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**Interim Bioventing Pilot Results Report for
LPST No. 98508, Building 675
Fort Bliss, Texas**

Prepared For



**The US Army Environmental Center
Aberdeen Proving Ground, Maryland**

**Fort Bliss
El Paso, Texas**

and



**Air Force Center for Environmental Excellence
Brooks Air Force Base
San Antonio, Texas**

May 1996



**PARSONS
ENGINEERING SCIENCE, INC.**

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AQMO1-03-0563

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**INTERIM BIOVENTING PILOT TEST RESULTS
REPORT FOR
LPST NO. 98508, BUILDING 675
FORT BLISS, TEXAS**

Prepared for:

**The U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland**

**Fort Bliss
El Paso, Texas**

and

**Air Force Center for Environmental Excellence
Brooks Air Force Base
San Antonio, Texas**

May 1996

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EXECUTIVE SUMMARY

The purpose of this project was to assess the extent of petroleum hydrocarbon contamination, if any, present beneath LPST No. 98508, and to perform a bioventing pilot test to determine if air injection bioventing would be a feasible remedial alternative for any contamination encountered. The installed pilot test system is capable of supplying air (oxygen) to all contaminated subsurface soils located below the former tank excavation site. Biodegradation rates observed during the pilot test indicate that bioventing is a technically feasible alternative for remediation of contaminants at the site to below risk-based criteria. A Field Activity Report (FAR) has been prepared in accordance with TNRCC's Reporting Guidelines for LPST Cleanups in Texas (PST 93-01) to summarize the assessment activities and the implementation of remedial actions on standardized report forms. This FAR is included as appendix E of this report for reference.

The site assessment and bioventing pilot test were completed at Building 675 (LPST No. 98508) at Fort Bliss, Texas, during the period of April 9 through 19, 1996. The purpose of this report is to describe the results of sampling activities and the pilot test at this site and to make specific recommendations for extended testing to determine the long-term impact of bioventing on site contaminant concentrations. Descriptions of the site history, including excavation of the tanks, are contained in the Bioventing Pilot Test Work Plan for Building 675 LPST Site, Fort Bliss, Texas (Parsons ES, 1996).

An initial soil gas survey was performed at the site on April 11, 1996 to determine the probable locations containing greatest contaminant levels. Installation of an air injection vent well (VW), three vapor monitoring points (MPs), and a background monitoring point (MPBG) was completed on April 13, 1996. Drilling services were provided by Tierra Drilling and Environmental Services, Inc., of El Paso, Texas. Well installation and soil sampling were directed by Brian Vanderglas (CAPM 00758), the Parsons Engineering Science, Inc. (Parsons ES) site manager, and Dan Switek. The following sections describe the final design and installation of the bioventing pilot test system at this site.

SECTION 1.0 INTRODUCTION

One VW, three MPs (MPA, MPB, and MPC), a background monitoring point (MPBG), and a blower unit were installed at Fort Bliss near Building 675 (LPST No. 98508). Figures 1.1 and 1.2, respectively, depict the locations of and hydrogeologic cross sections for the VW and MPs completed at Building 675. The locations of the VW and MPs were changed from those proposed in the work plan after results from the initial soil gas survey identified a north-south trend of contamination rather than the east-west orientation anticipated. Boring logs for the MPs and VW are included in appendix A. An MPBG MP was installed in clean soils, approximately 200 feet north of the VW:

1.1 SOIL GAS SURVEY

An initial soil gas survey was accomplished to aid in locating the VW and MPs. A 25-foot grid was set up around the excavation site. Sampling began in the center of the grid and extended outward until the extent of contamination was reached. Sample depths ranged from 6 to 15 feet bgs, the maximum depth of the sampler. Soil gas samples were analyzed using field instruments to measure oxygen, carbon dioxide, and TVH. Sampling locations and oxygen results are illustrated in Figure 1.3. Soil gas samples were collected using a Geoprobe® hydraulic sampler. The results of the soil gas survey are provided in Table 1.1.

The VW and MPs were located based on the results of the soil gas survey. Areas with depleted levels of oxygen were confined to the excavated site. The VW was placed in the center of the excavated area, with the monitoring points placed to the south, where oxygen levels were lowest. The central placement of the VW, combined with the highly permeable sandy soils, should allow for oxygen transport throughout the entire zone of vadose soils contaminated by releases from the excavated tanks.

1.2 AIR INJECTION VENT WELL

The air injection VW was installed following procedures described in the Air Force Center for Environmental Excellence (AFCEE) bioventing protocol document (Hinchee, et al., 1992). Figure 1.4 shows construction details for the VW. The VW was installed in dry to damp sands that contained hydrocarbon contamination at all sampling locations below the backfill material which extends to 12 feet below ground surface (bgs). Perched groundwater was encountered at approximately 48 feet bgs. The total depth drilled in the VW was 55 feet bgs. The VW was constructed using 2-inch diameter, schedule 40 polyvinyl chloride (PVC) casing, with approximately 30 feet of 0.04-inch slotted PVC screen installed from 15 to 45 feet bgs (for soil gas sampling). To accommodate future

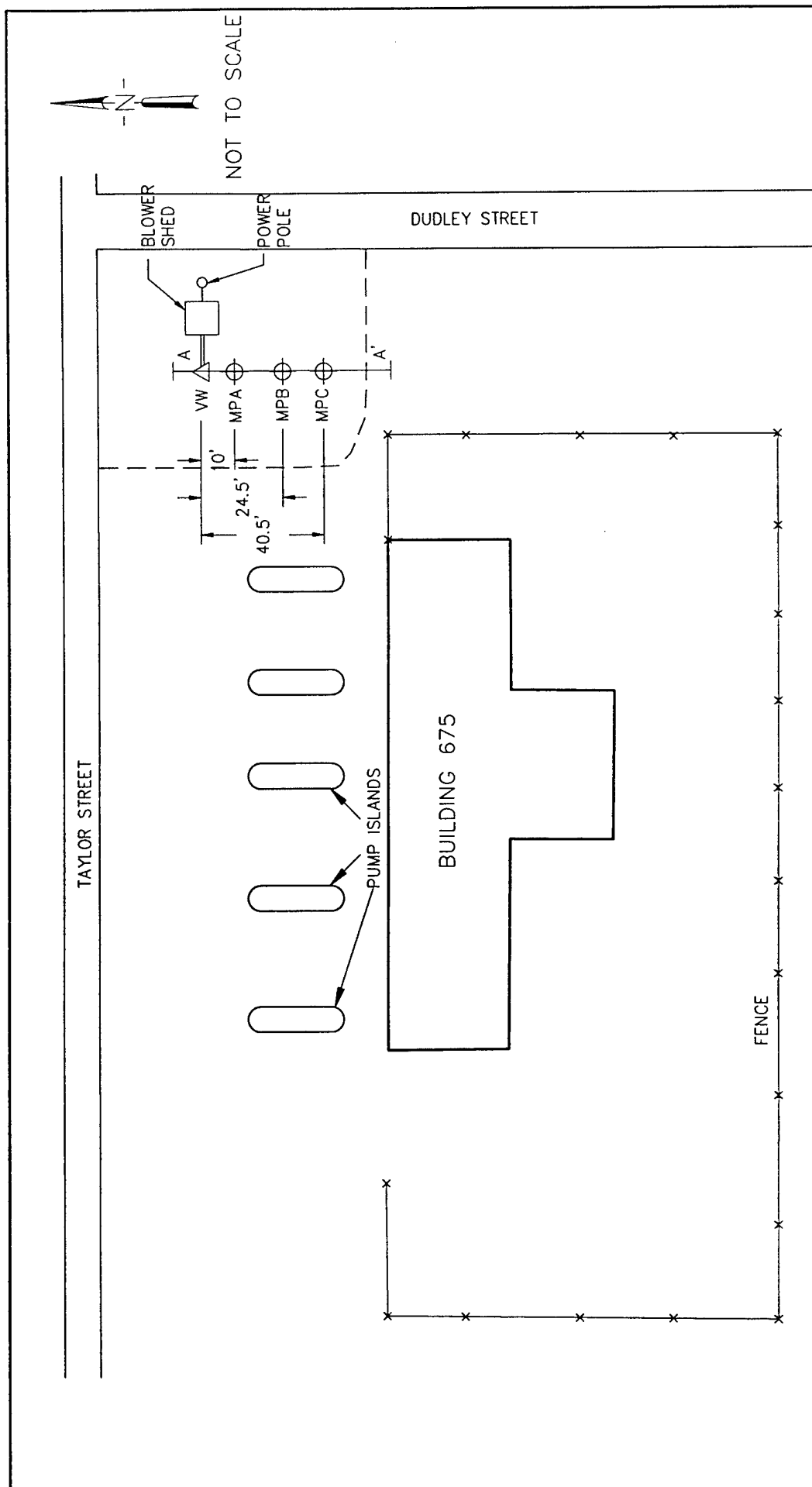


FIGURE 1.1

LOCATIONS OF VENT WELL, MONITORING POINTS, AND BLOWER SYSTEM COMPONENTS
LPST NO. 98508
FORT BLISS, TEXAS

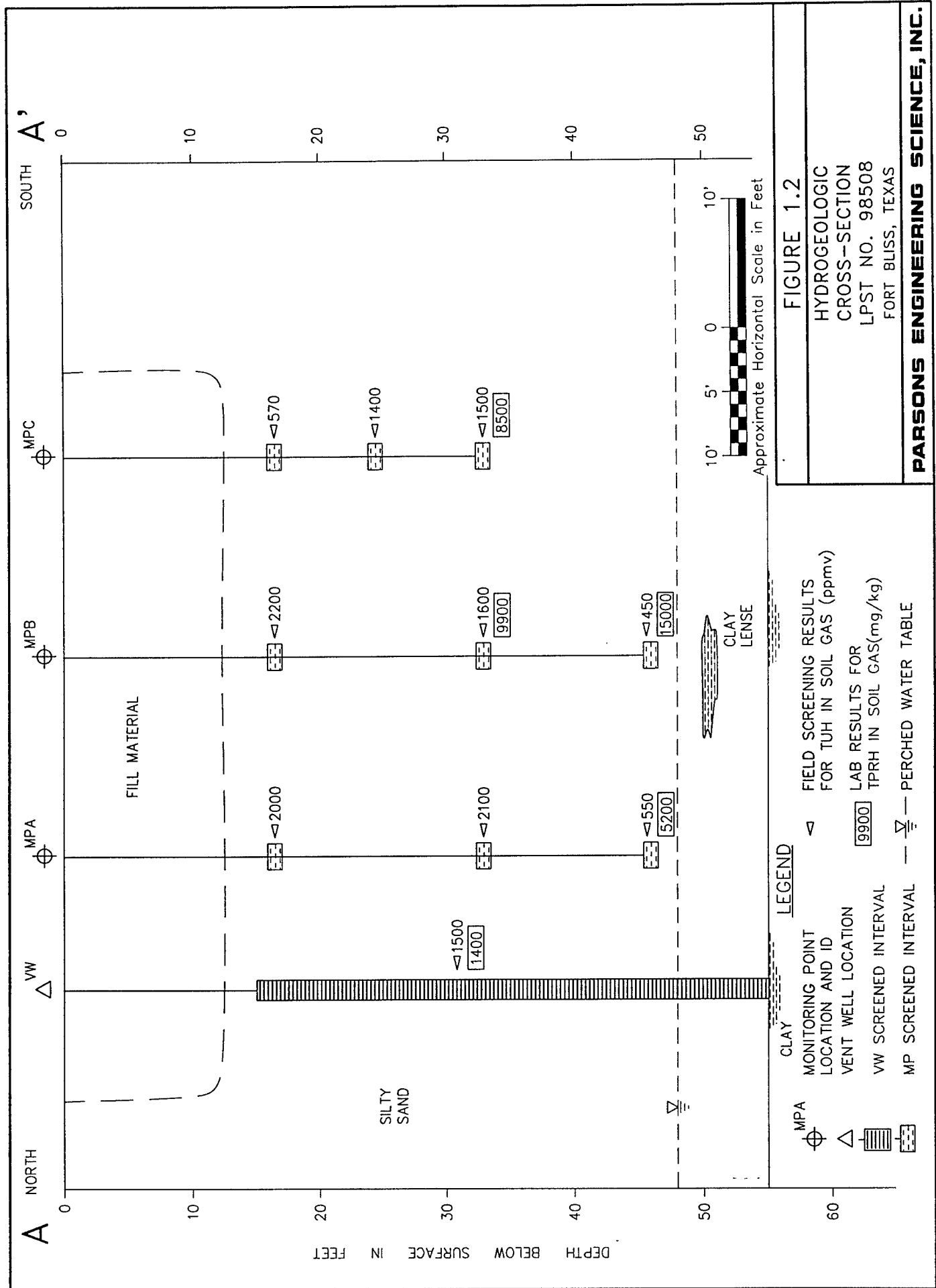
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LEGEND

