNIT 182									
11/13/95 18:36:04 UNIT 182									
100	0. 99.F 73.F 62.F	61.	-25.0 -25.0	0. -387.	0.0	0.1	0.700	0.00	212.
11/13/95 18:38:55 UNIT 182									
100	1813. 125.F 95.F 605.F	47.	23.6 -0.5	0. -1.	14.4	10.9	0.678	0.00	212.
11/13/95 19:01:14 UNIT 182									
100	1861. 156.F 158.F 834.F	53.	18.9 -0.5	0. 1.	14.1	50.2	0.600	0.00	213.
11/13/95 19:02:32 UNIT 182									
100	2087. 158.F 158.F 854.F	53.	20.6 -0.5	0. 1.	14.1	39.7	0.621	1.07	213.
11/13/95 19:03:07 UNIT 182									
100	2249. 160.F 159.F 883.F	53.	21.8 -0.5	0. 1.	14.1	42.9	0.614	2.35	213.
11/13/95 19:08:21 UNIT 182									
100	2438. 161.F 164.F 947.F	53.	22.1 -0.6	42. 1.	14.1	38.5	0.623	2.07	213.
11/13/95 19:10:38 UNIT 182									
100	2288. 161.F 166.F 947.F	53.	13.7 2.9	65. 0.	14.2	41.0	0.618	2.37	213.
11/13/95 20:00:00 UNIT 182									
100	2244. 162.F 171.F 931.F	52.	-0.2 13.3	115. 0.	14.1	41.9	0.616	2.24	214.
11/13/95 21:00:00 UNIT 182									

11/13/95 23:00:00 UNIT 182
 100 2251. 163.F 171.F 928.F 52. -0.2 13.3 115. -0. 14.1 39.9 0.620 2.24 25 120 216.

V.R.SYSTEMS INC.

MODEL V3 S/N 182
 PERMIT NO.

ENGINE RPM	TEMPERATURE COOLANT OIL EXHAUST	OIL PSI	POSITIONS CARB. BYPASS	WELL FLOW CFM-VAC.H2O	BATTERY VOLTS	DUTY CYCLE	PERCENT OXYGEN	AUXILIARY FUEL CFM THOUSANDS-UNITS	ENGINE HOURS
11/13/95 23:00:00 UNIT 182									
100 2239.	163.F 172.F	928.F 52.	-0.2 13.3	115. -0.	14.1	40.5	0.619	2.26 25	257 217.
11/14/95 00:00:00 UNIT 182									
100 2238.	163.F 171.F	929.F 52.	-0.2 13.3	115. -1.	14.1	39.5	0.621	2.24 25	395 218.
11/14/95 01:00:00 UNIT 182									
100 2241.	163.F 172.F	928.F 52.	-0.2 13.3	115. -1.	14.1	41.1	0.618	2.25 25	533 219.
11/14/95 02:00:00 UNIT 182									
100 2240.	163.F 171.F	928.F 52.	-0.2 13.3	115. -1.	14.1	41.1	0.618	2.25 25	671 220.
11/14/95 03:00:00 UNIT 182									
100 2236.	163.F 172.F	928.F 52.	-0.2 13.3	115. -1.	14.1	40.3	0.619	2.25 25	810 221.
11/14/95 04:00:00 UNIT 182									
100 2232.	164.F 172.F	926.F 52.	-0.3 13.3	115. -2.	14.1	41.6	0.617	2.25 25	948 222.
11/14/95 05:00:00 UNIT 182									
100 2231.	163.F 172.F	927.F 52.	-0.2 13.3	115. -2.	14.1	40.6	0.619	2.25 26	86 223.

100	2241.	163.F	173.F	927.F	52.	-0.3	13.3	115.	-2.	14.1	41.7	0.617	2.24	26	224	224.
11/14/95 07:00:00	UNIT 182															
100	- 2228.	163.F	172.F	927.F	52.	-0.3	13.3	115.	-2.	14.1	41.9	0.616	2.29	26	364	225.
11/14/95 08:00:00	UNIT 182															
100	2232.	163.F	172.F	929.F	52.	-0.3	13.3	115.	-3.	14.1	40.3	0.619	2.27	26	503	226.
11/14/95 09:00:00	UNIT 182															
100	2262.	164.F	174.F	927.F	52.	-0.3	13.1	114.	-3.	14.0	40.1	0.620	2.62	26	644	227.
11/14/95 10:00:00	UNIT 182															
100	2261.	163.F	174.F	921.F	52.	-0.3	12.9	114.	-4.	14.0	43.8	0.612	2.59	26	803	228.
11/14/95 11:00:00	UNIT 182															
100	2214.	163.F	174.F	924.F	52.	-0.3	12.9	114.	-4.	14.0	43.4	0.613	2.44	26	962	229.
11/14/95 12:00:00	UNIT 182															
100	2251.	163.F	175.F	946.F	52.	-0.3	14.2	118.	-5.	14.0	43.9	0.612	2.23	27	103	230.
11/14/95 13:00:00	UNIT 182															
100	2261.	163.F	175.F	941.F	52.	-0.3	14.2	118.	-5.	14.1	41.7	0.617	2.36	27	245	231.
11/14/95 14:00:00	UNIT 182															
100	2262.	163.F	174.F	940.F	52.	-0.3	14.2	117.	-6.	14.1	41.4	0.617	2.37	27	390	232.
11/14/95 15:00:00	UNIT 182															
100	2253.	163.F	174.F	940.F	52.	-0.3	14.2	117.	-7.	14.1	44.2	0.612	2.39	27	537	233.
11/14/95 16:00:00	UNIT 182															
100	2270.	163.F	175.F	938.F	52.	-0.3	14.2	117.	-8.	14.1	43.4	0.613	2.45	27	683	234.
11/14/95 17:00:00	UNIT 182															
100	2262.	163.F	174.F	939.F	52.	-0.3	14.1	117.	-8.	14.0	44.0	0.612	2.37	27	829	235.
11/14/95 18:00:00	UNIT 182															
100	2257.	163.F	174.F	935.F	52.	-0.3	14.1	117.	-9.	14.1	42.9	0.614	2.42	27	976	236.
11/14/95 19:00:00	UNIT 182															
100	2251.	163.F	174.F	937.F	52.	-0.3	14.1	116.	-9.	14.1	43.3	0.613	2.38	28	122	237.
11/14/95 20:00:00	UNIT 182															
100	2249.	163.F	174.F	935.F	52.	-0.3	14.1	116.	-10.	14.1	41.6	0.617	2.38	28	268	238.
11/14/95 21:00:00	UNIT 182															
100	2247.	164.F	174.F	935.F	52.	-0.3	14.1	116.	-11.	14.0	43.5	0.613	2.39	28	415	239.
11/14/95 22:00:00	UNIT 182															
100	2235.	164.F	174.F	938.F	52.	-0.3	14.1	116.	-11.	14.0	43.9	0.612	2.37	28	561	240.
11/14/95 23:00:00	UNIT 182															
100	2242.	164.F	177.F	945.F	52.	-0.1	14.6	118.	-10.	13.8	43.8	0.612	2.41	28	707	241.
11/15/95 00:00:00	UNIT 182															
100	2233.	164.F	178.F	954.F	52.	-0.6	15.0	119.	-11.	13.7	47.9	0.604	2.45	28	858	242.
11/15/95 01:00:00	UNIT 182															
100	2253.	163.F	176.F	953.F	52.	-0.6	14.9	119.	-11.	13.8	46.2	0.608	2.41	29	7	243.
11/15/95 02:00:00	UNIT 182															
100	2268.	161.F	172.F	945.F	52.	-0.6	14.9	119.	-11.	14.1	42.1	0.616	2.38	29	154	244.