△ VENT WELL

⊕ MONITORING POINT

A-A' HYDRO GEOLOGIC CROSS-SECTION LINE



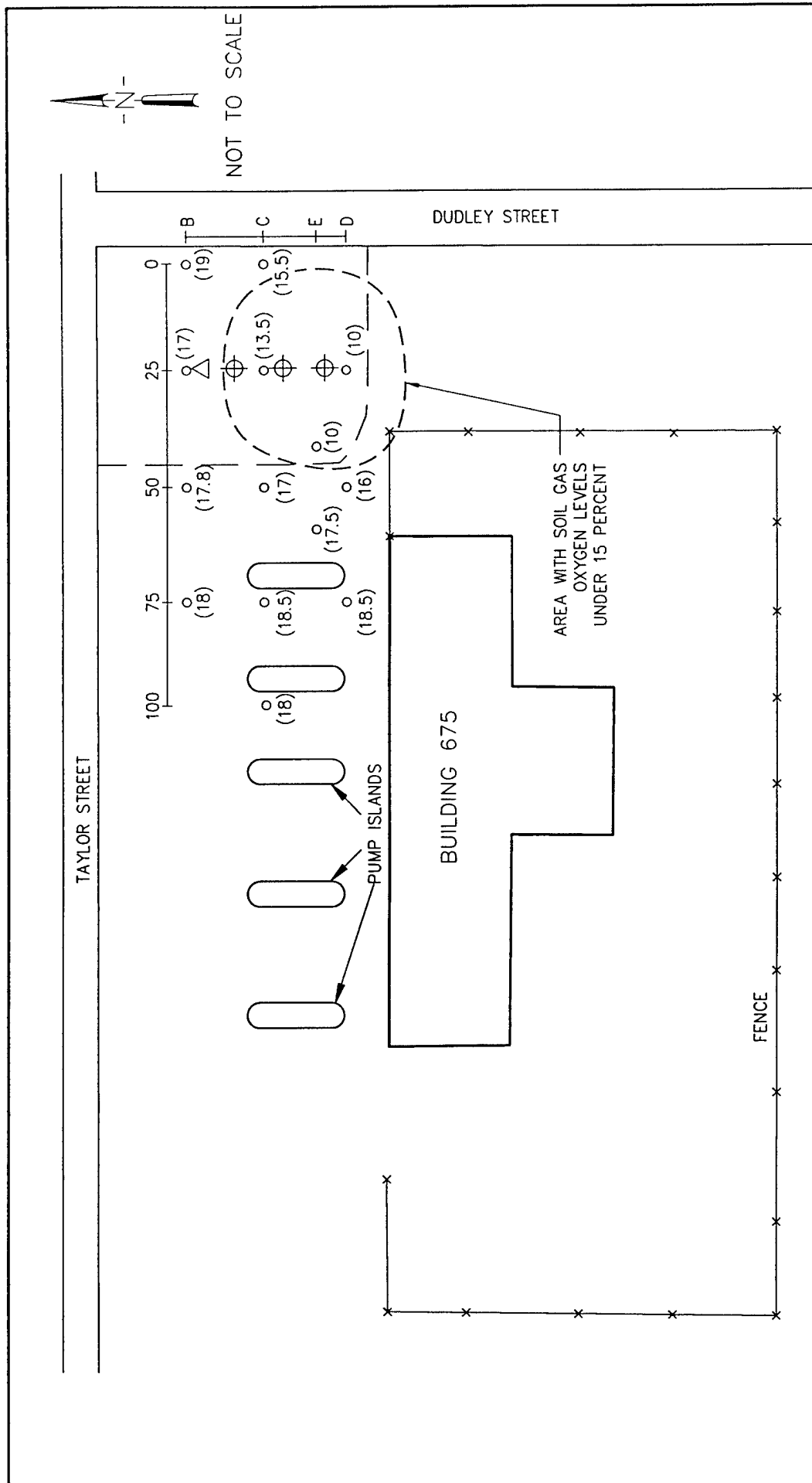


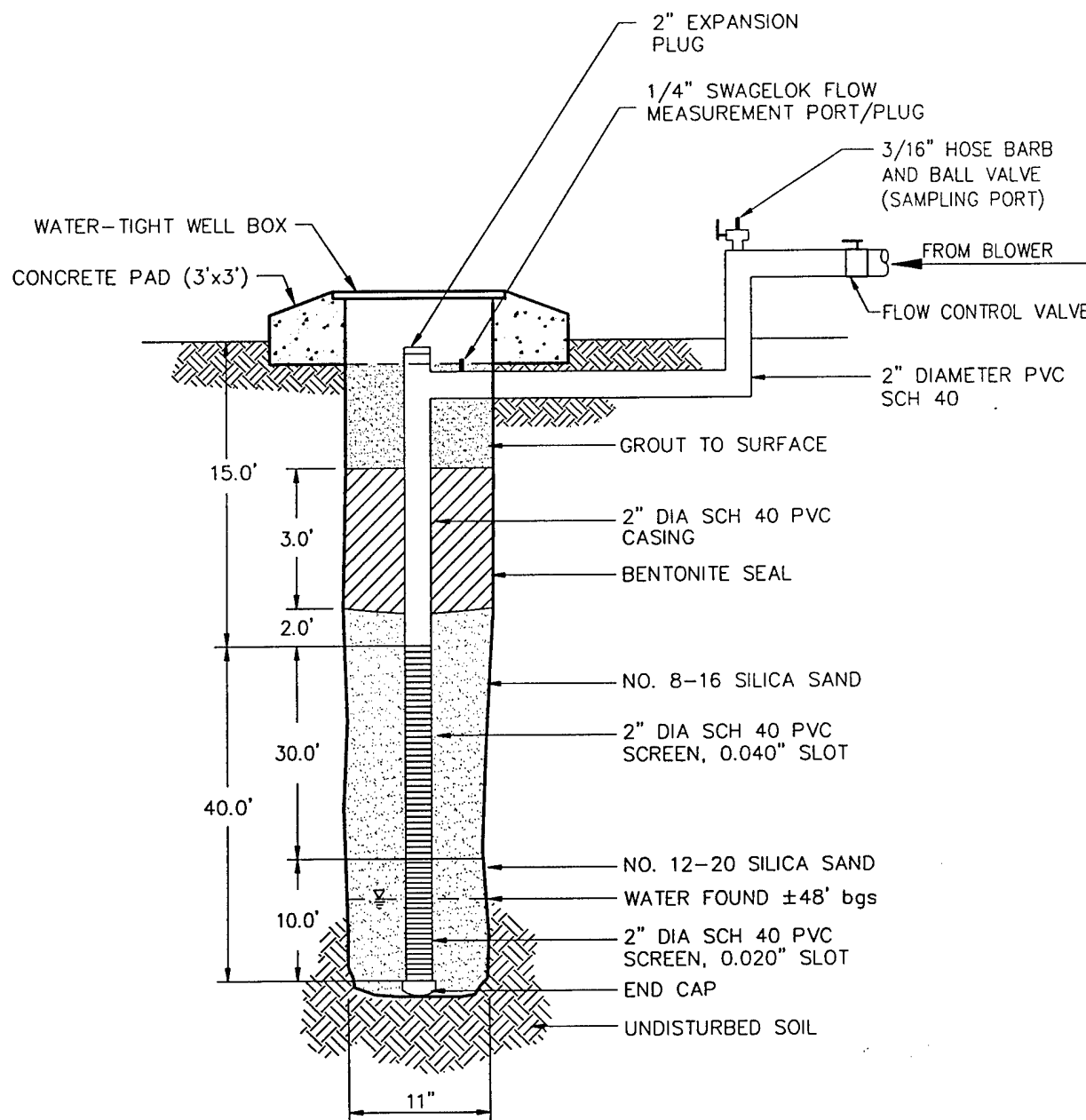
FIGURE 1.3

GEOPROBE SOIL GAS
SAMPLING LOCATIONS
LPST NO. 98508
FORT BLISS, TEXAS

PARSONS ENGINEERING SCIENCE, INC.

Table 1.1
Geoprobe Soil Gas Survey Results
LPST No. 98508
Fort Bliss, Texas

Sample Location (ft bgl)	Oxygen %	Carbon Dioxide %	TVH (ppmv)
B-000(9)	19	0.75	270
B-25(12)	17	2.5	390
B-50(9)	17.8	1.8	390
B-75(6)	18	1	290
C-000(14)	15.5	3.5	370
C-25(15)	13.5	4.5	1300
C-50(3)	19.5	1	220
C-50(6)	17	2.5	1600
C-75(6)	18.5	1	620
C-100(6)	18	1	520
D-25(12)	10	6	5800
D-50(6)	16	3	430
D-75(6)	18.5	1	1800
E-40(10)	10	6	400
E-65(9)	17.5	1	350



NOT TO SCALE

FIGURE 1.4

AS BUILT AIR INJECTION VENT
WELL CONSTRUCTION DETAIL
LPST NO. 98508
FORT BLISS, TEXAS

PARSONS ENGINEERING SCIENCE, INC.

potential groundwater sampling needs, 10 feet of 0.02-inch slotted screen was installed across the saturated zone, from 45 to 55 feet bgs. The annular space between the well casing and borehole was filled with 8-16 silica sand from the bottom of the 0.04-inch screen to approximately 2 feet above the well screen. Filter pack for the 0.02-inch screen set as a monitoring well consists of 12-20 silica sand. Approximately 3 feet of granular bentonite was placed above the sand and hydrated in place using potable water. Concrete grout was placed above the bentonite seal and brought up to one foot below the surface. The well casing was cut off approximately 6 inches below the surface. A 2-inch PVC Tee was installed at the top of the casing, with two-inch PVC pipe connected to the blower and a 2-inch expansion plug sealing the well that allows access for groundwater sampling. To allow for air flow velocity testing, a swage lock fitting was attached to the PVC running to the blower.

1.3 MONITORING POINTS

At Building 675, the MP screens were installed at three depths depending on conditions encountered in each borehole. The three MPs (MPA, MPB, and MPC) and the MPBG were constructed as shown in Figures 1.5, 1.6, and 1.7, and 1.8. Each MP monitoring interval was constructed using a 6-inch section of 1-inch-diameter PVC well screen and a 0.25-inch-diameter schedule 80 PVC riser pipe extending to the ground surface. At the top of each riser, a ball valve and a $\frac{3}{16}$ -inch hose barb were installed. The top of each MP was completed with a flush-mounted metal well protector set in a concrete base. Thermocouples were installed at the 16- and 45-foot depths at MPA to measure soil temperature variations.

Screened intervals for the three MPs are all located beneath the primarily uncontaminated fill material, which extends approximately 12 feet bgs. The depths of screened intervals at MPA and MPB were chosen based on encountering the plastic liner to a depth of 12 feet below surface. The borehole for MPA and MPB was in primarily uncontaminated fill material until it penetrated beneath the plastic liner. The MPs were placed at 16, 32, and 45 feet bgs to provide coverage across the entire contaminated vadose zone. The MPs for MPC were located at 16, 24, and 32 feet bgs. MPBG was located approximately 200 feet north of the VW with MPs set at 16, 24, and 32 feet BGS.

1.4 BLOWER UNIT

A 1.0-horsepower (hp) Gast®, regenerative blower unit was used for the initial testing and has been permanently installed for use throughout the extended pilot test. The pilot test blower is energized by 208-volt, single-phase, 30-amp line power which was installed specifically for the project. A starter/disconnect switch was set up on the inside wall of the small, portable shed which houses the blower. The configuration, instrumentation, and specifications for this blower system are shown on Figure 1.9. From anemometer readings, the blower is transporting air at a flow rate of approximately 16.5 actual cubic feet per minute (acfm) for the extended pilot test, as of readings taken on April 18, 1996. Shortly after blower installation and startup, Parsons ES engineers will provide an operation and maintenance (O&M) manual, including maintenance instructions, equipment specifications, and monitoring forms to post personnel.

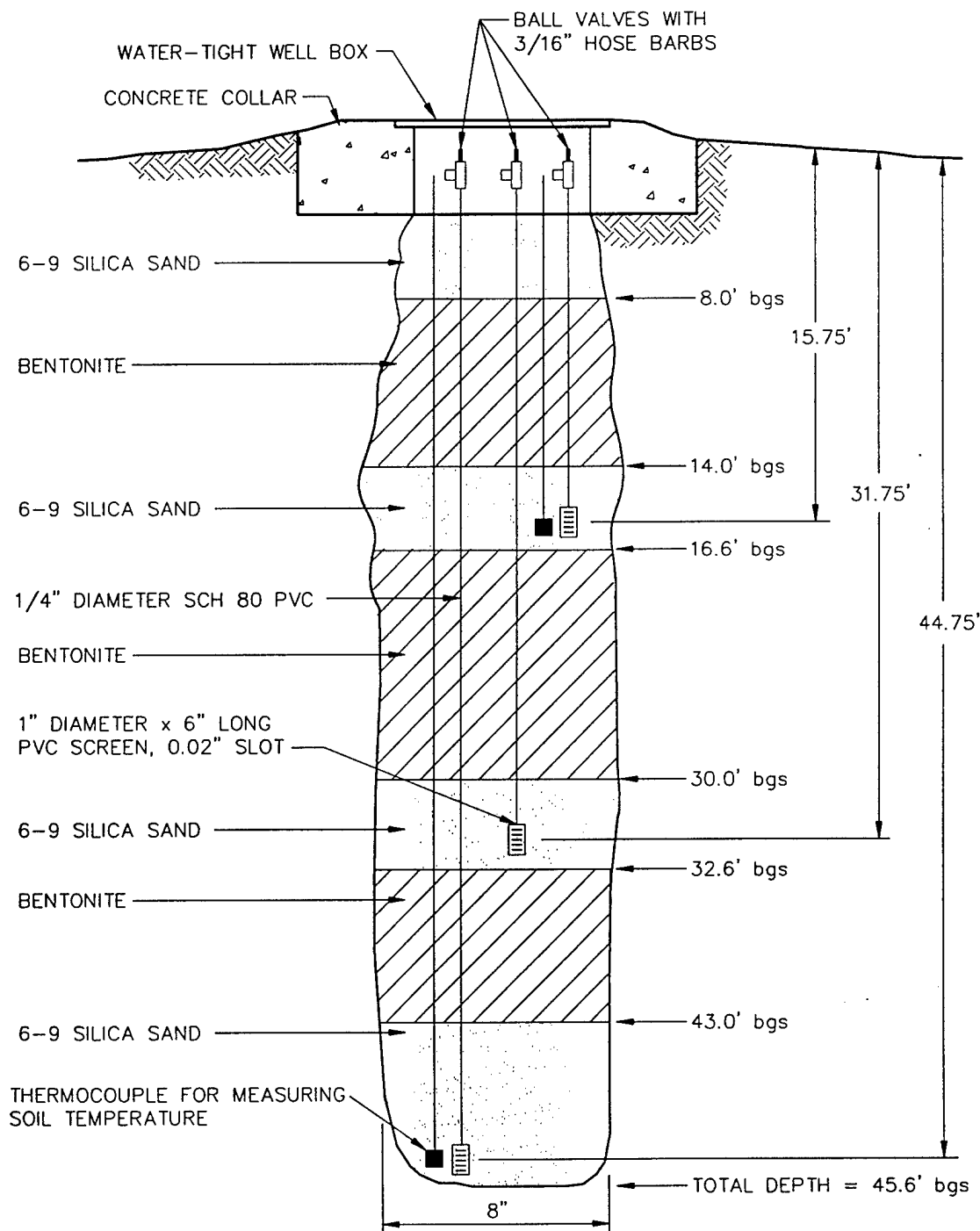


FIGURE 1.5

AS BUILT MPA MONITORING
POINT CONSTRUCTION DETAIL
LPST NO. 98508
FORT BLISS, TEXAS

PARSONS ENGINEERING SCIENCE, INC.

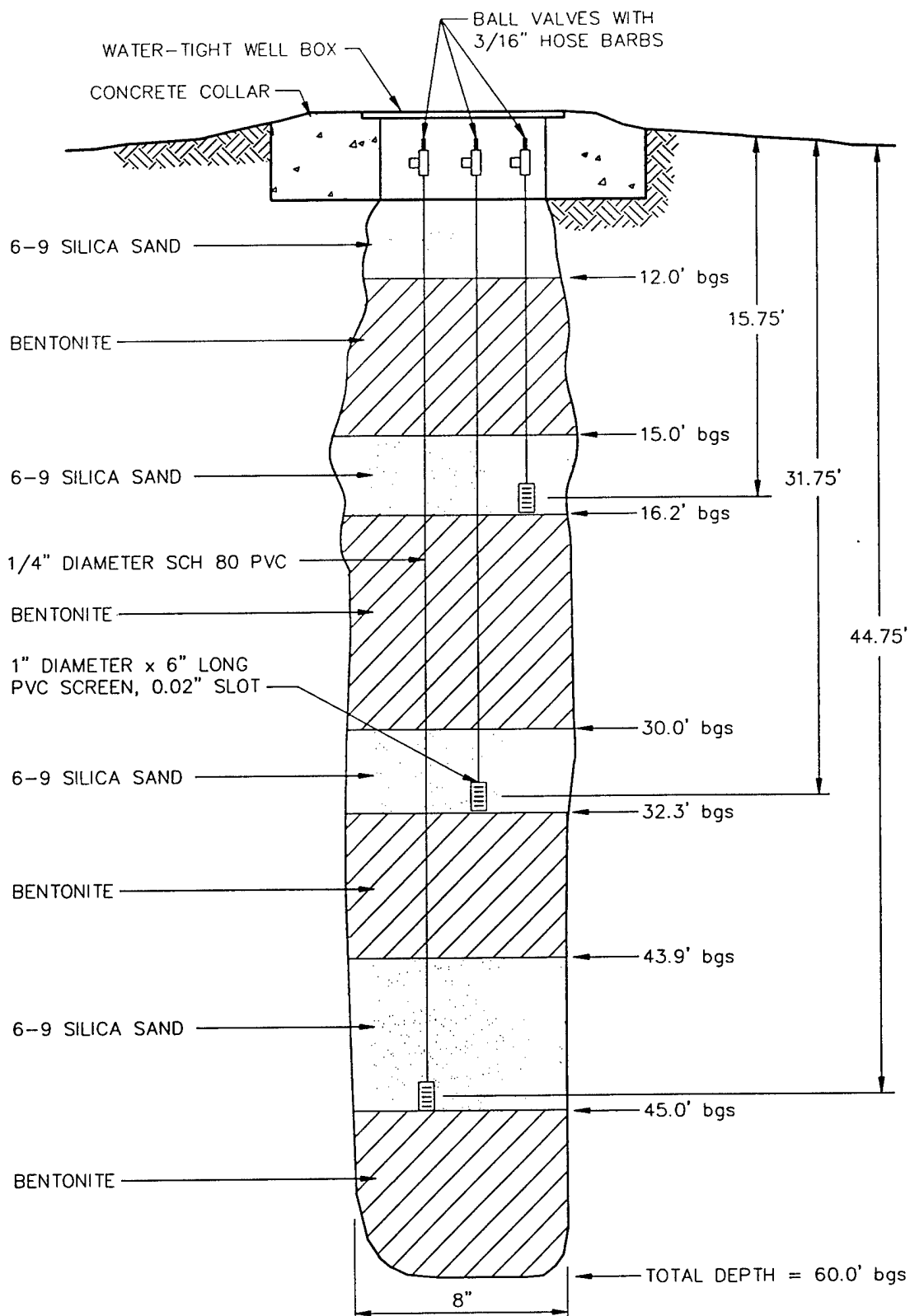


FIGURE 1.6

AS BUILT MPB MONITORING
POINT CONSTRUCTION DETAIL
LPST NO. 98508
FORT BLISS, TEXAS

PARSONS ENGINEERING SCIENCE, INC.

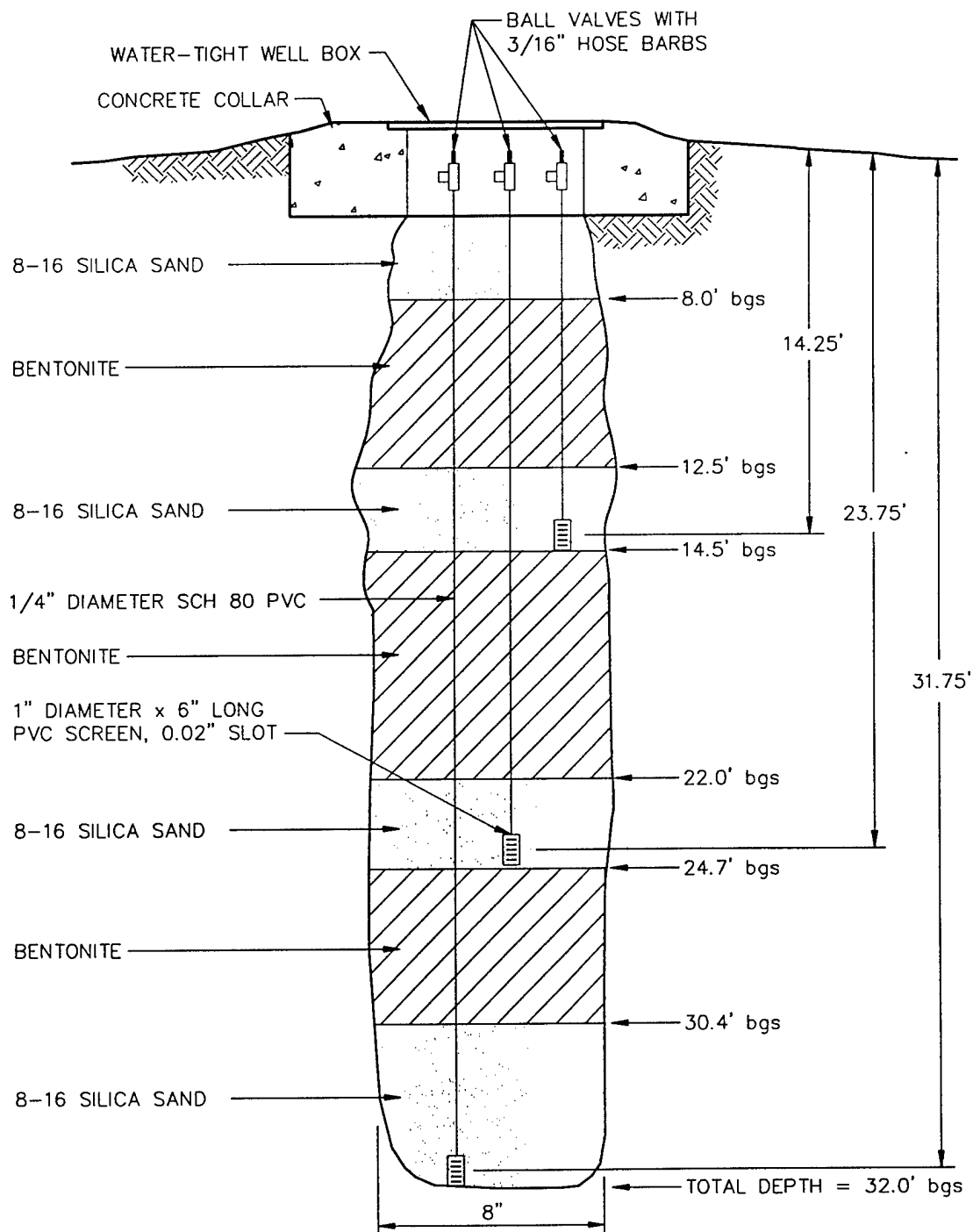


FIGURE 1.7

AS BUILT MPC MONITORING
POINT CONSTRUCTION DETAIL
LPST NO. 98508
FORT BLISS, TEXAS

PARSONS ENGINEERING SCIENCE, INC.

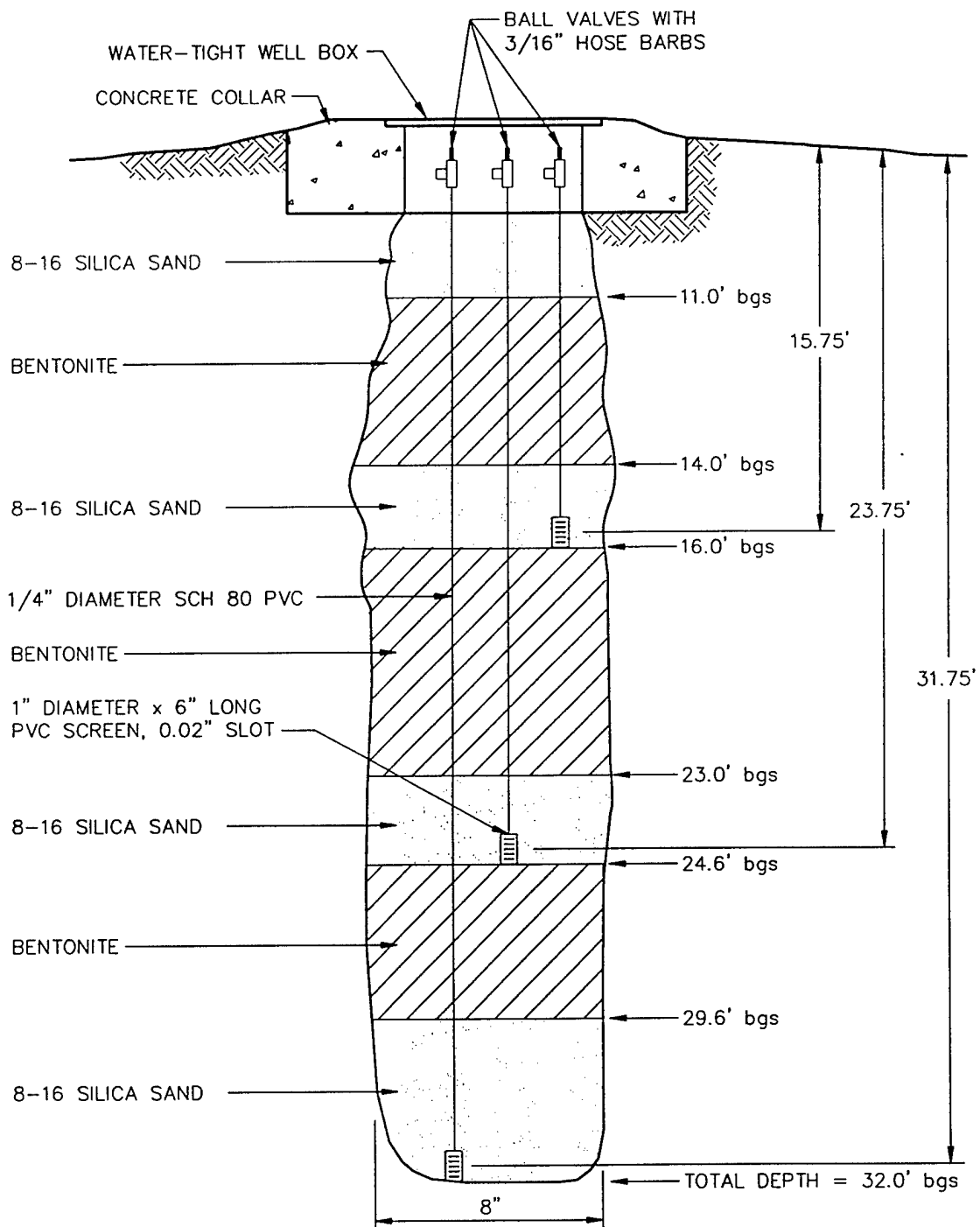
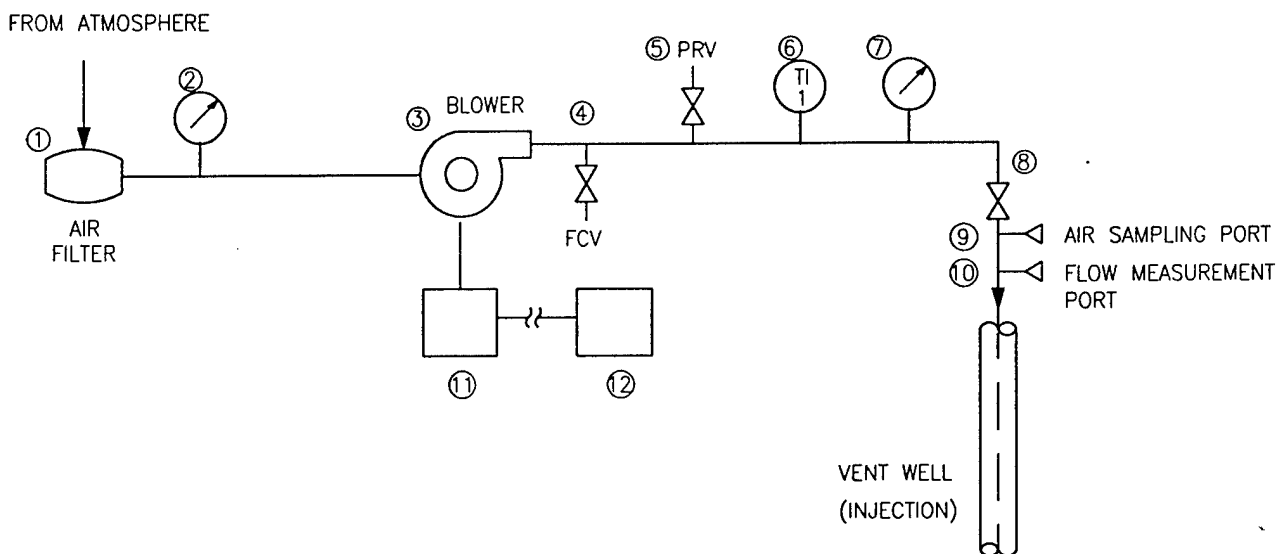


FIGURE 1.8

AS BUILT MPBG MONITORING
POINT CONSTRUCTION DETAIL
LPST NO. 98508
FORT BLISS, TEXAS

PARSONS ENGINEERING SCIENCE, INC.



LEGEND

- ① INLET AIR FILTER - SOLBERG® AJ 134E
- ② VACUUM GAUGE (0-60 in. H₂O)
- ③ BLOWER - GAST® 1hp R4110-50
- ④ MANUAL PRESSURE RELIEF (BLEED) VALVE - 1 1/2 in. GATE
- ⑤ AUTOMATIC PRESSURE RELIEF VALVE, SET TO RELEASE AT 46 in. H₂O PRESSURE.
- ⑥ TEMPERATURE GAUGE (0-250 °F)
- ⑦ PRESSURE GAUGE (0-100 in. H₂O)
- ⑧ FLOW CONTROL GATE VALVE - 2 in. PVC
- ⑨ AIR SAMPLING PORT (3/16" HOSE BARB WITH 1/4" BALL VALVE)
- ⑩ FLOW MEASUREMENT PORT (1/4" SWAGelok FITTING AND CAP)
- ⑪ MANMOTOR STARTER (CR1062R2B), MOUNTED IN SHED HOUSING BLOWER
- ⑫ BREAKER BOX - 208 V/SINGLE PHASE/20 A LOCATED IN BUILDING 2001.

FIGURE 1.9

AS BUILT BLOWER SYSTEM INSTRUMENTATION
 DIAGRAM FOR AIR INJECTION
 LPST NO. 98508
 FORT BLISS, TEXAS

PARSONS ENGINEERING SCIENCE, INC.

SECTION 2.0

PILOT TEST SOIL AND SOIL GAS SAMPLING RESULTS

2.1 SAMPLING RESULTS

Soils at this site primarily consist of dry sands and silty sands with varying amounts of gravel. The moisture content of site soils increased with depth. Clay was encountered in MPB at depths of approximately 48 to 50 feet, and in the VW at approximately 56-57 feet bgs. Soil within the backfilled excavation consist of lightly packed, fine- to medium-grained sands, with varying amounts of silts and gravels. Saturated conditions were encountered at depths of approximately 48 feet bgs in MPB and VW boreholes. More detailed hydrogeologic information regarding Building 675 can be found in the hydrogeologic cross section (Figure 1.2) and the geologic boring logs (appendix A).

Contaminated soils were identified based on visual appearance, odor, and results of total hydrocarbon analyzer field screening for volatile organic compounds (VOCs). Hydrocarbon contamination at this site appears to extend from about 18 to 55 feet bgs in the VW and all MP boreholes. Contaminant concentrations appeared to be greatest at depths of 40 to 50 feet bgs in soils directly beneath the excavation of the former underground storage tanks. In some instances, dark, hydrocarbon staining was observed in sampled cores. No evidence of contaminated soils was encountered in the background soil boring (MPBG).

Soil samples for laboratory analysis were collected from 2- or 5-foot split-spoon samplers. Soil samples were screened for VOCs using a hydrocarbon analyzer to determine the presence of contamination and to select depths for soil sampling for laboratory analysis. Soil samples for laboratory analysis were collected from MPA at depths of 37 to 38 feet bgs and 44 to 45 feet bgs, from MPB at depths of 24 to 25 feet bgs and 48 to 49 feet bgs, from MPC at depths of 23 to 24 feet bgs, and from the VW at depths of 45 to 46 feet bgs. Two background soil samples (from uncontaminated soils) were also collected from MPBG at 16 to 17 feet bgs and 31 to 32 feet bgs.

Soil gas samples were collected at VW-01, MPA (45 ft bgs), MPB (32 ft bgs), MPB (45 ft bgs), and MPC (32 ft bgs). These MP intervals were selected based on the depleted oxygen and elevated TVH in soil gas measured during initial soil gas survey activities. Initial soil gas screening results are discussed in Section 3. Soil gas samples were collected using 3-liter Tedlar® bags and vacuum chambers. After the samples were collected with Tedlar® bags, they were transferred to 1-liter SUMMA® canisters and shipped to the laboratory.

Soil samples were shipped via overnite delivery service (Federal Express) to Evergreen Analytical, Inc., for chemical and physical analysis. Soil samples were analyzed for total petroleum hydrocarbons (TPH); benzene, toluene, ethylbenzene and xylenes (BTEX) + chlorobenzene; total iron; alkalinity; total Kjeldahl nitrogen (TKN); total phosphorus, polynuclear aromatic hydrocarbons (PAH), and several physical parameters. The results of these analyses are presented in Table 2.1. Soil gas samples were shipped via to Air Toxics, Inc., in Folsom, California, for total petroleum hydrocarbons (TPH) and BTEX analysis. The TPH analyses were referenced to gasoline. The results of these analyses are provided in Table 2.2. Chain-of-custody forms are provided in appendix B.

2.2 EXCEPTIONS TO TEST PROTOCOL PROCEDURES

Procedures described in the protocol document (Hinchee et al., 1992) were used to complete this pilot test, with the following exception:

- Due to a faulty regulator, a helium tracer was not continuously injected into the MP screened intervals throughout the *in situ* respiration test. The helium was equilibrated at 2.9 % at the start of the test. Upon returning to check the test ten hours later, the helium tank was found to be empty. A replacement helium tank was installed, only to be found empty again 11 hours later.

Table 2.1
Soil Sample Chemistry Data
Fort Bliss, Texas
LPST No. 98508

	Sample Location (depth - feet below ground surface)									
	VW01 (45-46)	VW01 (56.5)	MPA (37-38)	MPA(44-45)	MPB (24-25)	MPB (47-50)	MPC (23-25)	MPBG (16-17)	MPBG (31-32)	
Soil Hydrocarbons										
TPH-gasoline (mg/kg)	U (0.1)	U (0.1)	1200	450	360	8200	37	NT	NT	
Benzene (µg/kg)	U (0.4)	U (0.5)	U (212)	U (207)	U (52)	U (2940)	U (2.1)	NT	NT	
Toluene (µg/kg)	U (0.4)	1.0	16000	310	1200	190000	U (2.1)	NT	NT	
Chlorobenzene (µg/kg)	U (0.4)	0.7	2800	980	600	22000	U (2.1)	NT	NT	
Ethyl Benzene (µg/kg)	U (0.4)	1.3	13000	3100	1900	110000	U (2.1)	NT	NT	
Total Xylenes (µg/kg)	U (0.4)	3.9	79000	18000	20000	550000	U (2.1)	NT	NT	
1,3,5-Trimethylbenzene (µg/kg)	1.0	2.7	17000	9400	6900	100000	110	NT	NT	
1,2,4-Tetramethylbenzene (µg/kg)	U (0.4)	4.9	47000	27000	17000	260000	180	NT	NT	
1,2,3-Trimethylbenzene (µg/kg)	0.4	8.9	14000	860	5000	860000	45	NT	NT	
1,2,3,4-Tetramethylbenzene (µg/kg)	U (0.6)	7.9	13000	10000	6400	78000	3100	NT	NT	
TEH-extractable (mg/kg)	U (11.0)	U (11.0)	500	430	140	2800	150	NT	NT	
Base Neutrals										
Naphthalene (mg/kg)	NT	NT	2200	NT	NT	28000	NT	NT	NT	
2-Methylnaphthalene (mg/kg)	NT	NT	2600	NT	NT	30000	NT	NT	NT	
Phenanthrene (mg/kg)	NT	NT	U (350)	NT	NT	190 J	NT	NT	NT	
Soil Inorganics										
Total Kjeldahl Nitrogen (mg/kg)	<5.0	NT	NT	NT	<4.6	<5.0	NT	<5.1	<4.7	
Total Iron (mg/kg)	3260	NT	NT	NT	4960	6980	NT	NT	NT	
Phosphates (mg/kg)	85	NT	NT	NT	138	208	NT	NT	NT	
Soil physical properties										
Moisture %	9.40	NT	NT	NT	3.04	7.50	NT	10.2	1.47	
pH	10.18	NT	NT	NT	10.15	10.23	NT	NT	NT	
Alkalinity (mg CaCO ₃ /kg)	269	NT	NT	NT	359	566	NT	NT	NT	
Gravel (%>2 mm)	0.00	NT	NT	NT	4.88	1.12	NT	NT	NT	
Sand (%0.75-2.0 mm)	96.09	NT	NT	NT	89.63	77.69	NT	NT	NT	
Silt and Clay (<0.75 mm)	3.94	NT	NT	NT	5.49	21.19	NT	NT	NT	

NT = not tested

U = compound analyzed for, but not detected. Detection limits in parenthesis.