V.R.SYSTEMS INC.

MODEL V3 S/N 182
PERMIT NO.

ENGINE	TEMPERATURE	OIL	POSITIONS	WELL FLOW	BATTERY	DUTY	PERCENT	AUXILIARY FUEL	ENGINE							
RPM	COOLANT	OIL	CARB. BYPASS	CFM-VAC.H2O	VOLTS	CYCLE	OXYGEN	CFM THOUSANDS-UNITS	HOURS							
11/15/95 03:00:00	UNIT 182															
100	2247.	162.F	172.F	946.F	52.	-0.6	14.9	119.	-11.	14.0	43.4	0.613	2.39	29	300	245.
11/15/95 04:00:00	UNIT 182															
100	2248.	162.F	171.F	944.F	52.	-0.6	14.9	120.	-11.	14.1	41.5	0.617	2.36	29	446	246.
11/15/95 05:00:00	UNIT 182															
100	2264.	162.F	171.F	942.F	52.	-0.5	15.0	120.	-11.	14.1	42.9	0.614	2.36	29	592	247.
11/15/95 06:00:00	UNIT 182															
100	2270.	162.F	172.F	940.F	52.	-0.5	14.9	120.	-11.	14.1	40.3	0.619	2.38	29	737	248.
11/15/95 07:00:00	UNIT 182															
100	2252.	162.F	170.F	935.F	52.	-0.3	14.7	119.	-11.	14.2	41.2	0.618	2.35	29	882	249.
11/15/95 08:00:00	UNIT 182															
100	2257.	162.F	170.F	934.F	52.	-0.3	14.7	119.	-11.	14.3	41.5	0.617	2.33	30	26	250.
11/15/95 09:00:00	UNIT 182															
100	2266.	162.F	170.F	935.F	52.	-0.3	14.7	119.	-11.	14.0	40.7	0.610	2.35	30	170	251.

11/15/95 11:00:00	UNIT 182	100	2260.	162.F	170.F	936.F	52.	-0.0	14.7	119.	-10.	14.3	41.7	0.617	2.35	30	457	253.
11/15/95 12:00:00	UNIT 182	100	2267.	162.F	170.F	937.F	53.	-0.3	14.8	118.	-10.	14.3	42.0	0.616	2.35	30	603	254.
11/15/95 13:00:00	UNIT 182	100	2278.	162.F	170.F	936.F	53.	-0.3	14.8	118.	-9.	14.3	40.7	0.619	2.36	30	746	255.
11/15/95 14:00:00	UNIT 182	100	2273.	162.F	170.F	937.F	53.	-0.1	14.8	119.	-9.	14.3	41.4	0.617	2.35	30	890	256.
11/15/95 15:00:00	UNIT 182	100	2329.	163.F	172.F	950.F	53.	OVRNG	16.0	124.	-8.	14.4	40.0	0.620	2.45	31	40	257.
11/15/95 16:00:00	UNIT 182	100	2257.	162.F	171.F	933.F	53.	-0.5	14.5	119.	-7.	14.3	39.3	0.621	2.31	31	183	258.
11/15/95 17:00:00	UNIT 182	100	2247.	163.F	171.F	933.F	53.	-0.5	14.5	119.	-6.	14.2	40.7	0.619	2.31	31	325	259.
11/15/95 18:00:00	UNIT 182	100	2237.	163.F	171.F	935.F	53.	-0.5	14.5	118.	-6.	14.2	40.2	0.620	2.32	31	467	260.
11/15/95 19:00:00	UNIT 182	100	2239.	163.F	171.F	934.F	53.	-0.5	14.5	119.	-5.	14.3	40.5	0.619	2.29	31	608	261.
11/15/95 20:00:00	UNIT 182	100	2246.	162.F	170.F	934.F	53.	-0.5	14.5	119.	-5.	14.3	42.0	0.616	2.31	31	749	262.
11/15/95 21:00:00	UNIT 182	100	2251.	163.F	170.F	938.F	53.	-0.5	14.5	119.	-4.	14.2	40.3	0.619	2.28	31	890	263.
11/15/95 22:00:00	UNIT 182	100	2249.	162.F	170.F	934.F	53.	-0.4	14.5	119.	-4.	14.3	41.2	0.618	2.30	32	31	264.
11/15/95 23:00:00	UNIT 182	100	2251.	162.F	170.F	936.F	53.	-0.1	14.5	118.	-3.	14.3	39.1	0.622	2.30	32	172	265.
11/16/95 00:00:00	UNIT 182	100	2266.	163.F	170.F	938.F	53.	-0.4	14.5	119.	-3.	14.2	39.5	0.621	2.29	32	314	266.
11/16/95 01:00:00	UNIT 182	100	2263.	162.F	170.F	938.F	53.	-0.4	14.5	119.	-3.	14.3	38.9	0.622	2.31	32	455	267.
11/16/95 02:00:00	UNIT 182	100	2253.	163.F	170.F	940.F	53.	-0.3	14.5	119.	-3.	14.3	39.4	0.621	2.30	32	597	268.
11/16/95 03:00:00	UNIT 182	100	2249.	163.F	170.F	939.F	53.	-0.2	14.5	119.	-2.	14.3	39.9	0.620	2.30	32	738	269.
11/16/95 04:00:00	UNIT 182	100	2262.	163.F	170.F	940.F	53.	-0.4	14.5	119.	-2.	14.3	39.0	0.622	2.30	32	880	270.
11/16/95 05:00:00	UNIT 182	100	2249.	162.F	171.F	939.F	53.	-0.1	14.4	119.	-2.	14.3	39.0	0.622	2.29	33	21	271.
11/16/95 06:00:00	UNIT 182	100	2254.	163.F	171.F	942.F	53.	-0.7	14.6	120.	-2.	14.2	39.0	0.622	2.32	33	163	272.

V.R.SYSTEMS INC.

MODEL V3 S/N 182
PERMIT NO.

ENGINE RPM	TEMPERATURE COOLANT OIL EXHAUST	OIL PSI	POSITIONS CARB. BYPASS	WELL FLOW CFM-VAC.H2O	BATTERY VOLTS	DUTY CYCLE	PERCENT OXYGEN	AUXILIARY FUEL CFM THOUSANDS-UNITS	ENGINE HOURS									
11/16/95 07:00:00	UNIT 182	100	2246.	163.F	171.F	943.F	53.	-0.7	14.6	119.	-2.	14.3	39.0	0.622	2.30	33	305	273.
11/16/95 08:00:00	UNIT 182	100	2265.	163.F	173.F	940.F	53.	-0.3	14.5	119.	-2.	14.3	40.0	0.620	2.31	33	447	274.
11/16/95 09:00:00	UNIT 182	100	2249.	163.F	174.F	941.F	53.	-0.2	14.5	119.	-1.	14.3	39.9	0.620	2.29	33	588	275.
11/16/95 10:00:00	UNIT 182	100	2245.	163.F	172.F	938.F	53.	-0.2	14.5	120.	-1.	14.2	39.5	0.621	2.28	33	728	276.
11/16/95 11:00:00	UNIT 182	100	2214.	163.F	171.F	941.F	53.	-0.2	14.5	119.	-1.	14.2	39.4	0.621	2.27	33	867	277.
11/16/95 12:00:00	UNIT 182	100	2227.	163.F	172.F	941.F	53.	-0.2	14.5	120.	-2.	14.2	40.2	0.620	2.28	34	7	278.
11/16/95 13:00:00	UNIT 182	100	2226.	164.F	172.F	940.F	53.	-0.2	14.5	120.	-2.	14.3	40.2	0.620	2.29	34	146	279.

100	2245.	163.F	171.F	937.F	53.	-0.1	14.5	119.	-2.	14.5	39.2	0.617	2.28	34	288	280.
11/16/95 14:00:52 UNIT 182																
100	2230.	163.F	171.F	938.F	53.	-0.1	14.5	119.	-2.	14.4	39.2	0.622	2.27	34	288	280.
11/16/95 14:02:37 UNIT 182																
100	2152.	163.F	171.F	928.F	53.	-0.1	13.0	115.	-2.	14.3	41.9	0.616	2.15	34	292	280.
11/16/95 14:03:31 UNIT 182																
100	2182.	163.F	170.F	922.F	53.	3.7	10.3	102.	-1.	14.3	41.1	0.618	2.14	34	294	280.
11/16/95 14:04:16 UNIT 182																
100	2199.	163.F	170.F	928.F	53.	8.4	7.4	87.	-0.	14.3	39.6	0.621	2.20	34	296	280.
11/16/95 14:05:04 UNIT 182																
100	2203.	163.F	170.F	929.F	53.	12.8	3.0	66.	0.	14.3	39.4	0.621	2.21	34	298	280.
11/16/95 14:05:34 UNIT 182																
100	2212.	162.F	171.F	928.F	53.	15.0	-0.3	54.	0.	14.3	40.6	0.619	2.22	34	299	280.
11/16/95 14:06:03 UNIT 182																
100	2216.	163.F	170.F	929.F	53.	15.2	-0.4	54.	1.	14.3	40.0	0.620	2.23	34	300	280.
11/16/95 14:06:40 UNIT 182																
100	2073.	163.F	170.F	929.F	53.	13.1	-0.4	56.	1.	14.3	42.1	0.616	2.22	34	301	280.
11/16/95 14:07:55 UNIT 182																
100	1841.	161.F	168.F	884.F	53.	9.3	-0.4	58.	1.	14.4	41.6	0.617	1.72	34	303	280.
11/16/95 14:08:04 UNIT 182																
100	1851.	161.F	168.F	880.F	53.	9.3	-0.4	58.	0.	14.4	41.1	0.618	1.70	34	304	280.
11/16/95 14:10:02 UNIT 182																
100	1759.	161.F	164.F	828.F	53.	18.5	-0.4	0.	1.	14.4	49.1	0.602	0.00	34	306	280.
11/16/95 14:10:17 UNIT 182																
100	1528.	161.F	164.F	821.F	53.	15.9	-0.5	0.	1.	14.4	47.8	0.604	0.00	34	306	280.
ESTART AT: 11/17/95 16:13:34 (11/16/95 14:21:13) S5245 V2.23 .																
11/17/95 16:13:37 LIMIT 414 ENG TMR OVRNG ENGINE FAILED ALARM UNIT 182																
11/17/95 16:13:37 UNIT 182																
100	2.	43.F	47.F	46.F	44.	10.9	-0.3	0.	-1.	12.6	99.9	0.500	0.00	34	306	280.
ESTART AT: 11/17/95 16:15:39 (11/17/95 16:13:50) S5245 V2.23 .																
11/17/95 16:15:42 UNIT 182																
100	1.	43.F	47.F	46.F	0.	10.9	-0.3	0.	-0.	12.6	99.9	0.500	0.00	34	306	280.
ESTART AT: 11/17/95 16:21:00 (11/17/95 16:16:00) S5245 V2.23 .																
11/17/95 16:21:03 UNIT 182																
100	2.	43.F	49.F	46.F	2.	11.4	-0.3	0.	-0.	12.7	99.9	0.500	0.00	34	306	280.
ESTART AT: 11/17/95 16:24:19 (11/17/95 16:21:37) S5245 V2.23 .																
11/17/95 16:24:22 UNIT 182																
100	2.	43.F	50.F	46.F	0.	13.5	-0.3	0.	0.	12.7	99.9	0.500	0.00	34	306	280.
RESTART AT: 11/17/95 16:26:57 (11/17/95 16:24:38) S5245 V2.23 .																
11/17/95 16:27:00 UNIT 182																
100	2.	44.F	51.F	46.F	18.	14.6	-0.3	0.	-0.	12.7	99.9	0.500	0.00	34	306	280.

11/18/95 07:00:00 UNIT 182
 100 2260. 163.F 173.F 943.F 47. -0.3 14.6 119. -0. 14.2 41.9 0.616 2.64 36 431 294.
 11/18/95 08:00:00 UNIT 182
 100 2255. 163.F 173.F 942.F 47. -0.3 14.7 119. -0. 14.2 40.7 0.619 2.61 36 591 295.
 11/18/95 09:00:00 UNIT 182
 100 2272. 163.F 172.F 934.F 47. -0.3 14.0 116. 0. 14.2 39.1 0.622 2.64 36 751 296.
 11/18/95 09:16:05 UNIT 182
 100 2219. 163.F 172.F 917.F 47. 14.2 -0.6 53. 3. 14.3 40.5 0.619 2.54 36 793 297.
 11/18/95 09:16:54 UNIT 182
 100 1941. 162.F 171.F 910.F 47. 9.4 -0.6 57. 3. 14.2 43.1 0.614 2.41 36 795 297.
 11/18/95 09:17:06 UNIT 182
 100 1879. 162.F 170.F 902.F 47. 8.4 -0.6 57. 3. 14.3 42.4 0.615 2.35 36 795 297.
 11/18/95 09:18:00 LIMIT 414 ENG TMR 60077. ENGINE FAILED ALARM UNIT 182
 11/18/95 09:18:00 LIMIT 302 OIL PSI 25. LOW OIL PSI SD UNIT 182
 2. ESTART AT: 11/18/95 17:20:02 (11/18/95 09:18:09) S5245 V2.23 .
 11/18/95 17:20:05 UNIT 182
 100 2. 52.F 47.F 45.F 0. 9.9 -0.5 0. -2. 12.5 99.9 0.500 2.00 36 797 297.
 2. ESTART AT: 11/18/95 17:23:11 (11/18/95 17:21:56) S5245 V2.23 .