J = indicates an estimated value when the compound is detected, but is below the EPA Estimated Quantitation Limit (EQL)

Table 2.2
Soil Gas Analytical Results
LPST No. 98508
Fort Bliss, Texas

Soil Gas Hydrocarbons (ppmv)	FBI:MPA-45	FBI:VW-01	FBI:MPB-32	FBI:MPB-45	FBI:MPC-32
Benzene	110	34	130	230	120
Toluene	270	32	560	910	520
Ethyl Benzene	33	8.8	140	210	190
Total Xylenes	146	47	610	940	1000
TPH (C2 + Hydrocarbons)	5200	1400	9900	15000	8500

SECTION 3.0

PILOT TEST RESULTS

3.1 INITIAL SOIL GAS CHEMISTRY

Prior to initiating air injection, all MPs and the VW were purged, and initial oxygen, carbon dioxide, and TVH concentrations were sampled using portable gas analyzers, as described in the technical protocol document (Hinchee et al., 1992). Table 3.1 summarizes the initial soil gas chemistry at the Building 675 site. The results strongly indicate that biological fuel degradation has depleted the oxygen supply in the vadose zone soils. Five of the ten sampling points are under anaerobic conditions, and soil gas at the remaining points were at low levels, ranging from 1.5 to 14.8 percent. In contrast the background MP, installed in uncontaminated soil approximately 200 feet north, contained oxygen levels ranging from 20.0 to 20.5 percent. Carbon dioxide was present at elevated concentrations, ranging from 4.5 to 13 percent, in all initial soil gas samples collected at Building 675. The background MP carbon dioxide levels ranged from 0.8 to 1.1 percent.

3.2 AIR PERMEABILITY

An air permeability test was performed at Building 675 according to protocol document procedures. Air was injected into the VW for two hours at a rate of approximately 45 cfm and an average pressure of 10.5 inches of water. The pressure response readings, including the pressure response measured at the end of two hours of continuous blower operation, are presented in Table 3.2. The pressure measured at each MP achieved steady state conditions after two hours. Since more than 10 minutes was required to achieve steady state conditions in all the MPs, the dynamic method of determining soil gas permeability was selected. As discussed in the technical protocol document (Hinchee et al., 1992), the dynamic method of determining soil gas permeability that is coded in the Hyperventilate® program is appropriate. Three depths from each of the MPs were used to calculate relative air permeability in the soils.

A constant injection rate of 45.8 scfm and a screened interval thickness of 33 feet were used to calculate soil gas permeabilities of 53.9, 32.5, and 26.3 darcys for the 10 foot radial distance, 64.8, 45.9, and 35.9 for the 24.5 foot radial distance and 67.8, 73.3, and 70.8 darcys for the 40.5 foot radial distance. An average of 52.4 darcys was calculated for the site. This value is typical for sandy soils, such as those encountered at this site. The Hyperventilate cards depicting these calculations are in appendix C.

Table 3.1
Initial Soil Gas Chemistry
LPST No. 98508
Fort Bliss, Texas

MP	Depth (ft)	O ₂ (%)	CO ₂ (%)	Field TPH (ppmv)	Lab TPH (ppmv)	Benzene (ppmv)	Toluene (ppmv)	Ethyl Benzene (ppmv)	Total Xylenes (ppmv)
VW	15-45	14.8	4.5	1500	1400	34	32	8.8	47
MPA	16	11.0	6.5	2000	NT	NT	NT	NT	NT
MPA	32	0.0	11.1	2100	NT	NT	NT	NT	NT
MPA	45	0.0	12.0	550	5200	110	270	33	146
MPB	16	11.5	6.0	2200	NT	NT	NT	NT	NT
MPB	32	0.0	12.0	1600	9900	130	560	140	610
MPB	45	0.0	13.0	450	1500	230	910	210	940
MPC	16	7.2	8.0	570	NT	NT	NT	NT	NT
MPC	24	1.5	11.5	1400	NT	NT	NT	NT	NT
MPC	32	0.0	12.5	1500	8500	120	520	190	1000
MPBG	16	20.5	0.8	250	NT	NT	NT	NT	NT
MPBG	24	20.0	1.0	290	NT	NT	NT	NT	NT
MPBG	32	20.0	1.1	360	NT	NT	NT	NT	NT

Table 3.2
Building 675, Pressure Response During the Air Permeability Test
LPST No. 98508
Fort Bliss, Texas

Elapsed Time (minutes)	Pressure Response in MP (inches of water)									
	MPA			MPB			MPC			
	16	32	45	16	32	45	16	24	32	
0.5	0.9	1.0	0.9	0	0.2	0.1	-	-	-	
1	1.0	1.6	1.2	0.3	0.6	0.3	0.08	0.15	0.20	
2	1.3	1.9	1.4	0.4	0.8	0.6	0.28	0.38	0.44	
3	1.4	2.3	1.6	0.5	0.7	0.7	0.35	0.45	0.56	
4	1.5	2.3	1.9	-	-	-	0.46	0.60	0.68	
5	1.6	2.45	2.1	0.6	1.0	0.75	0.52	0.64	0.78	
6	1.6	2.55	2.2	0.6	1.1	0.9	-	-	-	
7	1.7	2.60	2.25	0.7	1.15	1.1	0.60	0.68	0.84	
8	1.8	2.7	2.40	-	-	-	0.68	0.80	0.94	
9	1.8	2.8	2.50	0.8	1.3	1.1	0.70	0.84	0.98	
10	1.8	2.8	2.50	0.8	1.3	1.2	-	-	-	
12	1.8	2.9	2.55	0.8	1.4	1.3	0.70	0.84	1.0	
15	1.9	3.0	2.60	0.9	1.5	1.4	0.76	0.90	1.0	
20	2.0	3.0	2.80	0.95	1.5	1.5	0.84	0.98	1.0	
25	2.0	3.1	2.90	-	-	-	0.86	1.0	1.0	
30	2.0	3.15	2.95	1.0	1.6	1.6	0.88	1.0	1.0	
40	2.0	3.2	3.10	1.0	1.6	1.65	0.90	1.0	1.0	
50	2.05	3.2	3.10	1.0	1.6	1.7	0.90	1.0	1.1	
60	2.05	3.2	3.2	1.0	1.6	1.75	0.90	1.0	1.1	
90	2.10	3.15	3.25	1.1	1.7	1.85	0.960	1.0	1.1	
120	2.10	3.2	3.30	1.1	1.7	1.9	0.98	1.0	1.1	

3.3 OXYGEN INFLUENCE

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

Table 3.3 describes the change in soil gas oxygen levels that occurred during the first 24-hours of air injection at the site. This air injection period at approximately 16.5 scfm produced changes in soil gas oxygen levels at a distance of at least 40.5 feet from the central VW at all monitored depth intervals. Increases in the oxygen concentration were measured at each MP interval. Based on measured pressure response, which is an indicator of long-term oxygen transport, it is anticipated that the radius of influence for a long-term bioventing system at this site will exceed 50 feet. Monitoring during the extended pilot test at this site will better define the effective treatment radius.

3.4 *IN SITU* RESPIRATION RATES

In situ respiration testing was performed with a slight deviation from the protocol document. Air was injected into MPA-45, MPB-32, MPB-45, and MPC-32 for 22 hours at a rate of approximately 1 acfm per screened interval to deliver oxygen to contaminated soils. Injection of a continuous and uniform mixture of helium was attempted during the test, but was not successful due to a faulty regulator as described in Section 2.2. At the end of the 22 hour period, air injection ceased, and changes in soil gas composition were monitored over time. Oxygen, TVH, helium and carbon dioxide were measured over a period of 72 hours following the air injection period. The observed rates of oxygen utilization were then used to estimate the aerobic fuel degradation rates at Building 675. Respiration test data collection sheets are presented in appendix D. Figures 3.1 and 3.2 represent the results of *in situ* respiration testing at the site, and Table 3.4 is a summary of the observed oxygen utilization rates.

Based on these observed oxygen utilization rates, an estimated 1150 to 1699 milligrams (mg) of fuel per kilogram (kg) of soil can be degraded each year. This value is the range of the fuel consumption rates calculated for every point at which a respiration test was conducted. The point-specific fuel consumption rates were calculated using observed oxygen utilization rates, estimated air-filled porosities, and a conservative ratio of 3.5 mg of oxygen consumed for every 1 mg of fuel biodegraded. Oxygen loss was approximately linear during the first 2200 minutes of the test. The observed oxygen utilization rates ranged from 0.0035 percent per minute (%/min) to 0.0039 percent/min (Table 3.4), demonstrating that hydrocarbon contamination and biological activity is probably uniformly spread throughout the pilot test area. The air-filled porosity calculated for each sampling point ranged from 0.15 to 0.28 liters of air per kilogram of soil. Data and data calculation sheets to determine fuel degradation rates are included in appendix D.

Table 3.3
Influence of Air Injection at Vent Well on Monitoring Point
Oxygen Levels, Building 675
LPST No. 98508
Fort Bliss, Texas

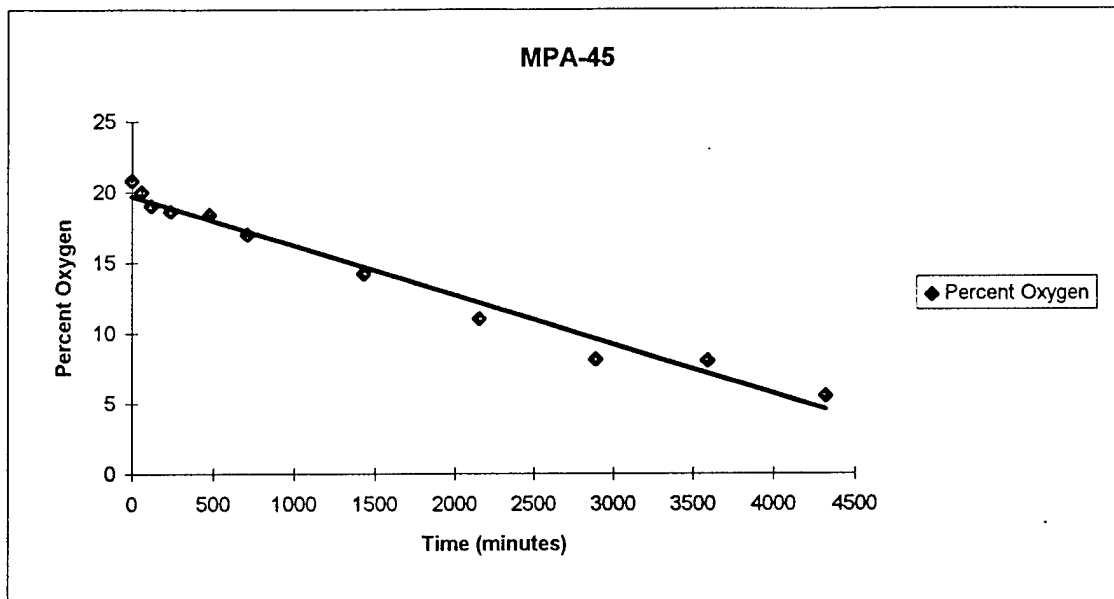
MP	Distance	Depth	Initial Oxygen (%)	Oxygen ¹ (%)	Oxygen ² (%)	Oxygen ³ (%)
A	10.0	16	9.0	19.9	20.5	NT
A	10.0	32	2.9	20.5	20.6	NT
A	10.0	45	5.5	19.5	20.0	NT
B	24.5	16	8.0	5.9	10.2	19.0
B	24.5	32	5.1	15.2	14.5	20.0
B	24.5	45	5.9	6.4	5.8	12.0
C	40.5	16	5.5	5.0	4.2	7.0
C	40.5	24	2.0	4.9	3.8	15.0
C	40.5	32	4.0	3.8	8.6	17.5

¹ Duration of air injection = 2 hours at 45.8 cfm.

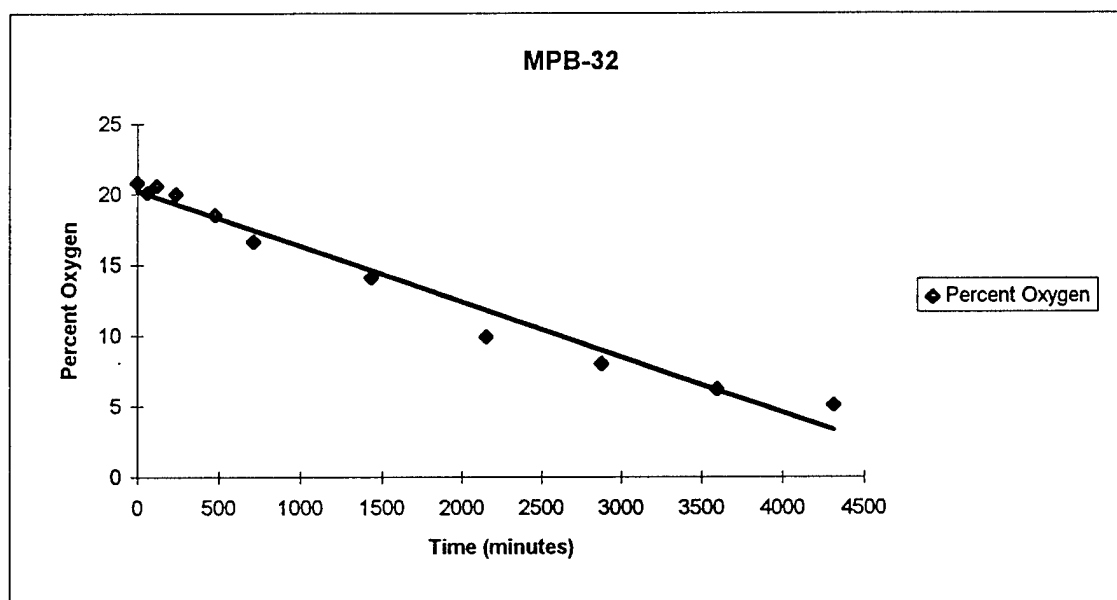
² Duration of air injection = 2 hours at 45.8 cfm, and 3.5 hours at 16.5 cfm.

³ Duration of air injection = 2 hours at 45.8 cfm, and 22 hours at 16.5 cfm.