ENGINE RPM	TEMPERATURE			OIL	POSITIONS		WELL FLOW	BATTERY	DUTY	PERCENT	AUXILIARY FUEL		ENGINE			
	COOLANT	OIL	EXHAUST	PSI	CARB.	BYPASS	CFM-VAC.H2O	VOLTS	CYCLE	OXYGEN	CFM	THOUSANDS-UNITS	HOURS			
11/18/95 20:58:54 UNIT 182																
100	2.	48.F	44.F	43.F	0.	23.4	-0.6	0.	-2.	12.6	99.9	0.500	0.00	36	797	297.
RESTART AT: 11/18/95 20:59:52 (11/18/95 20:59:16) S5245 V2.23																
11/18/95 20:59:55 UNIT 182																
100	2.	48.F	45.F	43.F	6.	23.4	-0.6	0.	-1.	12.5	99.9	0.500	0.00	36	797	297.
RESTART AT: 11/18/95 21:02:55 (11/18/95 21:00:25) S5245 V2.23																
11/18/95 21:02:58 UNIT 182																
100	2.	48.F	45.F	43.F	11.	23.5	-0.6	0.	-2.	12.6	99.9	0.500	0.00	36	797	297.
RESTART AT: 11/18/95 21:04:14 (11/18/95 21:03:19) S5245 V2.23																
11/18/95 21:04:17 UNIT 182																
100	2.	48.F	45.F	44.F	27.	23.5	-0.6	0.	-2.	12.6	99.9	0.500	0.00	36	797	297.
RESTART AT: 11/18/95 21:04:58 (11/18/95 21:04:27) S5245 V2.23																
11/18/95 21:05:01 UNIT 182																
100	2.	48.F	45.F	44.F	2.	23.4	-0.6	0.	-1.	12.5	99.9	0.500	0.00	36	797	297.
RESTART AT: 11/18/95 21:07:31 (11/18/95 21:06:40) S5245 V2.23																
11/18/95 21:07:34 UNIT 182																
100	2.	48.F	45.F	44.F	20.	19.9	-0.6	0.	-1.	12.5	99.9	0.500	0.00	36	797	297.
RESTART AT: 11/18/95 21:09:53 (11/18/95 21:09:29) S5245 V2.23																
11/18/95 21:09:56 UNIT 182																
100	2.	48.F	45.F	44.F	0.	24.3	-0.6	0.	-1.	12.5	99.9	0.500	0.00	36	797	297.
RESTART AT: 11/18/95 21:10:56 (11/18/95 21:10:06) S5245 V2.23																
11/18/95 21:10:59 UNIT 182																
100	2.	48.F	45.F	44.F	11.	24.5	-0.6	0.	-1.	12.5	99.9	0.500	0.00	36	797	297.
RESTART AT: 11/18/95 21:11:44 (11/18/95 21:11:23) S5245 V2.23																
11/18/95 21:11:47 UNIT 182																
100	0.	48.F	45.F	44.F	4.	-25.0	-25.0	0.	-369.	0.0	0.1	0.700	0.00	36	797	297.
RESTART AT: 11/18/95 21:12:35 (11/18/95 21:12:02) S5245 V2.23																
11/18/95 21:12:38 UNIT 182																
100	2.	48.F	45.F	44.F	100.	24.5	-0.6	0.	-1.	12.5	99.9	0.500	0.00	36	797	297.
11/18/95 21:16:48 UNIT 182																
100	1387.	121.F	70.F	815.F	43.	25.3	-0.9	25.	-1.	13.8	10.8	0.678	0.00	36	797	297.
11/18/95 21:24:20 UNIT 182																
100	1621.	155.F	147.F	935.F	49.	26.8	-1.0	24.	0.	13.9	10.9	0.678	0.00	36	797	297.
11/18/95 22:00:00 UNIT 182																
100	2225.	161.F	171.F	934.F	47.	-2.4	14.3	118.	-2.	14.0	42.2	0.616	2.62	36	873	297.
11/18/95 23:00:00 UNIT 182																
100	2204.	163.F	174.F	941.F	47.	-2.4	14.4	119.	-3.	13.9	41.1	0.618	2.63	37	32	298.
11/19/95 00:00:00 UNIT 182																
100	2237.	164.F	176.F	942.F	47.	-2.4	14.7	120.	-2.	14.0	41.5	0.617	2.66	37	193	299.
11/19/95 01:00:00 UNIT 182																
100	2236.	163.F	175.F	941.F	47.	-2.4	14.7	119.	-2.	14.0	41.0	0.618	2.65	37	354	300.
11/19/95 02:00:00 UNIT 182																
100	2218.	163.F	174.F	940.F	47.	-2.4	14.7	119.	-4.	14.0	40.8	0.618	2.60	37	515	301.
11/19/95 03:00:00 UNIT 182																
100	2224.	163.F	173.F	942.F	47.	-2.4	15.0	120.	-3.	14.0	41.8	0.616	2.65	37	675	302.
11/19/95 04:00:00 UNIT 182																
100	2231.	163.F	174.F	941.F	47.	-2.4	15.0	120.	-4.	14.0	42.0	0.616	2.66	37	836	303.
11/19/95 05:00:00 UNIT 182																
100	2259.	164.F	175.F	945.F	47.	-2.4	15.2	121.	-4.	14.0	41.7	0.617	2.68	37	997	304.
11/19/95 06:00:00 UNIT 182																
100	2231.	163.F	173.F	943.F	47.	-2.4	15.2	121.	-3.	14.1	42.1	0.616	2.65	38	159	305.
11/19/95 07:00:00 UNIT 182																
100	2250.	162.F	173.F	944.F	47.	-2.4	15.2	121.	-3.	14.1	40.9	0.618	2.67	38	321	306.
11/19/95 08:00:00 UNIT 182																
100	2234.	163.F	172.F	941.F	47.	-2.4	15.2	121.	-3.	14.1	38.3	0.623	2.65	38	482	307.

V.R.SYSTEMS INC.

MODEL V3 S/N 182
PERMIT NO.

ENGINE RPM	TEMPERATURE COOLANT OIL EXHAUST	OIL PSI	POSITIONS CARB. BYPASS	WELL FLOW CFM-VAC.H2O	BATTERY VOLTS	DUTY CYCLE	PERCENT OXYGEN	AUXILIARY FUEL CFM THOUSANDS-UNITS	ENGINE HOURS
11/19/95 09:00:00 UNIT 182									
100 2248.	163.F 173.F 943.F	47.	-2.4 15.2	120.	-3.	14.1	40.3 0.619	2.65 38 643	308.
11/19/95 10:00:00 UNIT 182									
100 2225.	163.F 173.F 943.F	47.	-2.4 15.2	121.	-3.	14.0	39.8 0.620	2.66 38 805	309.
11/19/95 11:00:00 UNIT 182									
100 2215.	164.F 175.F 946.F	47.	-2.4 15.2	121.	-2.	14.0	39.9 0.620	2.63 38 966	310.
11/19/95 11:08:05 UNIT 182									
100 2228.	164.F 174.F 946.F	47.	-2.4 15.2	122.	-2.	14.0	41.9 0.616	2.65 38 987	311.
11/19/95 12:00:13 UNIT 182									
100 2253.	163.F 175.F 945.F	47.	-2.4 15.6	123.	-2.	13.9	25.9 0.648	2.69 39 125	311.
11/19/95 12:07:41 UNIT 182									
100 2170.	163.F 174.F 928.F	47.	14.8 -0.4	53.	1.	14.0	43.4 0.613	2.60 39 145	312.
11/19/95 12:07:55 UNIT 182									
100 2027.	162.F 174.F 927.F	47.	12.3 -0.4	55.	1.	13.8	45.1 0.610	2.55 39 146	312.
11/19/95 12:08:18 UNIT 182									
100 1853.	161.F 173.F 914.F	47.	9.4 -0.4	56.	1.	14.0	42.0 0.616	2.38 39 147	312.
11/19/95 12:39:46 LIMIT 414 ENS TMR 55624.			ENGINE FAILED ALARM	UNIT 182					

APPENDIX D
SYSTEM CHECKLIST

Checklist for System Shakedown

Site: McGuire AFB

Date: _____

Operator's Initials: _____

Equipment	Check if Okay	Comments
Liquid Ring Pump	✓	
Aqueous Effluent Transfer Pump	✓	
Oil/Water Separator	✓	
Vapor Flowmeter	✓	magnehelic gasses stuck. Replaced with new.
Fuel Flowmeter	✓	
Water Flowmeter	✓	Replaced battery
Emergency Shut off Float Switch		
Effluent Transfer Tank	✓	
Analytical Field Instrumentation		
GasTector™ O ₂ /CO ₂ Analyzer	✓	
TraceTector™ Hydrocarbon Analyzer	✓	
Oil/Water Interface Probe	✓	
Magnehelic Boards	✓	
Thermocouple Thermometer	✓	

APPENDIX E

DATA SHEETS FROM THE SHORT-TERM PILOT TEST

ATMOSPHERIC OBSERVATIONS

Site: McGuire AFB

Operators: _____

[illegible]

Baildown Test Record Sheet

Site: McGuire AFB

Well Identification: 08mw19

Well Diameter (OD/ID): 4"

Date at Start of Test: 11/9/95

Sampler's Initials: _____

Time at Start of Test: 2:18 (1418)

Initial Readings

Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)	Total Volume Bailed (L)
12.89	16.80	3.91	

Test Data

Sample Collection Time	Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)
1418	14.70	14.76	0.06
1419	14.42	14.57	0.15
1422	14.25	14.42	0.17
1431	13.94	14.25	0.31
1443	13.80	14.22	0.42
1451	13.75	14.25	0.50
1520	13.68	14.38	0.70
1608	13.62	14.52	0.90
1716	13.56	14.72	1.16
~~1942~~ 0744	13.47	15.0	1.53
0744	13.29	15.59	2.30

Baildown Test Record Sheet

Site: mcguire AFB

Well Identification: 08 MW12

Well Diameter (OD/ID): 4"

Date at Start of Test: 11/9/95

Sampler's Initials: _____

Time at Start of Test: 1445

Initial Readings

Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)	Total Volume Bailed (L)
13.15	16.11	2.96	

Test Data

Sample Collection Time	Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)
0 1445	15.13	15.33	0.20
1447	14.91	15.26	0.35
1450	14.75	15.16	0.41
1455	14.42	14.97	0.55
1516	13.90	14.57	0.67
1610	13.70	14.43	0.73
1717	13.67	14.47	0.80
1944	13.65	14.56	0.91
0745	13.60	14.65	1.05

Baildown Test Record Sheet

Site: McGuire AFB

Well Identification: 08mw51

Well Diameter (OD/ID): 4"

Date at Start of Test: 11/9/95

Sampler's Initials: _____

Time at Start of Test: 1538

Initial Readings

Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)	Total Volume Bailed (L)
13.39	17.32	3.93	

Test Data

Sample Collection Time	Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)
1538	16.37	16.45	0.08
1540	16.0	16.08	0.08
1549	15.22	15.33	0.11
1611	14.45	14.68	0.23
1720	14.27	14.52	0.25
1945	14.24	14.61	0.37
~~1947~~			
0747	14.18	14.78	0.60

Bioslurping Pilot Test
(Data Sheet 1)
Well Characteristics

Page ____ of ____

Site: McGuire AFB

Test Type (skimmer, bioslurper vacuum extraction, drawdown): Skimmer (48 hrs)

Depth to Groundwater: 15.59

Depth to Fuel: 13.29

Depth of Slurper Tube: 14.75' (initial)
13.97' (final)

Date at Start of Test: 11/10/95

Time at Start of Test: 0900

Operator's Initials: _____

Date/Time	Well ID: 08mW19			Well ID:			Well ID:		
	LNAPL Level	Water Level	Pressure (in H ₂ O)	LNAPL Level	Water Level	Pressure (in H ₂ O)	LNAPL Level	Water Level	Pressure (in H ₂ O)
⁰⁹⁰⁰ 11/10/95	13.29	15.59							
⁰⁹⁴⁵	13.97	13.98							
¹³⁴³	13.97	13.975							
⁰⁷⁴⁵ 11/11/95	13.59	14.2							
⁰⁸⁰⁰ 11/12/95	13.64	13.86							

**Bioslurping Pilot Test
(Data Sheet 1)
Well Characteristics**

Page of

Site: McGuire AFB

Test Type (skimmer, bioslurper vacuum extraction, drawdown): Vacuum Enhanced

Depth to Groundwater: 13.64'

Depth of Slurper Tube: 13' 11"

Date at Start of Test: 11/12/95

Time at Start of Test: 1115

Operator's Initials: SLJ

Date/Time	Well ID:			Well ID:			Well ID:		
	LNAPL Level	Water Level	Pressure (in H ₂ O)	LNAPL Level	Water Level	Pressure (in H ₂ O)	LNAPL Level	Water Level	Pressure (in H ₂ O)
¹⁰²⁵ 11/12/95	10.31	NA	NA						
¹³¹⁵ 11/12/95	10.39	NA	NA						
⁰⁸⁰⁶ 11/13/95	11.18	15.05	NA						
⁰⁷¹⁵ 11/14/95	10.2	14.37	NA						
²⁰⁰⁰ 11/15/95	9.76	13.81	0.075						
⁰⁸⁰⁰ 11/16/95	9.68	13.30	0						
¹³⁰⁰ 11/16/95	9.65	13.15	0.015						

Distance from well 08mw19 = 55'

Page ____ of ____

Test Type (skimmer, bioslurper vacuum extraction, drawdown): Skimmer (24 holes)

Depth to Groundwater: NA 15.58 Depth to Fuel: — Depth of Slurper Tube: 15.5' (initial)
13.2' (final)

Date at Start of Test: 11/16/95

Time at Start of Test: 1400

Operator's Initials:

[illegible]

Bioslurping Pilot Test
(Data Sheet 3)
Fuel and Water Recovery Data

Page ____ of ____

Site: McGuire AFB

Start Date: 11/10/95

Test Type: SKimmer (2 day)

Operators: _____

Date/Time	Run Time	LNAPL Recovery (L) (volume collected in time period)	Groundwater Recovery (L) (volume collected in time period)
9:00 11/10/95	0		
0930	30	18.5	4.5 L
1000	60	1.2	0.8 L
1015	75	0.4	1.8 L
1030	90	0.25	2.2 L
1120	140	1.25	6.9 L
1204	184	0.55	10.0 L
1245	225	0.50	7.5 L
1336	276	0.70	9.0 L
1422	322	0.40	7.5 L
1510	370	0.25	9.0 L
1630	450	0.90	14.0 L
2100	720	0.40 gal	5.7 gal
11/11/95			
0745		2 gal	25 gal
1630		1 gal	40 gal
11/12/95			
0645		1.2 gal	85 gal
TOTALS:		11.2 gal	175 gal