NT = not tested



$k = 0.0035 \text{ \%/min}$ (oxygen utilization rate)

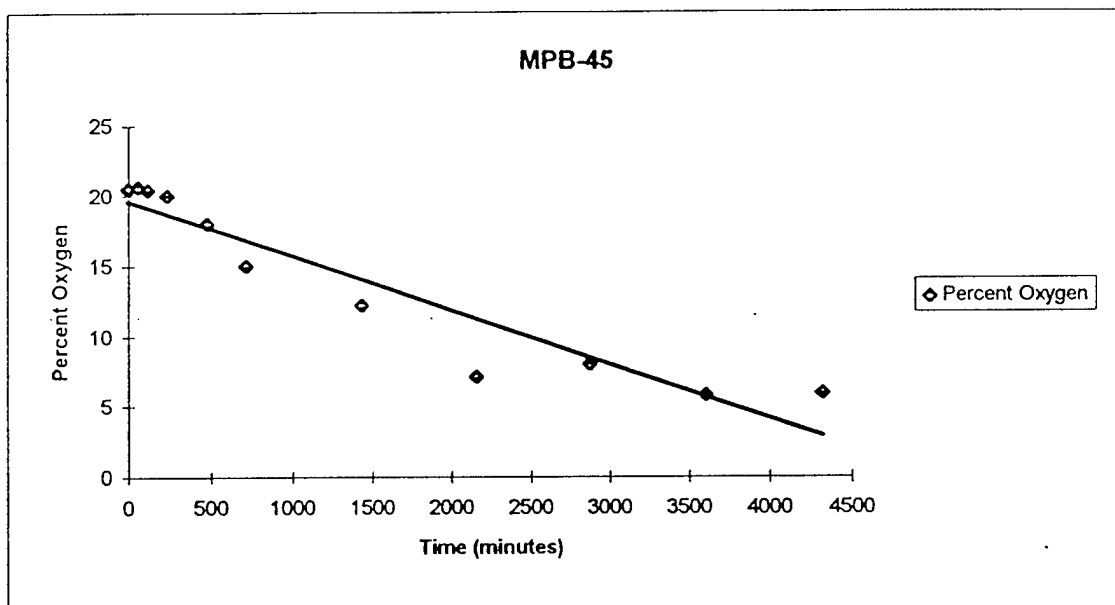


$k = 0.0039 \text{ \%/min}$ (oxygen utilization rate)

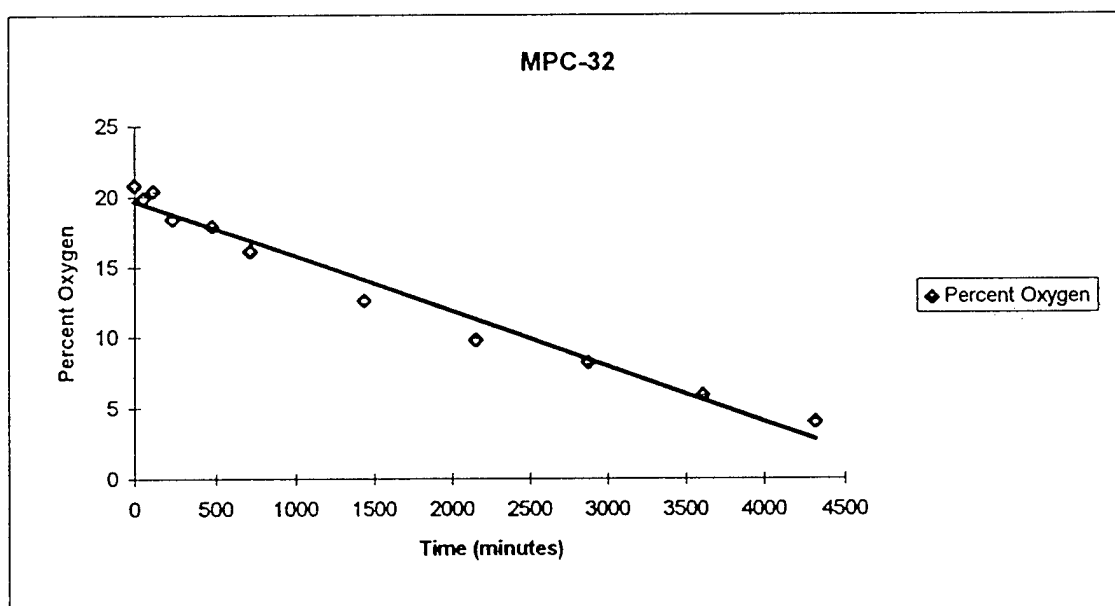
FIGURE 3.1

**RESULTS OF IN SITU RESPIRATION TEST
MPA-45 AND MPB-32
LPST NO. 98508
FORT BLISS, TEXAS**

PARSONS ENGINEERING SCIENCE, INC.



$k = 0.0039 \text{ \%/day}$ (oxygen utilization rate)



$k=0.0039 \text{ \%/min}$ (oxygen utilization rate)

FIGURE 3.2

RESULTS OF IN SITU RESPIRATION TEST
MPB-45 AND MPC-32
LPST NO. 98508
FORT BLISS, TEXAS

PARSONS ENGINEERING SCIENCE, INC.

Table 3.4
Oxygen Utilization Rates
LPST No. 98508
Fort Bliss, Texas

MP	Oxygen Loss* (%)	Test Duration (min)	Oxygen Utilization Rate (%/min)
MPA-45	15.1	4323	0.0035
MPB-32	16.8	4317	0.0039
MPB-45	16.9	4323	0.0039
MPC-32	16.8	4319	0.0039

* Values based on linear regression (Figures 3.1 and 3.2).

Based on a rate of 1150 to 1699 mg of fuel per kg of soil degraded each year, most of the volatile hydrocarbons in the soil will be removed at the end of a year. However, this rate will probably decrease as the soil moisture decreases and the concentrations of hydrocarbons in the soil decrease.

3.5 POTENTIAL AIR EMISSIONS

Soil concentrations of BTEX compounds detected were less than five mg/kg. Thus, the long-term potential for air emissions from full-scale bioventing operations at this site is low. Initial emissions should be minimal because accumulated vapors will move slowly outward from the air injection point and will be at least partially biodegraded as they move horizontally through the soil. The flow rate of the operating 1 hp blower at completion of the test was 0.5 cfm per foot of screened interval. At this flow rate, and assuming an air filled porosity of 0.15 (bulk density of 1.8 g/cm³), it would take approximately 72 hours to replace one pore volume of soil gas over a 50-foot radial influence.

SECTION 4.0 RECOMMENDATIONS

Initial bioventing tests at this site indicate that oxygen had been depleted in the contaminated soils, and that air injection is an effective method of stimulating aerobic fuel biodegradation. It is recommended that air injection continue at this site to determine the long term radius of oxygen influence and the effect of time, available nutrients, and changing temperatures and moisture contents on fuel biodegradation rates. It appears that contamination at the site is limited to soils above the saturated interval encountered at approximately 48 feet, and does not laterally extend significantly beyond the initial tank excavation limits. With a radius of influence of at least 50 feet from the VW, the 1 hp blower installed for the extended testing will probably be sufficient to remediate, over time, all contaminated soils associated with LPST No. 98508.

In May 1997, a final respiration test will be conducted, and soil gas samples will be collected from the site to assess the degree of remediation achieved during the first year of *in situ* treatment and to determine if significant changes to the system are necessary.

Based on the results of the first year of pilot-scale bioventing, one the following options will be recommended:

1. If one-year soil gas sampling and respiration testing indicates significant contaminant removal has occurred, confirmatory soil sampling may be recommended to verify that risk-based cleanup criteria have been achieved.
2. If significant contaminant removal is indicated, but additional treatment is still necessary to assure attainment of risk-based cleanup criteria, one additional year of air injection may be recommended.

SECTION 5.0

REFERENCES

- Hinchee, et al., 1992. Test Plan and Technical Protocol for a Field Treatability Test for Bioventing. January.
- Parsons ES, 1996. Bioventing Pilot Test Work Plan for Building 675 LPST Site, Fort Bliss, Texas. February.

APPENDIX A
BORING AND DRILLING LOGS

Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING	BORING NO.: VENT WELL
SITE LOCATION: BUILDING 675, LPST 98508	DRILLING METHOD: 6-INCH ID HOLLOW STEM AUGER
LOGGED BY: DAN SWITEK	SAMPLING METHOD: 2.5-FOOT SPLIT SPOON
DRILLING CONTRACTOR: TIERRA DRILLING	BOREHOLE DIAMETER: 11 INCHES
DRILLER: JOHN McDUFFEY	REF. LOGBOOK: 1
DRILLING RIG: CME 75	TOTAL DEPTH (FT BGSL): 57.5
DRILLING START: 4/12/96	WATER FOUND: 47.5
DRILLING END: 4/12/96	DATE COMPLETED: 4/12/96

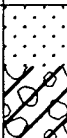
DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
0			FILL MATERIAL, consisting of sand, some clay, grayish-orange (10YR 7/4), fine-grained, moderately sorted, soft, dry. No description.			
5						
10		0	FILL MATERIAL, as above. SAND, some GRAVEL, pinkish-gray (5YR 8/1), sand is medium-grained, gravel up to 0.9 inches, poorly sorted, soft, damp.			No samples 0-10' Fill ends 10.9; sampling every 2.5 ft.
15			Not sampled.			
20		0	SAND, as above. SAND, pinkish-gray (5YR 8/1), medium-grained, moderate sorting, soft, damp.			
25			Not sampled.			
		84	CLAY, some SAND, dark gray (N3), sand is very fine-grained, medium plastic, soft, damp.		0	
		87	SAND, little GRAVEL, light gray (N7), sand is medium-grained, gravel up to 2 inches, poorly sorted, some organic laminae, hydrocarbon staining, soft, damp. No recovery.			
			Not sampled.			

Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING			BORING NO.: VENT WELL			
SITE LOCATION: BUILDING 675, LPST 98508			DRILLING METHOD: 6-INCH ID HOLLOW STEM AUGER			
LOGGED BY: DAN SWITEK			SAMPLING METHOD: 2.5-FOOT SPLIT SPOON			
DRILLING CONTRACTOR: TIERRA DRILLING			BOREHOLE DIAMETER: 11 INCHES			
DRILLER: JOHN McDUFFEY			REF. LOGBOOK: 1			
DRILLING RIG: CME 75			TOTAL DEPTH (FT BGSL): 57.5			
DRILLING START: 4/12/96			WATER FOUND: 47.5			
DRILLING END: 4/12/96			DATE COMPLETED: 4/12/96			
DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
25		130	SAND, pinkish-gray (5YR 8/1), medium grained, poorly sorted, soft, damp.		0	
		175	SAND, some GRAVEL, pinkish-gray (5YR 8/1), sand is coarse-grained, gravel up to 0.6 inches, poorly sorted, subangular, soft, damp.			
		190	Not sampled.			
30		76	SAND, some SILT, pinkish-gray (5YR 8/1), coarse- to very coarse-grained, poorly sorted, soft, dry.		0	
		30				
		25	Not sampled.			
35		0	SAND, some SILT, pinkish-gray (5YR 8/1), very fine-grained, poorly sorted, soft, dry.		0	
		22	SAND, some CLAY, light brown (5YR 6/6), very fine-grained, poorly sorted, firm, damp.			
			Not sampled.			
40		55	SAND, some SILT, pinkish gray (5YR 8/1), very fine-grained, soft, damp.		17	
		340	SAND, pinkish-gray, (5YR 8/1), very fine-grained, moderately sorted, soft, damp.			
		170				
			Not sampled.			
45		360	SAND, pinkish-gray (5YR 8/1), fine-grained, moderately sorted, soft, damp.		14.7	Analytical sample 45-46'
		315				
		180				
			Not sampled.			Wet at 47.5-50'
50						

Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING	BORING NO.: VENT WELL
SITE LOCATION: BUILDING 675, LPST 98508	DRILLING METHOD: 6-INCH ID HOLLOW STEM AUGER
LOGGED BY: DAN SWITEK	SAMPLING METHOD: 2.5-FOOT SPLIT SPOON
DRILLING CONTRACTOR: TIERRA DRILLING	BOREHOLE DIAMETER: 11 INCHES
DRILLER: JOHN McDUFFEY	REF. LOGBOOK: 1
DRILLING RIG: CME 75	TOTAL DEPTH (FT BGSL): 57.5
DRILLING START: 4/12/96	WATER FOUND: 47.5
DRILLING END: 4/12/96	DATE COMPLETED: 4/12/96

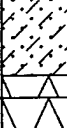
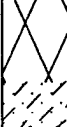
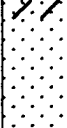
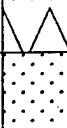
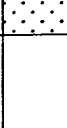
DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
50		0	SAND, pinkish-gray (5YR 8/1), coarse-grained, moderately sorted, soft, damp.		0	
			Not sampled.			
55			SAND, pale, yellowish-brown (10YR 6/2), medium- to fine-grained, moderately sorted, soft, wet. CLAY, some GRAVEL, pale, yellowish-brown (10YR 6/2), gravel up to 1.5 inches, moderate plasticity, firm, dry.		37	
			Total depth = 57.5.			
60						
65						
70						
75						

Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING	BORING NO.: MP-A
SITE LOCATION: BUILDING 675, LPST 98508	DRILLING METHOD: 3-INCH ID HOLLOW STEM AUGER
LOGGED BY: DAN SWITEK	SAMPLING METHOD: 5-FOOT SPLIT SPOON
DRILLING CONTRACTOR: TIERRA DRILLING	BOREHOLE DIAMETER: 8 INCHES
DRILLER: JOHN McDUFFEY	REF. LOGBOOK: 1
DRILLING RIG: CME 75	TOTAL DEPTH (FT BGSL): 45
DRILLING START: 4/12/96 (0830)	WATER FOUND: NA
DRILLING END: 4/12/96 (1045)	DATE COMPLETED: 4/12/96

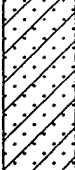
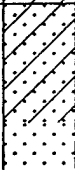
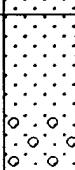
DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
0			FILL MATERIAL, SAND, some CLAY and GRAVEL, 5YR 6/4, very fine-grained, soft, damp.			
5						
10		0	FILL MATERIAL, as above. SILT, some SAND and GRAVEL, 10YR 8/6, very fine-grained, soft, dry. No recovery.	 		Liner at 9.4'
15		1	SILT, as above. SAND, some GRAVEL, 5YR 6/4, very coarse-grained, moderate sorting, soft, damp. No recovery.	 	188	
20		32 27 265 400	SAND, as above. CLAY, 5YR 3/4), very stiff, low plasticity, dry. SAND, N7, very fine-grained to fine-grained, soft, some staining (hydrocarbons), damp. No recovery.	  	174	Contamination starts at approx. 19.8'
25		220 180 420	SAND, 5YR 8/1, coarse-grained, little gravel at bottom, moderately sorted, soft, sub-rounded, damp.		75	

Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING			BORING NO.: MP-A			
SITE LOCATION: BUILDING 675, LPST 98508			DRILLING METHOD: 3-INCH ID HOLLOW STEM AUGER			
LOGGED BY: DAN SWITEK			SAMPLING METHOD: 5-FOOT SPLIT SPOON			
DRILLING CONTRACTOR: TIERRA DRILLING			BOREHOLE DIAMETER: 8 INCHES			
DRILLER: JOHN McDUFFEY			REF. LOGBOOK: 1			
DRILLING RIG: CME 75			TOTAL DEPTH (FT BGSL): 45			
DRILLING START: 4/12/96 (0830)			WATER FOUND: NA			
DRILLING END: 4/12/96 (1045)			DATE COMPLETED: 4/12/96			
DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
25			No recovery.		75	
		120	SAND, little GRAVEL, 5YR 8/1, very coarse-grained, poorly sorted, soft, well rounded, damp.			
30		70				
		26	No recovery.		43	
		240	SAND, as above.			
35		600	CLAY, some SILT, 10R 6/6, low plasticity, soft, damp.			
		430	SAND, some SILT, 10R 6/0, sand is very fine-grained, little GRAVEL limestone up to 1.5 inches in diameter, moderately sorted, soft, damp.			
		550	No recovery.			
		610				
		570	SAND, fine grained, some SILT, 10R 6/6, moderately sorted, soft, damp.			
40		520	CLAY, some SAND, 5YR 4/4, very fine-grained, firm, low plasticity, damp.		575	
			SAND, very fine-grained, 10YR 6/2, poorly sorted, soft, damp.			
			No recovery.			
		510	SAND, as above.		420	
45		520				
		520	Total depth = 45 feet.			
50						

Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING	BORING NO.: MP-B
SITE LOCATION: BUILDING 675, LPST 98508	DRILLING METHOD: 3-INCH ID HOLLOW STEM AUGER
LOGGED BY: DAN SWITEK	SAMPLING METHOD: 2.5-FOOT SPLIT SPOON
DRILLING CONTRACTOR: TIERRA DRILLING	BOREHOLE DIAMETER: 8 INCHES
DRILLER: JOHN McDUFFEY	REF. LOGBOOK: 1
DRILLING RIG: CME 75	TOTAL DEPTH (FT BGSL): 57.5
DRILLING START: 4/11/96 (1210)	WATER FOUND: 48
DRILLING END: 4/11/96	DATE COMPLETED: 4/12/96

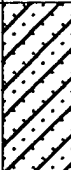
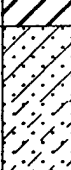
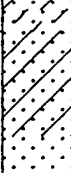
DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
0			SAND, some CLAY, sand is fine-grained, clay is moderately plastic, 10R 4/6, soft, damp.			0-14.2' fill
5		0				
10			SAND, as above.			
15		0	SAND, as above.		15.5	
		5	SAND, 5YR 8/1, coarse- to very coarse-grained, moderately sorted, sub-rounded, soft, damp.			
		40	CLAY, some fine SAND, 10R 4/6, soft, plastic, damp.			
		20	SAND, some GRAVEL, 5YR 8/1, sand is very coarse-grained, gravel up to 0.2 inch in diameter, poorly sorted, well rounded.			
		37	SAND, 5YR 8/1, medium-grained, well sorted, well rounded, soft, damp.			
		0				
		30	SAND, as above.		140	
		15	SAND and GRAVEL, 5YR 8/1, sand is coarse-grained, gravel up to 1.0 inch in diameter, poorly sorted, sub-angular, soft, damp.			
20						

Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING				BORING NO.: MP-B		
SITE LOCATION: BUILDING 675, LPST 98508				DRILLING METHOD: 3-INCH ID HOLLOW STEM AUGER		
LOGGED BY: DAN SWITEK				SAMPLING METHOD: 2.5-FOOT SPLIT SPOON		
DRILLING CONTRACTOR: TIERRA DRILLING				BOREHOLE DIAMETER: 8 INCHES		
DRILLER: JOHN McDUFFEY				REF. LOGBOOK: 1		
DRILLING RIG: CME 75				TOTAL DEPTH (FT BGSL): 57.5		
DRILLING START: 4/11/96 (1210)				WATER FOUND: 48		
DRILLING END: 4/11/96				DATE COMPLETED: 4/12/96		
DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
20			SAND, as above.			
		460	SAND, 5YR 8/1, medium-grained, moderately sorted.		140	
			CLAY, 5G 2/1, hard, low plasticity, dry.			
		33	CLAY, as above.			
		130	SAND, trace GRAVEL, 5YR 8/1, sand is very coarse-grained, gravel up to 0.2 inch in diameter, sub-rounded, moderate sorting, damp, soft.			
		510				
25		315	SAND, 5YR 8/1, medium-grained, well sorted, soft, well rounded, damp.			
		450	No recovery.			
		610	SAND, as above.			
			SAND, some GRAVEL, 5YR 8/1, sand is coarse-grained, gravel up to 0.3 inch in diameter, poorly sorted, sub-rounded, soft, damp.		210	
			No recovery.			
30		6	SAND, some GRAVEL, as above.			
		530	SAND, little GRAVEL, sand is very coarse-grained, gravel up to 0.2 inch in diameter, soft, poorly sorted, well rounded, damp.		520	
		620	No recovery.			
		300	SAND as above, moist.			
		517	SAND, some GRAVEL, 5YR 8/2, sand is very coarse-grained, poorly sorted, soft, damp.			
			No recovery.			
35			SAND, some GRAVEL, 10G 6/2, sand is very coarse-grained, gravel up to 0.4 inch in diameter, poorly sorted, soft, damp, some green mineral (glauconite).		620	
		515	CLAY, 10R 6/6, some very fine SAND, firm, low plasticity, damp.			
		310	CLAY, as above.			
		405				
40						

Contamination starts at approx. 21.8'

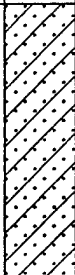
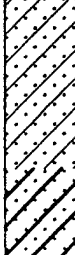
Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING			BORING NO.: MP-B			
SITE LOCATION: BUILDING 675, LPST 98508			DRILLING METHOD: 3-INCH ID HOLLOW STEM AUGER			
LOGGED BY: DAN SWITEK			SAMPLING METHOD: 2.5-FOOT SPLIT SPOON			
DRILLING CONTRACTOR: TIERRA DRILLING			BOREHOLE DIAMETER: 8 INCHES			
DRILLER: JOHN McDUFFEY			REF. LOGBOOK: 1			
DRILLING RIG: CME 75			TOTAL DEPTH (FT BGSL): 57.5			
DRILLING START: 4/11/96 (1210)			WATER FOUND: 48			
DRILLING END: 4/11/96			DATE COMPLETED: 4/12/96			
DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
40			CLAY, as above (increasing sand).			Water found at 48'
			CLAY, as above (increasing sand).			
			SAND, 10YR 6/2, sand is very fine-grained, moderate sorting, sub-rounded, some organic rich laminae, soft, damp.		340	
45			SAND as above, but fine-grained.			
			SAND, as above.			
			SAND, 5GY 4/1, coarse-grained, well sorted, sub-rounded, soft, wet.			
			CLAY, 5YR 3/4, firm, low plasticity, dry.			
50		210	SAND, as above.			
		510	SAND, as above.			
		660	CLAY, as above.			
		650	SAND, some CLAY, 5YR 5/6, sand is very fine-grained, low plasticity, well sorted, soft, wet.			
		610	SAND, little SILT, N2, sand is very coarse-grained, moderate to poor sorting, well rounded, soft.			
		660	SAND, as above with some gravel up to 0.2 inch in diameter.			
		600	SAND, 5GY 2/1, coarse-grained, poorly sorted, well rounded, loose, wet.		340	
		200	SAND, as above.			
		270	SAND, 10YR 5/4, very coarse-grained, poorly sorted, well rounded, wet.		690	
55		650	Sand, as above.			
		610				
			Total depth = 57.5 feet.			
60						

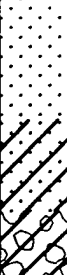
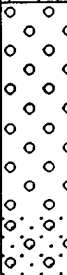
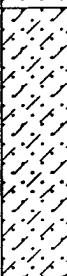
Water found at 48'

Drilling Log - Fort Bliss

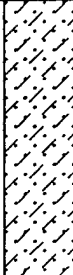
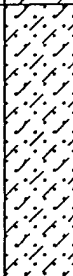
PROJECT: FORT BLISS BIOVENTING	BORING NO.: MP-C
SITE LOCATION: BUILDING 675, LPST 98508	DRILLING METHOD: 3-INCH ID HOLLOW STEM AUGER
LOGGED BY: DAN SWITEK	SAMPLING METHOD: 2.5-FOOT SPLIT SPOON
DRILLING CONTRACTOR: TIERRA DRILLING	BOREHOLE DIAMETER: 8 INCHES
DRILLER: JOHN McDUFFEY	REF. LOGBOOK: 1
DRILLING RIG: CME 75	TOTAL DEPTH (FT BGSL): 32.5
DRILLING START: 4/11/96 (0755)	WATER FOUND: NA
DRILLING END: 4/11/96 (0935)	DATE COMPLETED: 4/11/96

DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
0		0	SAND, some CLAY, 10YR 6/2, trace caliche, sand is medium-grained, trace of gravel, soft, damp.			Soil is very soft preventing good recovery (probably fill).
		0	SAND, little CLAY, 10YR 6/2, some 1-inch zones of caliche, clay is medium plastic, damp, medium-grained sand. No recovery, moist.			
5		0	CLAY, some SAND, 10YR 6/8, sand is fine-grained, medium plastic, soft, moist. CLAY, little SAND, 10YR 6/2, very plastic, soft, moist. No recovery.			
		0	SAND, some CLAY, 10YR 6/2, sand is fine-grained, well sorted, damp, quartz gravel at 8.2. No recovery.			
10		0	SAND, some CLAY, 10YR 6/2, sand is fine- to medium-grained, clay is medium plastic, moderate sorting, soft, damp. CLAY, little SAND, sand is medium-grained, firm, low plasticity, damp.			
						Natural - 11.7'

Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING			BORING NO.: MP-C			
SITE LOCATION: BUILDING 675, LPST 98508			DRILLING METHOD: 3-INCH ID HOLLOW STEM AUGER			
LOGGED BY: DAN SWITEK			SAMPLING METHOD: 2.5-FOOT SPLIT SPOON			
DRILLING CONTRACTOR: TIERRA DRILLING			BOREHOLE DIAMETER: 8 INCHES			
DRILLER: JOHN McDUFFEY			REF. LOGBOOK: 1			
DRILLING RIG: CME 75			TOTAL DEPTH (FT BGSL): 32.5			
DRILLING START: 4/11/96 (0755)			WATER FOUND: NA			
DRILLING END: 4/11/96 (0935)			DATE COMPLETED: 4/11/96			
DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
12.5		0	SAND, 5YR 8/1, sand is coarse- to very coarse-grained, poorly sorted, soft, damp. CLAY, little SAND, 10YR 6/2, sand is fine-grained, soft, low plastic, damp. CLAY, little GRAVEL, little SAND, 5YR 5/2, sand is medium-grained, gravel up to .2 inch in diameter.			
		2.5	SAND, little GRAVEL, 5YR 8/1, sand is coarse-grained, poorly sorted, soft, damp. SAND, some GRAVEL, 5YR 8/1, sand is coarse- to very coarse-grained and moderately sorted, gravel up to .3 inch in diameter, soft, damp. No recovery.		2.4	
17.5			GRAVEL, some SAND, 5YR 8/1, gravel up to 1.1 inches in diameter, sand is very coarse-grained and poorly sorted, soft, damp. SAND, trace GRAVEL, sand is medium to coarse-grained, gravel up to .3 inch in diameter, soft, poorly sorted.			
		4.5	SAND, little GRAVEL, 10YR 6/2, sand is coarse-grained, gravel up to .5-inch in diameter, moderate sorting, well rounded, soft, damp.			
		3.5				
22.5			SAND, trace SILT, 10YR 6/2, sand is medium-grained, poorly sorted, soft, damp.			No odor; analytical sample at 23-24' (BTEX).
		170				
		260				
		230				
		480				

Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING			BORING NO.: MP-C			
SITE LOCATION: BUILDING 675, LPST 98508			DRILLING METHOD: 3-INCH ID HOLLOW STEM AUGER			
LOGGED BY: DAN SWITEK			SAMPLING METHOD: 2.5-FOOT SPLIT SPOON			
DRILLING CONTRACTOR: TIERRA DRILLING			BOREHOLE DIAMETER: 8 INCHES			
DRILLER: JOHN McDUFFEY			REF. LOGBOOK: 1			
DRILLING RIG: CME 75			TOTAL DEPTH (FT BGSL): 32.5			
DRILLING START: 4/11/96 (0755)			WATER FOUND: NA			
DRILLING END: 4/11/96 (0935)			DATE COMPLETED: 4/11/96			
DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
25		170	SAND, trace SILT, 10YR 6/2, sand is medium- to coarse-grained, sub-rounded, soft, poorly sorted, damp.			
			SAND, as above, GRAVEL lens at 28.4-28.6', gravel up to .6 inch in diameter.		190	
30			SAND, some GRAVEL, sand is medium- to coarse-grained, gravel up to .2 inch in diameter, sand coarsens down to very coarse-grained, soft, poorly sorted, damp.			
			Total depth = 32.5 feet.			
35						

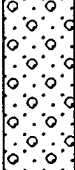
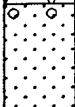
Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING	BORING NO.: MPBG
SITE LOCATION: BUILDING 675, LPST 98508	DRILLING METHOD: 3-INCH ID HOLLOW STEM AUGER
LOGGED BY: DAN SWITEK	SAMPLING METHOD: 2.5-FOOT SPLIT SPOON
DRILLING CONTRACTOR: TIERRA DRILLING	BOREHOLE DIAMETER: 8 INCHES
DRILLER: JOHN McDUFFEY	REF. LOGBOOK: 1
DRILLING RIG: CME 75	TOTAL DEPTH (FT BGSL): 32
DRILLING START: 4/13/96	WATER FOUND: NA
DRILLING END: 4/13/96 (1025)	DATE COMPLETED: 4/13/96

DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
0		0	SAND, some CLAY, some GRAVEL, grayish-orange (10YR 7/4), sand is fine-grained, gravel up to 0.5 inches, low plasticity, moderately sorted, firm, dry. No recovery.			Gravel probably from surface.
		0	SAND, some SILT, fine-grained, poorly sorted, firm, dry.			
5			SAND, same as above. SAND, little GRAVEL, grayish-orange (10YR 7/4), coarse-grained, poorly sorted, sub-angular, soft, dry. No recovery.			
10		0	SAND, grayish-orange pink (5YR 7/4), coarse- to very coarse-grained at top, fines towards bottom, poorly sorted at top, moderately sorted at bottom, soft, dry. No recovery.			
15		1.8	SAND, some GRAVEL, grayish-orange pink (5YR 7/4), sand is coarse- to very coarse-grained, gravel up to 0.4 inches, poorly sorted, loose, dry. SAND, some CLAY, grayish-orange pink (5YR 7/4), coarse-grained, poorly sorted, dense, hard, dry. SAND, some GRAVEL, grayish-orange (10YR 7/4), poorly sorted, soft, dry. No recovery.			Analytical sample.
20		0	SAND, grayish-orange pink (5YR 7/4), fine-grained, poorly sorted, sub-rounded, soft, damp.			Very hard drilling; Cement-like from 15.9-16.3'
		0	SAND, trace GRAVEL, grayish-orange pink (5YR 7/4), medium- to coarse-grained, poorly sorted, sub-rounded. No recovery.			
25						

Drilling Log - Fort Bliss

PROJECT: FORT BLISS BIOVENTING	BORING NO.: MPBG
SITE LOCATION: BUILDING 675, LPST 98508	DRILLING METHOD: 3-INCH ID HOLLOW STEM AUGER
LOGGED BY: DAN SWITEK	SAMPLING METHOD: 2.5-FOOT SPLIT SPOON
DRILLING CONTRACTOR: TIERRA DRILLING	BOREHOLE DIAMETER: 8 INCHES
DRILLER: JOHN McDUFFEY	REF. LOGBOOK: 1
DRILLING RIG: CME 75	TOTAL DEPTH (FT BGSL): 32
DRILLING START: 4/13/96	WATER FOUND: NA
DRILLING END: 4/13/96 (1025)	DATE COMPLETED: 4/13/96

DEPTH (FT)	ANALYTICAL SAMPLE	HNU SCAN (ppm)	LITHOLOGIC DESCRIPTION	GRAPHIC LOG	HNU HDSP (ppm)	COMMENTS
25			SAND, some GRAVEL, 5YR 7/2, coarse- to very coarse-grained, some gravel up to 1 inch in diameter, poorly sorted, sub-angular, some hornblende, soft, dry.			
			SAND, some GRAVEL, 5YR 7/2, sand is medium-grained, poorly sorted, subangular, soft, dry.			
30			No recovery.			
			SAND, some GRAVEL, very coarse-grained, gravel up to 1 inch in diameter, poorly sorted, subangular, damp.			
			SAND, 5Y 7/2, medium-grained, poorly sorted, subangular, damp.			Analytical sample.
			<i>Total depth = 32 feet.</i>			
35						
40						
45						
50						

ATTENTION OWNER: Confidentiality
Privilege Notice on Reverse Side

State of Texas
Monitor/Vapor Well WELL REPORT

Texas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

1) OWNER **CDR., USAADACENSB** ADDRESS **Fort Bliss, Texas 79906**
(Name) (Street or RFD) (City) (State) (Zip)

2) ADDRESS OF WELL: **Bldg. 675 Fort Bliss Texas 79906** GRID # **49-13-5**
County **El Paso** (Street, RFD or other) (City) (State) (Zip)

3) TYPE OF WORK (Check):
☒ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic
☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No

6) WELL LOG:
Date Drilling:
Started **Apr. 12 1996**
Completed **Apr. 13 1996**

DIAMETER OF HOLE		
Dia. (in.)	From (ft.)	To (ft.)
12	Surface	55

7) DRILLING METHOD (Check): ☐ Driven
☐ Air Rotary ☐ Mud Rotary ☒ Bored
☐ Air Hammer ☐ Cable Tool ☐ Jetted
☐ Other _____

From (ft.)	To (ft.)	Description and color of formation material
0 to 10ft.		Fill, sand, brown, moist.
10 to 20,		Sand, brown, moist.
20 to 25,		Clay, soft, brown, moist.
25 to 55,		Sand, some silt, poorly sorted, tan dry.
30-32ft.		sandstone, tan
35-37ft.		clay, brown, damp
		Hydrocarbons encountered

8) Borehole Completion (Check): ☐ Open Hole ☐ Straight Wall
☐ Underreamed ☐ Gravel Packed ☒ Other **SI02 8-16**
If Gravel Packed give interval ... from **15** ft. to **55** ft.

CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.)		Gage Casting Screen
			From	To	
2	N	PVC., Mfg.,	0	15	Blk.
2	N	PVC. Screen Mfg.	15	45	0.04
2	N	PVC. Screen Mfg.	45	55	0.02

9) CEMENTING DATA [Rule 338.44(1)]
Cemented from **0** ft. to **11** ft. No. of sacks used **3**
Bentonite **11** ft. to **15** ft. No. of sacks used **2**
Method used **Hand Mix/ Gravity Placed**
Cemented by **Tierra Drilling**
Distance to septic system field lines or other concentrated contamination **0** ft.
Method of verification of above distance **Visual LUST site**

13) TYPE PUMP: **N/A**
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS: **N/A**
Type test: ☐ Pump ☐ Bailor ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

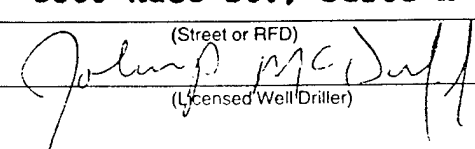
10) SURFACE COMPLETION
☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
☐ Pitless Adapter Used [Rule 338.44(3)(b)]
☐ Approved Alternative Procedure Used [Rule 338.71]

11) WATER LEVEL: **47**
Static level **0** ft. below land surface Date **April 12-96**
Artesian flow _____ gpm. Date _____

15) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable constituents?
☒ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? **Natural** Depth of strata **47**
Was a chemical analysis made? ☒ Yes ☐ No

12) PACKERS: **N/A** Type _____ Depth _____

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME **Tierra Drilling and Environmental Services INC.** WELL DRILLER'S LICENSE NO. **2994W**
(Type or print)
ADDRESS **5309 Mace St., Suite A-1 El Paso, Texas 79932**
(Street or RFD) (City) (State) (Zip)
(Signed)  (Signed) _____
(Licensed Well Driller) (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

ATTENTION OWNER: Confidentiality
Privilege Notice on Reverse Side

MP-A

State of Texas
WELL REPORTTexas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

page one of two --String 1 and 2

1) OWNER CDR., USAADACENSB ADDRESS Fort Bliss, Texas 79906
(Name) (Street or RFD) (City) (State) (Zip)

2) ADDRESS OF WELL:
County El Paso Bldg. 675 Fort Bliss Texas 79906 GRID # 49-13-5
(Street, RFD or other) (City) (State) (Zip)

3) TYPE OF WORK (Check):
☒ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic
☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No

5)

6) WELL LOG:
Date Drilling:
Started Apr. 12 19 96
Completed Apr. 13 19 96

DIAMETER OF HOLE		
Dia. (in.)	From (ft.)	To (ft.)
8	Surface	46

7) DRILLING METHOD (Check): ☐ Driven
☐ Air Rotary ☐ Mud Rotary ☒ Bored
☐ Air Hammer ☐ Cable Tool ☐ Jetted
☐ Other _____

8) Borehole Completion (Check): ☐ Open Hole ☐ Straight Wall
☐ Underreamed ☐ Gravel Packed ☒ Other SEE #8 below
If Gravel Packed give interval ... from _____ ft. to _____ ft.

CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.)		Gage Casting Screen
			From	To	
.5	N	Plastic STG-1	0	15.1	Blk.
1"	N	PVC Screen Mfg.	15.1	16.0	0.02
.5	N	Plastic STG-2	0	31.2	Blk.
1"	N	PVC Screen Mfg.	31.2	32.0	0.02

9) CEMENTING DATA [Rule 338.44(1)]
Cemented from 0 ft. to 8 ft. No. of sacks used 2
Bentonite 8 ft. to 13 ft. No. of sacks used 2
Method used Hand Mix/ Gravity Placed
Cemented by Tierra Drilling
Distance to septic system field lines or other concentrated contamination 0 ft.
Method of verification of above distance Visual LUST Site

10) SURFACE COMPLETION
☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
☐ Pitless Adapter Used [Rule 338.44(3)(b)]
☐ Approved Alternative Procedure Used [Rule 338.71]

11) WATER LEVEL: N/A
Static level _____ ft. below land surface Date Apr. 12-96
Artesian flow 0 gpm. Date _____

12) PACKERS: N/A Type _____ Depth _____

13) TYPE PUMP: N/A
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS: N/A
Type test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable constituents?
☒ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? None Depth of strata 20ft.
Was a chemical analysis made? ☒ Yes ☐ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME Environmental Services Inc. WELL DRILLER'S LICENSE NO. 2994W
(Type or print)
5309 Mace St., Suite A-1, El Paso, Texas 79932
ADDRESS (Street or RFD) (City) (State) (Zip)

(Signed) John A. McDaniel (Signed) _____
(Licensed Well Driller) (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

ATTENTION OWNER: Confidentiality
Privilege Notice on Reverse SideMP-A
Page two of
two, String 3
State of Texas
WELL REPORTTexas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

1) OWNER CDR., USAADACENS ADDRESS Fort Bliss, Texas 79906		(Name) (Street or RFD) (City) (State) (Zip)																																	
2) ADDRESS OF WELL: El Paso Bldg. 675 Fort Bliss Texas 79906 GRID # 49-13-5		(City) (State) (Zip)																																	
3) TYPE OF WORK (Check): ☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging		4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No																																	
6) WELL LOG: Date Drilling: Apr. 12 1996 Started Apr. 13 1996 Completed _____		7) DRILLING METHOD (Check): ☐ Driven ☐ Air Rotary ☐ Mud Rotary ☒ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☐ Other _____																																	
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COMPANY NAME **Tierra Drilling and Services Inc.** WELL DRILLER'S LICENSE NO. **2994W**
(Type or print)
ADDRESS **5309 Mace St., Suite A-1 El Paso, Texas 79932**
(Street or RFD) (City) (State) (Zip)(Signed) John P. McDuff (Signed) _____
(Licensed Well Driller) (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

ATTENTION OWNER: Confidentiality Privilege Notice on Reverse Side		MP-B State of Texas WELL REPORT page one of two--String 1 and 2		Texas Water Well Drillers Advisory Council P.O. Box 13087 Austin, TX 78711-3087 512-239-0530																																																								
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		12) PACKERS: <u>N/A</u> Type _____ Depth _____																																																										

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME Tierra Drilling and Environmental Services Inc. (Type or print) WELL DRILLER'S LICENSE NO. 2994W

ADDRESS 5309 Mace St., Suite A-1 El Paso, Texas 79932 (Street or RFD) (City) (State) (Zip)

(Signed) John P. McDiff (Licensed Well Driller) (Signed) _____ (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

MP-B

State of Texas

WELL REPORT

page two of two-- String 3

Texas Water Well Drillers Advisory Council

P.O. Box 13087

Austin, TX 78711-3087

512-239-0530

- 2) ADDRESS OF WELL:
County El Paso Bldg. 675 Fort Bliss, Texas 79906 GRID # 49-13-5
(Street, RFD or other) (City) (State) (Zip)

- | | |
|---|--|
| <p>3) TYPE OF WORK (Check):</p> <p>☒ New Well ☐ Deepening</p> <p>☐ Reconditioning ☐ Plugging</p> | <p>4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic</p> <p>☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell</p> <p>If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No</p> |
|---|--|

- 6) WELL LOG:
Date Drilling:
Started Apr. 11 19 96
Completed Apr. 13 19 96

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8	Surface	58

- 7) **DRILLING METHOD (Check):** ☐ Driven
☐ Air Rotary ☐ Mud Rotary ☒ Bored
☐ Air Hammer ☐ Cable Tool ☐ Jetted
☐ Other _____

- | From (ft.) | To (ft.) | Description and color of formation material |
|------------|----------|---|
|------------|----------|---|

SEE PAGE ONE PLEASE

- 8) Borehole Completion (Check): ☐ Open Hole ☐ Straight Wall
☐ Underreamed ☐ Gravel Packed ☒ Other **SEE #8 Below**
 If Gravel Packed give interval ... from _____ ft. to _____ ft.

CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.)		Gage Casting Screen
			From	To	
.5	N	Plastic STG-3	0	44.2	Blk.
1"	N	PVC Screen mfg.	44.2	45.0	0.02

- 13) TYPE PUMP: **N/A**

- ☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder

- ☐
- Other _____

Depth to pump bowls, cylinder, jet, etc., _____ ft.

- 9) CEMENTING DATA [Rule 338.44(1)] **See page one**

Cemented from _____ ft. to _____ ft. No. of sacks used _____

ft. to _____ ft. No. of sacks used _____

Method used

Cemented by _____

Distance to septic system field lines or other concentrated contamination _____ ft.

Method of verification of above distance _____

- ## 10) SURFACE COMPLETION

- ☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]

- ☐
- Specified Steel Sleeve Installed [Rule 338.44(3)(A)]

- ☐
- Pitless Adapter Used [Rule 338.44(3)(b)]

- ☐
- Approved Alternative Procedure Used [Rule 338.71]

- 11) WATER LEVEL: See page one

Static level _____ ft. below land surface Date _____

Artesian flow _____ gpm. Date _____

- | 12) PACKERS: | Type | Depth |
|--------------|------|-------|
| N/A | | |

-
-
-

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME Tierra Drilling and
Environmental (Type or print) Services Inc.

WELL DRILLER'S LICENSE NO. 2994W

ADDRESS 5309 Mace St., Suite A-1 El Paso, Texas

(Signed) _____ (Licensed Well Driller) (Signed) _____ (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

ATTENTION OWNER: Confidentiality
Privilege Notice on Reverse Side

MP-C

State of Texas
WELL REPORTTexas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

page one of two -- String 1 and 2

1) OWNER CDR., USAADACENSB ADDRESS Fort Bliss, Texas 79906
(Name) (Street or RFD) (City) (State) (Zip)2) ADDRESS OF WELL: Bldg. 676 Fort Bliss, Texas 79906 GRID # 49-13-5
County El Paso (Street, RFD or other) (City) (State) (Zip)

3) TYPE OF WORK (Check):

☒ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):

☒ Monitor ☐ Environmental Soil Boring ☐ Domestic
☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No

6) WELL LOG:

Date Drilling:

Started Apr. 11 19 96Completed Apr. 13 19 96

DIAMETER OF HOLE

Dia. (in.) From (ft.) To (ft.)

8 Surface 33

7) DRILLING METHOD (Check):

☐ Driven
☐ Air Rotary ☐ Mud Rotary ☒ Bored
☐ Air Hammer ☐ Cable Tool ☐ Jetted
☐ Other _____

From (ft.) To (ft.) Description and color of formation material

0 to 10ft. Fill, sand, brown, moist.10 to 20 Sand, brown, moist.20 to 25 Clay, soft, brown, moist.25 to 33 Sand, poorly sorted, tan,
dry.Hydrocarbons encounteredX #8 Borehole Completion12.5 to 15.5 SI02 8-1615.5 to 22.0 Bentonite22.0 to 24.7 SI02 8-16

(Use reverse side if necessary)

13) TYPE PUMP: N/A☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder☐ Other _____

Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS: N/AType test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated

Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:

Did you knowingly penetrate any strata which contained undesirable constituents?

☒ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER"Type of water? None Depth of strata 20ft.Was a chemical analysis made? ☒ Yes ☐ No

8) Borehole Completion (Check):

☐ Open Hole ☐ Straight Wall
☐ Underreamed ☐ Gravel Packed ☒ Other SEE #8 below
If Gravel Packed give interval ... from _____ ft. to _____ ft.

CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.)		Gage Casting Screen
			From	To	
<u>.5</u>	<u>N</u>	<u>Plastic STG-1</u>	<u>0</u>	<u>14.7</u>	<u>BLK.</u>
<u>1"</u>	<u>N</u>	<u>PVC Screen mfg.</u>	<u>14.7</u>	<u>15.5</u>	<u>0.02</u>
<u>.5</u>	<u>N</u>	<u>Plastic STG-2</u>	<u>0</u>	<u>23.2</u>	<u>BLK.</u>
<u>1"</u>	<u>N</u>	<u>PVC Screen mfg.</u>	<u>23.2</u>	<u>24.0</u>	<u>0.02</u>

9) CEMENTING DATA [Rule 338.44(1)]

Cemented from 0 ft. to 8 ft. No. of sacks used 2Bentonite 8 ft. to 12.5 ft. No. of sacks used 3Method used Hand Mix/ Gravity PlacedCemented by Tierra DrillingDistance to septic system field lines or other concentrated contamination 0 ft.Method of verification of above distance Visual LUST Site

10) SURFACE COMPLETION

☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)]☐ Pitless Adapter Used [Rule 338.44(3)(b)]☐ Approved Alternative Procedure Used [Rule 338.71]11) WATER LEVEL: N/A

Static level _____ ft. below land surface

Date Apr. 11 1996Artesian flow 0 gpm.

Date _____

12) PACKERS: N/A

Type

Depth

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME Tierra Drilling and
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(Type or print)WELL DRILLER'S LICENSE NO. 2994WADDRESS 5309 Mace St., Suite A-1 El Paso, Texas 79932
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(Licensed Well Driller)(Signed) _____
(Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

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Privilege Notice on Reverse Side

MP-C

State of Texas

Texas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

WELL REPORT
page two of two-- String 3

1) OWNER CDR., USAADACENSEB ADDRESS Fort Bliss, Texas 79906
(Name) (Street or RFD) (City) (State) (Zip)

2) ADDRESS OF WELL: Bldg. 675 Fort Bliss, Texas 79906 GRID # 49-13-5
County El Paso (Street, RFD or other) (City) (State) (Zip)

3) TYPE OF WORK (Check):
☒ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic
☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No

6) WELL LOG:
Date Drilling:
Started Apr. 11 19 96
Completed Apr. 13 19 96

DIAMETER OF HOLE		
Dia. (in.)	From (ft.)	To (ft.)
<u>8</u>	Surface	<u>33</u>

7) DRILLING METHOD (Check): ☐ Driven
☐ Air Rotary ☐ Mud Rotary ☒ Bored
☐ Air Hammer ☐ Cable Tool ☐ Jetted
☐ Other _____

From (ft.) To (ft.) Description and color of formation material
SEE PAGE ONE PLEASE

8) Borehole Completion (Check): ☐ Open Hole ☐ Straight Wall
☐ Underreamed ☐ Gravel Packed ☒ Other SEE #8 below
If Gravel Packed give interval ... from _____ ft. to _____ ft.

CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.)		Gage Casting Screen
			From	To	
<u>.5</u>	<u>N</u>	<u>Plastic STG-3</u>	<u>0</u>	<u>31.2</u>	<u>BLK.</u>
<u>1"</u>	<u>N</u>	<u>PVC Screen mfg.</u>	<u>31.2</u>	<u>33.0</u>	<u>0.02</u>

9) CEMENTING DATA [Rule 338.44(1)] See page one
Cemented from _____ ft. to _____ ft. No. of sacks used _____
_____ ft. to _____ ft. No. of sacks used _____
Method used _____
Cemented by _____
Distance to septic system field lines or other concentrated contamination _____ ft.
Method of verification of above distance _____

13) TYPE PUMP: N/A
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS: N/A
Type test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable constituents?
☒ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? None Depth of strata 20ft.
Was a chemical analysis made? ☐ Yes ☐ No

10) SURFACE COMPLETION
☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
☐ Pitless Adapter Used [Rule 338.44(3)(b)]
☐ Approved Alternative Procedure Used [Rule 338.71]

11) WATER LEVEL: See page one
Static level _____ ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

12) PACKERS: N/A Type _____ Depth _____

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME Tierra Drilling and Services Inc. WELL DRILLER'S LICENSE NO. 2994W
(Type or print)
5309 Mace St., Suite A-1 El Paso, Texas 79932

ADDRESS _____ (Street or RFD) (City) (State) (Zip)

(Signed) John P. McDuff (Signed) _____ (Registered Driller Trainee)
(Licensed Well Driller)

Please attach electric log, chemical analysis, and other pertinent information, if available.