Bioslurping Pilot Test
(Data Sheet 3)
Fuel and Water Recovery Data

Page ___ of ___

Site: McGuire AFB

Start Date: 11/12/95

Test Type: Vacuum Enhanced

Operators: _____

Date/Time	Run Time	LNAPL Recovery (L) (volume collected in time period)	Groundwater Recovery (gal) (volume collected in time period)
11/12/95 ¹¹¹⁵	0		
1145	0.5	0.4	103
1215	1	0	67
1245	1.5	0	94
1315	2	0	92
1415	3	0	136
1815	7	0	824
2215	11	0	623
11/13/95 ⁰⁸⁰⁶	20.9	5	2316
1330	26.2	38.4 (From filter box and right side of separator. Accumulated during first 26 hours of test)	911
2045	29	4	NA
11/14/95 ⁰⁷¹⁵	39.5	28	1922
1020	42.6	89 (From filter tank)	NA
1600	48.2	10 (From left side of separator)	1229
2130	53.7	4	1251
11/15/95 ⁰⁷³⁰	63.7	35	2817
1000	66.2	40 (From filter box)	NA
2000	76.2	82 (75 L from filter box 10 L from right side of separator)	2101
11/16/95 ⁰⁸⁰⁰	84.2	10	2034
1300	89.2	65 (10 from right side of sep 45 from filter box)	713

Unless noted, product was recovered
from product storage compartment (right
side of separator)

SLURPPT.DS3 (G462201-1001 DISK)

Page ____ of ____

Start Date: 11/16/95

Operators: _____

[illegible]

Page ____ of ____

Start Date: 11/17/93

Operators: SR

[illegible]

Bioslurping Pilot Test
(Data Sheet 2)
Pilot Test Pumping Data

Page ___ of ___

Site: McGuire AFB

Start Date: 11/12/95

Operators: S.R. J.E.

Start Time: 1115

Test Type: Vacuum Enhanced

Well ID: 02mw19

Depth to Groundwater: 13.64'

Depth to Fuel: 13.86'

Depth of Tube: 13' 11"

Date/Time	Run Time	Vapor Extraction			Pump Stack Temp (°C)	Pump Head Vacuum (in. Hg)	Extraction Well Vacuum (in. H ₂ O) Hg
		Stack Pressure (in. H ₂ O)	Carbon Drums (in. H ₂ O)	Flowrate (scfm)			
¹¹¹⁵ 11/12/95	0						
1215	1	0.30			20.3	22	>60" H ₂ O
1245	1.5	0.35			21.0	24	12" Hg
1315	2	0.35			21.0	24	12"
1415	3	0.35			21.1	24	12
1815	7	0.35			20.0	25	12
2215	11	0.35			20.2	25	12.5
⁰⁸⁰⁶ 11/13/95	20.9	0.35				24	13
2045	29	0.40			22.0	26.5	13
⁰⁷⁴⁵ 11/14/95	39.5	0.40			16.4	26.5	13
1600	48.2	0.40				26	13
⁰⁷³⁰ 11/15/95	63.7	0.25			25.3	26	12
2000	76.2	0.20			28.3	26	12
⁰⁸⁰⁰ 11/16/95	84.2	0.20			28.2	26	12
1300	89.2	0.35			28.6	26	12

**Bioslurping Pilot Test
(Data Sheet 2)
Pilot Test Pumping Data**

Page of

Site: McGuire AFB

Start Date: 11/17/95

Operators: SR

Start Time: 1530

Test Type: Drawdown

Well ID: 08mw19

Depth to Groundwater: 13.24

Depth to Fuel: 13.23

Depth of Tube: 18.55' *

[illegible]

- * Includes 2.31' extension on casing to accommodate tee.

SLURPPT.DS2 (G462201-1001 DISK)

APPENDIX F
SOIL GAS PERMEABILITY TEST RESULTS

[illegible]

[illegible]

APPENDIX G
IN SITU RESPIRATION TEST RESULTS

In Situ Respiration Test

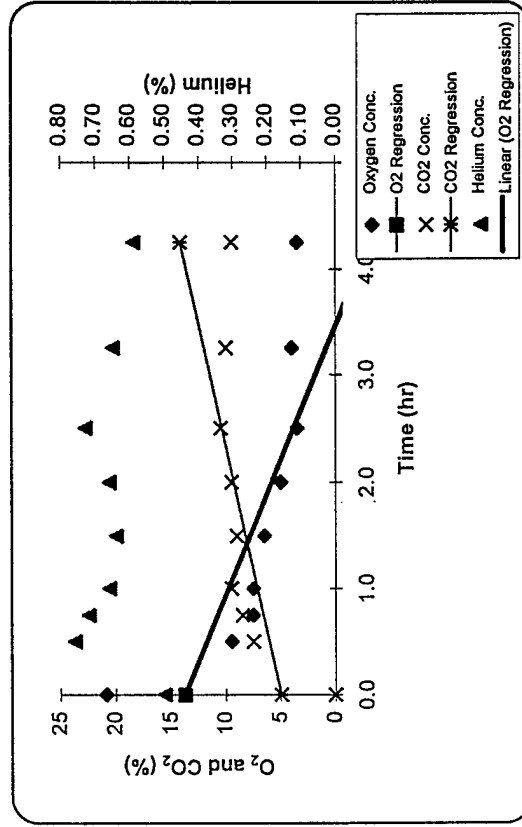
Site Name: McGuire AFB, NJ

Date: 12/22/95

Depth of M.P. (ft): 6

Monitoring Point: MPA-6

Date/Time (mm/dd/yr hr:min)	Time (hr)	Oxygen (%)	Carbon Dioxide (%)	Helium (%)
11/17/95 13:30	0.0	20.90	0.05	0.50
11/17/95 14:00	0.5	9.50	7.50	0.76
11/17/95 14:15	0.8	7.50	8.50	0.72
11/17/95 14:30	1.0	7.50	9.50	0.66
11/17/95 15:00	1.5	6.50	9.00	0.64
11/17/95 15:30	2.0	5.00	9.50	0.66
11/17/95 16:00	2.5	3.50	10.50	0.73
11/17/95 16:45	3.2	4.00	10.00	0.65
11/17/95 17:45	4.3	3.50	9.50	0.59



O₂ Utilization Rate

K_o 0.066 %/min
3.979 %/hr
95.497 %/day

Regression Lines	O ₂	CO ₂
Slope	-3.9790	2.1674
Intercept	13.7699	4.9531
Determination Coef.	0.6098	0.4936
No. of Data Points.	8	8

In Situ Respiration Test

Date: 12/27/95

Site Name: McGuire AFB, NJ

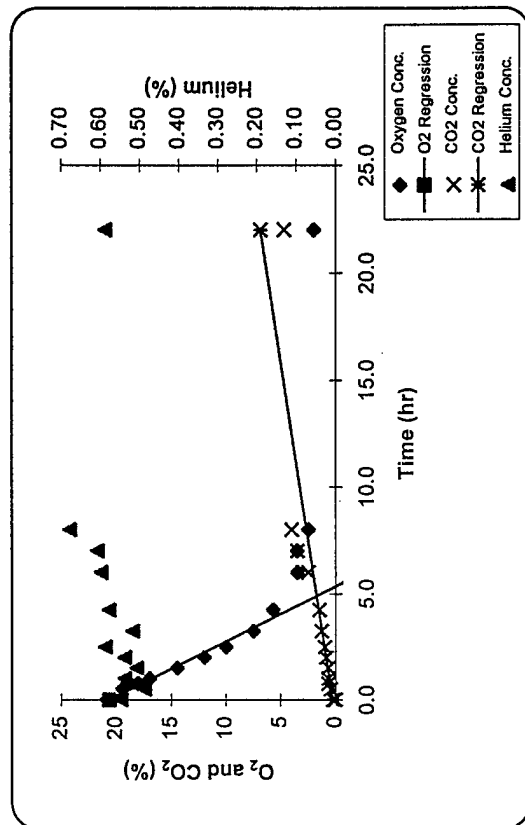
Monitoring Point: MPB-9

Depth of M.P. (ft): 9

Date/Time (mm/dd/yr hr:min)	Time (hr)	Oxygen (%)	Carbon Dioxide (%)	Helium (%)
11/17/95 13:30	0.0	20.90	0.05	0.55
11/17/95 14:00	0.5	19.50	0.50	0.49
11/17/95 14:15	0.8	18.00	0.70	0.52
11/17/95 14:30	1.0	17.00	0.70	0.54
11/17/95 15:00	1.5	14.50	0.70	0.51
11/17/95 15:30	2.0	12.00	0.90	0.54
11/17/95 16:00	2.5	10.00	1.00	0.59
11/17/95 16:45	3.2	7.50	1.30	0.52
11/17/95 17:45	4.3	5.70	1.50	0.58
11/17/95 19:30	6.0	3.50	2.50	0.60
11/17/95 20:30	7.0	3.50	3.50	0.61
11/17/95 21:30	8.0	2.50	4.00	0.68
11/18/95 11:30	22.0	2.00	4.70	0.59

O₂ Utilization Rate

K_o 0.064 %/min
3.859 %/hr
92.605 %/day



Regression Lines	O ₂	CO ₂
Slope	-3.8585	0.2967
Intercept	20.6524	0.2974
Determination Coef.	0.9776	0.9210
No. of Data Points.	9	9

In Situ Respiration Test

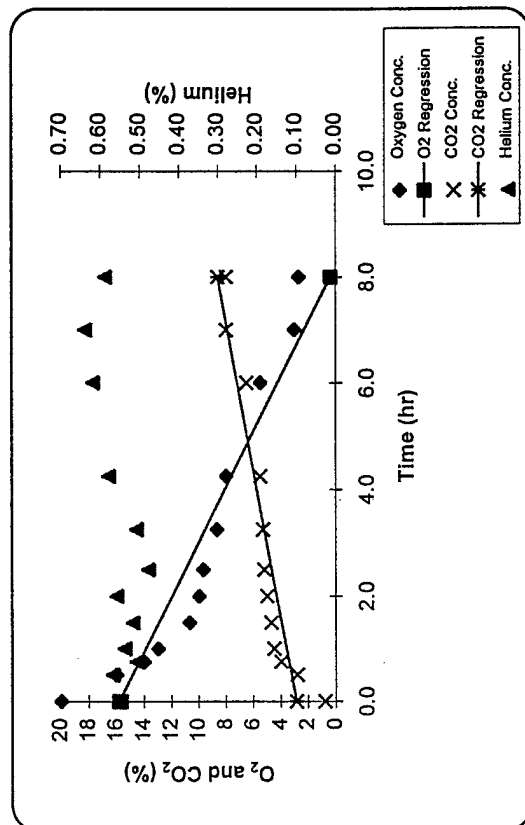
Site Name: McGuire AFB, NJ

Date: 12/27/95

Depth of M.P. (ft): 6

Monitoring Point: MPC-6

Date/Time (mm/dd/yr hr:min)	Time (hr)	Oxygen (%)	Carbon Dioxide (%)	Helium (%)
11/17/95 13:30	0.0	20.00	0.80	0.55
11/17/95 14:00	0.5	16.00	2.80	0.57
11/17/95 14:15	0.8	14.00	4.00	0.51
11/17/95 14:30	1.0	13.00	4.50	0.54
11/17/95 15:00	1.5	10.70	4.70	0.52
11/17/95 15:30	2.0	10.00	5.00	0.56
11/17/95 16:00	2.5	9.70	5.20	0.48
11/17/95 16:45	3.2	8.70	5.30	0.51
11/17/95 17:45	4.3	8.00	5.50	0.58
11/17/95 19:30	6.0	5.50	6.50	0.62
11/17/95 20:30	7.0	3.00	8.00	0.64
11/17/95 21:30	8.0	2.70	8.00	0.59



Regression Lines	O ₂	CO ₂
Slope	-1.9301	0.7170
Intercept	15.8265	2.8804
Determination Coef.	0.8559	0.7803
No. of Data Points.	11	11

O₂ Utilization Rate

K₀ 0.032 %/min
1.930 %/hr
46.323 %/day

In Situ Respiration Test

Date: 12/27/95

Site Name: McGuire AFB, NJ

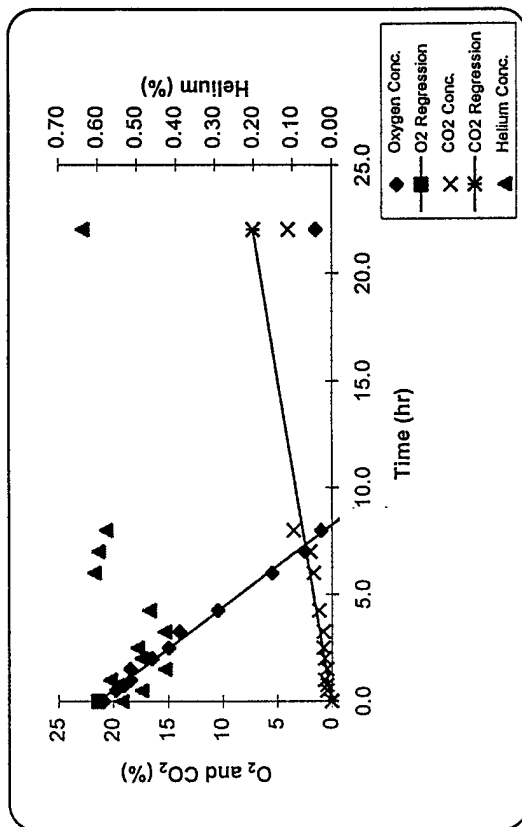
Monitoring Point: MPC-9

Depth of M.P. (ft): 9

Date/Time (mm/dd/yr hr:min)	Time (hr)	Oxygen (%)	Carbon Dioxide (%)	Helium (%)
11/17/95 13:30	0.0	20.90	0.05	0.54
11/17/95 14:00	0.5	19.80	0.50	0.49
11/17/95 14:15	0.8	19.00	0.50	0.55
11/17/95 14:30	1.0	18.50	0.70	0.57
11/17/95 15:00	1.5	18.50	0.50	0.43
11/17/95 15:30	2.0	16.50	0.70	0.49
11/17/95 16:00	2.5	15.00	0.80	0.50
11/17/95 16:45	3.2	14.00	0.80	0.43
11/17/95 17:45	4.3	10.50	1.20	0.47
11/17/95 19:30	6.0	5.50	1.70	0.61
11/17/95 20:30	7.0	2.50	2.00	0.60
11/17/95 21:30	8.0	1.00	3.50	0.58
11/18/95 11:30	22.0	1.50	4.00	0.64

O₂ Utilization Rate

Ko 0.043 %/min
2.591 %/hr
62.178 %/day



Regression Lines	O ₂	CO ₂
Slope	-2.5907	0.3239
Intercept	21.4092	0.0872
Determination Coef.	0.9933	0.8661
No. of Data Points	12	12

ABB ENVIRONMENTAL SERVICES, Inc.

08BS128

Project

McGUIRE AIR FORCE BASE RI/FS

Site

McGUIRE AFB

Project No. _____

6623-04

Client

HAZWRAP

Logged By
SJC

Checked By	
------------	--

Ground Elev
106.39

Drilling Contractor

MATHIES OF NEW JERSEY

Driller's Name

MIKE LOGAN

Rig Type

D-50

Start Date	12/1/2011
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02/06/91

Finish Date

02/06/91

Drilling Method

Hollow Stem Auger

Protection Level

MOD. D

P.I.D. (eV)

10.2

Casing Size

N/A

Auger Size

4.25"

Soil Drilled (ft)

36.3

Rock Drilled (ft)

N/A

Ttl Depth (ft)

36.3

Depth to Water (ft)-Date

9.00 - 02/06/91

Piez Boring Well

☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT.)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC./RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.T.D. PPM			DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL		
5	S-1 1.0/2.0		1/2/2/4	4		0.0-2.3: TOPSOIL; Coal Ash; Refuse.	FILL		BKG	BKG			
	S-2 2.0/2.0		10/9/6/7	15		2.3-4.0: Brown Silty fine to medium SAND; trace coarse Sand.	SM		BKG	0.8			
	S-3 1.5/1.5		7/11/13	24		4.0-4.4: Black to dark brown organic SILT; roots; grass.	OL		5.7	BKG			F
	S-4 1.5/1.5		10/6/8	14		4.4-16.0: Tan to gray to black stained SAND; well graded; some Silt laminae; organic Silt layer at 14.3 to 14.5 feet.	SP		1.8	0.8			F
	S-5 2.0/2.0		14/9/29/24	38			SP		307.0	50.3			L
18	S-6 1.5/1.5		6/14/20	34			SP		6700	490.0			F
	S-7 1.4/1.5		10/13/22	35			SP		870.0	440.0			F
	S-8 2.0/2.0		2/4/8/11	12			SP		26.4	307.0			F
15	S-9 2.0/2.0		10/11/13/18	24			SP		5.2	97.2			
28	S-10 1.8/2.0		10/12/14/10	26		Dark brown organic SILT; trace fine Sand.	OL		BKG	94.0			F
25	S-11 2.0/2.0		4/11/6/15	17		25.0-25.3: Similar to S-10 25.3-27.0: Black to dark green Clayey fine SAND; medium Sand laminae; wet.	SC		BKG	18.1			
38	S-12 2.0/2.0		1/5/7/12	12		Similar to S-11 (25.3-27.0); fossiliferous.	SC		0.8	4.9			
35	S-13 1.3/1.3		14/20/50	70		Similar to S-12; hard calcareous layer at bottom causing refusal at 38.3 feet.	SC	1	2.4	9.8			L
48	BOTTOM OF EXPLORATION AT 38.3 FEET												
	NOTES:												
	1. Boring backfilled with high solids bentonite grout.												

ABB ENVIRONMENTAL SERVICES, Inc.

08BS129

Project McGUIRE AIR FORCE BASE RI/FS			Site McGUIRE AFB		Project No. 6623-04
Client HAZWRAP			Logged By SJC	Checked By	Ground Ele. 106.45
Drilling Contractor MATHES OF NEW JERSEY		Driller's Name MIKE LOGAN	Rig Type D-50	Start Date 01/14/91	Finish Date 01/15/91
Drilling Method Hollow Stem Auger		Protection Level MOD. D	P.I.D. (eV) 10.2	Casing Size N/A	Auger Size 4.25"
Soil Drilled (ft) 37.0	Rock Drilled (ft) N/A	Ttl Depth (ft) 37.0	Depth to Water (ft)-Date 9.00 - 01/15/91		Piez. Boring Well ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P. I. D. PPM		PI METER HEAD SPACE WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER		
0	S-1 2.0/2.0		WOH/3/3/5	6		0.0-0.2: TOPSOIL	SM		BKG	0.7		L
2	S-2 2.0/2.0		9/8/5/5	13		0.2-14.5: Tan to gray to black stained Silty fine SAND; trace medium and coarse Sand; black laminae; wet below 9.0 feet.	SM		BKG	0.3		L
4	S-3 1.5/1.5		8/18/30	48			SM		BKG	4.3		
6	S-4 1.5/1.5		8/27/42	69			SM		BKG	4.2		F
8	S-5 1.5/1.5		9/31/40	71			SM		BKG	4.0		
10	S-6 1.5/1.5		14/20/39	59			SM		BKG	6.1		L
12	S-7 1.5/1.5		17/23/32	55			SM		BKG	10.0		F
14	S-8 1.5/2.0		4/14/42/48	56		14.5-16.0: Gray Silty fine SAND; bark fragments.	SM		BKG	0.8		
20	S-9		3/3/5/9	8		Dark brown Silty fine SAND; wet.	SM	1	BKG	0.7		
25	S-10		2/7/10/10	17		Black to dark green Silty fine SAND; trace coarse Sand; wet.	SM		BKG	0.3		
30	S-11 1.5/2.0		9/15/20/10	35		Blue-green Clayey fine SAND; fossiliferous; little medium Sand; damp; dense.	SC		BKG	0.2		
35	S-12 1.5/2.0		17/17/21/35	38		Similar to S-11; some coarse Sand.	SC	2	BKG	0.3		L
40						BOTTOM OF EXPLORATION AT 37.0 FEET						
48						NOTES: 1. Recovery/penetration not recorded for S-9 and S-10. 2. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.						08BS130						
Project McGUIRE AIR FORCE BASE RI/FS						Site McGUIRE AFB		Project No. 6623-04				
Client HAZWRAP						Logged By SJC		Checked By Ground Elev 112.16				
Drilling Contractor MATHES OF NEW JERSEY			Driller's Name MIKE LOGAN			Rig Type D-50		Start Date 02/21/91				
Drilling Method Hollow Stem Auger			Protection Level MOD. D			P.L.D. (eV) 10.2		Casing Size N/A				
Soil Drilled (ft) 16.0		Rock Drilled (ft) N/A		Ttl Depth (ft) 16.0		Depth to Water (ft)-Date 12.00 - 02/21/91		Piez. Boring Well ☐ ☒ ☐				
DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
5	S-1 1.2/2.0		7/3/2/3	6		0.0-5.1: Green to black fine to medium SAND; concrete fragments; damp; fuel odor.	SP	1	BKG	777.0		F
	S-2 1.4/2.0		8/8/8/12	16		SP	BKG		0.5	F		
	S-3 1.7/2.0		9/10/9/10	19		SP	BKG		3.0			
	S-4 1.9/2.0		8/10/12/10	22		SM	BKG		8.0			
	S-5 2.0/2.0		3/6/5/6	11		SM	BKG		BKG			
	S-6 2.0/2.0		1/2/3/10	5		SM	BKG		0.2			
	S-7 2.0/2.0		6/12/15/8	27		SP	BKG		2.3	L		
	S-8 2.0/2.0		3/8/9/10	17		SP	BKG		2.8	F		
15												
20												
25												
30												
35												
40												
BOTTOM OF EXPLORATION AT 16.0 FEET NOTES: 1. Auger refusal at 2.0 feet. Moved to new location twice. 2. Boring backfilled with high solids bentonite grout.												