ATTENTION OWNER: Confidentiality
Privilege Notice on Reverse Side

MP-D

State of Texas

Texas Water Well Drillers Advisory Council

P.O. Box 13087

Austin, TX 78711-3087

512-239-0530

WELL REPORT
page one of two--- String 1 and 2

1) OWNER CDR., USAADACENSB ADDRESS Fort Bliss Texas 79906 (Name) (Street or RFD) (City) (State) (Zip)																																	
2) ADDRESS OF WELL: Bldg. 675 Fort Bliss, Texas 79906 GRID # 49-13-5 County El Paso (Street, RFD or other) (City) (State) (Zip)																																	
3) TYPE OF WORK (Check): ☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging	4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No																																
6) WELL LOG: Date Drilling: Apr. 13 96 Started Apr. 13 1996 Completed _____	7) DRILLING METHOD (Check): ☐ Driven ☐ Air Rotary ☐ Mud Rotary ☒ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☐ Other _____																																
5) _____																																	
8) Borehole Completion (Check): ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☐ Gravel Packed ☒ Other SEE #8 below If Gravel Packed give interval ... from _____ ft. to _____ ft.																																	
CASING, BLANK PIPE, AND WELL SCREEN DATA:																																	
<table border="1" style="width:100%"><thead><tr><th rowspan="2">Dia. (in.)</th><th rowspan="2">New or Used</th><th rowspan="2">Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial</th><th colspan="2">Setting (ft.)</th><th rowspan="2">Gage Casting Screen</th></tr><tr><th>From</th><th>To</th></tr></thead><tbody><tr><td>.5</td><td>N</td><td>Plastic STG-1</td><td>0</td><td>15.2</td><td>BLK.</td></tr><tr><td>1"</td><td>N</td><td>PVC Screen mfg.</td><td>15.2</td><td>16.0</td><td>0.02</td></tr><tr><td>.5</td><td>N</td><td>Plastic STG-2</td><td>0</td><td>23.2</td><td>BLK.</td></tr><tr><td>1"</td><td>N</td><td>PVC Screen mfg.</td><td>23.2</td><td>24.0</td><td>0.02</td></tr></tbody></table>		Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.)		Gage Casting Screen	From	To	.5	N	Plastic STG-1	0	15.2	BLK.	1"	N	PVC Screen mfg.	15.2	16.0	0.02	.5	N	Plastic STG-2	0	23.2	BLK.	1"	N	PVC Screen mfg.	23.2	24.0	0.02
Dia. (in.)	New or Used				Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.)		Gage Casting Screen																									
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.5	N	Plastic STG-2	0	23.2	BLK.																												
1"	N	PVC Screen mfg.	23.2	24.0	0.02																												
9) CEMENTING DATA [Rule 338.44(1)] Cemented from 8 ft. to 13 ft. No. of sacks used 2 Bentonite Hand Mix/ Gravity Placed Method used Tierra Drilling Cemented by _____ Distance to septic system field lines or other concentrated contamination 200 ft. Method of verification of above distance Tape measure																																	
10) SURFACE COMPLETION ☒ Specified Surface Slab Installed [Rule 338.44(2)(A)] ☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)] ☐ Pitless Adapter Used [Rule 338.44(3)(b)] ☐ Approved Alternative Procedure Used [Rule 338.71]																																	
11) WATER LEVEL: N/A Apr. 13 96 Static level _____ ft. below land surface Date _____ Artesian flow _____ gpm. Date _____																																	
12) PACKERS: N/A Type _____ Depth _____																																	
13) TYPE PUMP: N/A ☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder ☐ Other _____ Depth to pump bowls, cylinder, jet, etc., _____ ft.																																	
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15) WATER QUALITY: Did you knowingly penetrate any strata which contained undesirable constituents? ☐ Yes ☒ No If yes, submit "REPORT OF UNDESIRABLE WATER" Type of water? _____ Depth of strata _____ Was a chemical analysis made? ☐ Yes ☒ No																																	

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

Tierra Drilling and Environmental Services Inc. WELL DRILLER'S LICENSE NO. **2994W**
5309 Mace St., Suite A-1 El Paso Texas 79932
(Type or print)

ADDRESS _____ (Street or RFD) (City) (State) (Zip)
(Signed) John P. McDaniel (Signed) _____
(Licensed Well Driller) (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

ATTENTION OWNER: Confidentiality
Privilege Notice on Reverse Side

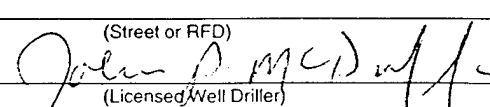
MP-D

State of Texas

Texas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530page two of two **WELL REPORT** String 3

1) OWNER CDR., USAADACENSB (Name)		ADDRESS Fort Bliss, Texas 79906 (Street or RFD) (City) (State) (Zip)																					
2) ADDRESS OF WELL: County El Paso		Bldg. 675 Fort Bliss, Texas 79906 GRID # 49-13-5 (Street, RFD or other) (City) (State) (Zip)																					
3) TYPE OF WORK (Check): ☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging		4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No																					
6) WELL LOG: Date Drilling: Started Apr. 13 19 96 Completed Apr. 13 96		7) DRILLING METHOD (Check): ☐ Driven ☐ Air Rotary ☐ Mud Rotary ☒ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☐ Other _____																					
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Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.)				Gage Casting Screen																
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.5	N	Plastic STG-3	0	32	Blk.																		
1"	N	PVC Screen mfg.	32	32.8	0.02																		
X#8 Borehole Completion 25 to 32ft. Bentonite 32 to 33 SIO2 8-16																							
(Use reverse side if necessary)		9) CEMENTING DATA [Rule 338.44(1)] See Page One Cemented from _____ ft. to _____ ft. No. of sacks used _____ _____ ft. to _____ ft. No. of sacks used _____ Method used _____ Cemented by _____ Distance to septic system field lines or other concentrated contamination _____ ft. Method of verification of above distance _____																					
13) TYPE PUMP: N/A ☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder ☐ Other _____ Depth to pump bowls, cylinder, jet, etc., _____ ft.		10) SURFACE COMPLETION ☒ Specified Surface Slab Installed [Rule 338.44(2)(A)] ☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)] ☐ Pitless Adapter Used [Rule 338.44(3)(b)] ☐ Approved Alternative Procedure Used [Rule 338.71]																					
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15) WATER QUALITY: See page one Did you knowingly penetrate any strata which contained undesirable constituents? ☐ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER" Type of water? _____ Depth of strata _____ Was a chemical analysis made? ☐ Yes ☐ No		12) PACKERS: N/A Type _____ Depth _____																					

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME **Tierra Drilling and Environmental Services Inc.** WELL DRILLER'S LICENSE NO. **2994W**
(Type or print)
ADDRESS **5309 Mace St., Suite A-1 El Paso, Texas 79932**
(Street or RFD) (City) (State) (Zip)
(Signed)  (Signed) _____
(Licensed Well Driller) (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

State of Texas

REPORT OF
UNDESIRABLE WATER OR CONSTITUENTS

To be completed by Well Driller. (Type or print.)

1. Well Driller: John P. McDuffee
Company Name: Tierra Drilling and Environmental Services Inc.
Address: 5200 Wade St., Suite A-1 El Paso, Texas 79902
(Street or RFD) (City) (State)

2. Landowner or Person Having Well Drilled: CEL., USAMADENSR
Address: Wade St., Texas 79906
(Street or RFD) (City) (State)

3. Location of Well: County El Paso ☒ See attached map
League _____ Abstract No. _____
NW⁴, NE⁴, SW⁴, SE⁴, of Section _____ Block _____
Survey _____
_____ miles in _____ direction.
(NE, SW, etc.)
from _____
(Town)

4. Reason why Report was submitted:
☐ Naturally-occurring, poor-quality groundwater encountered;
☒ Hydrocarbon contamination encountered (includes gasoline, diesel, etc.);
☐ Hazardous material/hazardous waste contamination encountered;
☐ Other; describe _____

5. Date Well Drilled: April 11 to 13, 1996 Type Well: 2" PVC Monitor/Vapor Well,
.5" Plastic Monitor pts. A-B-C

6. Has a Water Well Report form relating to this well been forwarded to the Texas Water Commission?

☒ Yes ☐ No Date April 20, 1996

7. I do hereby certify that in drilling, deepening, or otherwise altering the above described well, undesirable water or constituents has been encountered and the landowner or person having the well drilled has been informed by certified mail that such well must be completed or plugged in such a manner as to avoid injury or pollution.

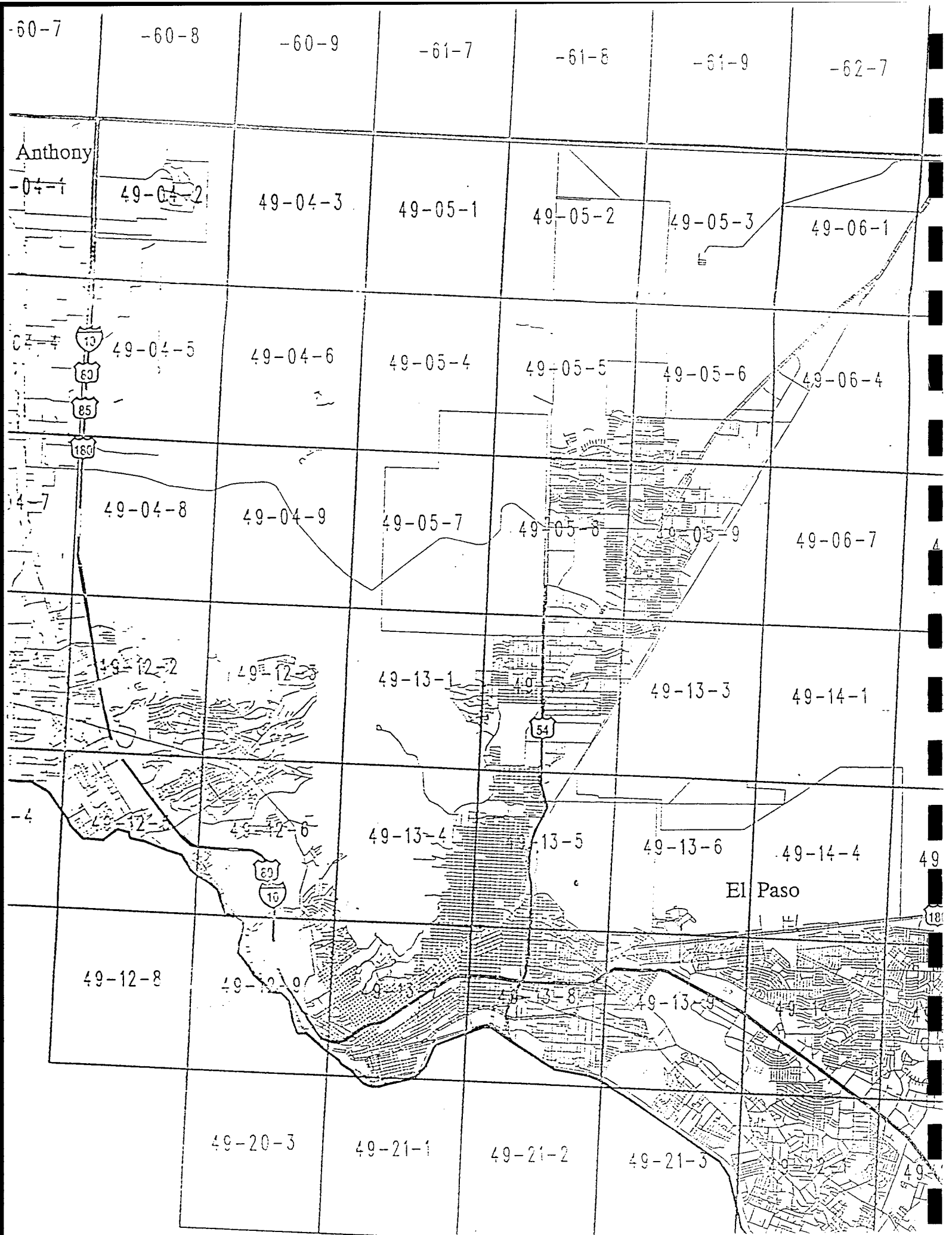
Date April 20, 1996

Reg. No. 5554 (Signed) John P. McDuffee
(Well Driller)

Send White Copy by Certified Mail to: TEXAS WATER COMMISSION, P.O. Box 13087, Austin, Texas 78711

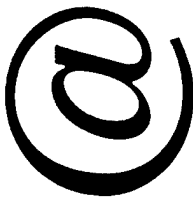
Send Yellow Copy by Certified Mail to: LANDOWNER or PERSON HAVING WELL DRILLED

Pink Copy to be retained by: WELL DRILLER



APPENDIX B

**CHAIN-OF CUSTODY FORMS AND ANALYTICAL DATA
REPORTING SHEETS**



AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX: (916) 985-1020

No. 008872

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Contact Person <u>Erion Vanderglas</u>	Project info: P.O. # Project # <u>726876-71130</u> Project Name <u>Fort Bliss Bunker</u>	Turn Around Time: ☒ Normal ☐ Rush _____ Specify _____
Company <u>Perseus Engineering Service</u>		
Address <u>5800 Corva Park Dr</u> City <u>Austin</u> State <u>TX</u> Zip <u>78754</u>		
Phone <u>512/477-6000</u> FAX <u>512/719-6099</u>		
Collected By: Signature <u>Erion Vanderglas</u>		

Lab I.D.	Field Sample I.D.	Date & Time	Analyses Requested	Canister Pressure / Vacuum Initial Final Receipt
~~MPA-45~~ <u>PEL: MPA-45</u>	<u>4/14/96 @ 0920</u>	<u>TO-3 (PEL + TPH - gasoline) / 9460</u>		
<u>PEL: MW-01</u>	<u>4/14/96 @ 0925</u>	<u>TO-3 (PEL + TPH - gasoline) / 94917</u>		
<u>PEL: MPPB-32</u>	<u>4/14/96 @ 0924</u>	<u>TO-3 (PEL + TPH - gasoline) / 9431</u>		
<u>PEL: MPPB-45</u>	<u>4/14/96 @ 0922</u>	<u>TO-3 (PEL + TPH - gasoline) / 94921</u>		
<u>PEL: MPPC-32</u>	<u>4/14/96 @ 0917</u>	<u>TO-3 (PEL + TPH - gasoline) / R120</u>		

Relinquished By: (Signature) <u>Erion Vanderglas</u> Date/Time <u>4/14/96 @ 1500</u> Print Name <u>Erion Vanderglas</u>	Notes: <u>High TVH readings at all sample locations during screening activities.</u> <u>REV</u>
Relinquished By: (Signature) _____ Date/Time _____	
Relinquished By: (Signature) _____ Date/Time _____	

Shipper Name	Air Bill #	Opened By	Date/Time	Temp. (°C)	Condition	Custody Seals Intact?	Work Order #
Lab Use Only						Yes No None N/A	

PARSONS ENGINEERING SCIENCE, INC.
8000 CENTRE PARK DRIVE SUITE 200
AUSTIN, TEXAS 78754
(512) 719-6000

White: laboratory returns with data; Yellow: laboratory copy; Pink: sampler copy.

(512) 719-6000

White: laboratory returns with data; Yellow: laboratory copy; Pink: sampler copy.

96-1162 98

TOTAL P.02

White: laboratory returns with data; Yellow: laboratory copy; Pink: sampler copy.

* [redacted] sample MOB 607-2009 10066444 ABBEY ROAD NORTON MASSACHUSETTS

PARSONS ENGINEERING SCIENCE, INC.
8000 CENTRE PARK DRIVE SUITE 200
AUSTIN, TEXAS 78754
(512) 719-6000

White: laboratory returns with data; Yellow: laboratory copy; Pink: sampler copy.

96-1162 98

96-1162 98

White: laboratory returns with data; Yellow: laboratory copy; Pink: sampler copy.

* SAMPLE MPB (24-25) IN 16WM IS LABELED MPB (23-25) OF 0

CHAIN OF CUSTODY RECORD

PARSONS ENGINEERING SCIENCE, INC.
8000 CENTRE PARK DRIVE SUITE 200
AUSTIN, TEXAS 78754
(512) 719 6000

PROJECT NAME/LOCATION

Fort Bliss bioventing, site LPS198504

PROJECT NUMBER

726876.71130

SAMPLE USE

Brian Vanderglas

Din Switers

CARRIER

☒ Federal Express ☐ UPS

Other

AIRBILL OR CARRIER ID #

FedEx # 7751746984

PRESERVATIVE

2M (B)

ANALYSIS REQUIRED

TPH, BTEX, Chloroethers

Salph

Alkalinity

Hardness

TKN

Phosphates

PAHs (B270)

FIELD LOT CONTROL NUMBER

Ambient Condition Blank

Equipment Blank

Top Blank

Cooler/Letter

REMARKS

01 Ambient 1000
02 Retz or Rusty
03 Freshwater
04 (203) 831-8100
05 for specific
06 question's asked
07 analytical methods
08
09
10

Sample Type

NI

NI

NI

NI

NI

NI

NI

NI

NI

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NI

NI

NI

NI

NI

NI

NI

Sample ID/Desc.

FB1: MPB(47-50)

FB1: MPB(48-49)

VW01(45-46)

MPB(24-25)

MPA(37-38)

MPB(23-25)

FB1: MPB(23-24)

MPA(44-45)

FB1: VW01(56.5)

TB1

Date

4/11/96

4/11/96

4/12/96

4/11/96

4/12/96

4/11/96

4/11/96

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4/12/96

4/12/96

Brian Vanderglas

4/12/96 1800

4/12/96 0900

4/12/96 0900

4/12/96 0900

White: laboratory returns with data; Yellow: laboratory copy; Pink: sampler copy.

* SAMPLE MPB(24.75) in 16WH is in error and not used.

LOC: C212
2, 4, 16WH

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Methods 602/8020 and 5030/8015 Modified Data Report

Client Sample Number : FB1:MPB(48-49) Client Project Number : 726876.71130
Lab Sample Number : 96-1162-02 Lab Project Number : 96-1162
Date Sampled : 4/11/96 Matrix : SOIL
Date Received : 4/13/96 Lab File Number(s) : TVB10417021
Date Prepared : 4/15/96 Method Blank : MEB1041596
FID Dilution Factor : 6250 Soil Extracted? : YES
PID Dilution Factor : 6250 Soil Moisture : 14.97%

Compound Name	Cas Number	Analysis Date	Sample Concentration	RL	Units
TVH-Gasoline	----	4/17/96	8200	735	mg/kg
Benzene	71-43-2	4/17/96	U	2940	ug/kg
Toluene	108-88-3	4/17/96	190000	2940	ug/kg
Chlorobenzene	108-90-7	4/17/96	22000	2940	ug/kg
Ethyl Benzene	100-41-4	4/17/96	110000	2940	ug/kg
Total Xylenes (m,p,o)	1330-20-7	4/17/96	550000	2940	ug/kg
1,3,5-Trimethylbenzene	108-67-8	4/17/96	100000	2940	ug/kg
1,2,4-Trimethylbenzene	95-63-6	4/17/96	260000	2940	ug/kg
1,2,3-Trimethylbenzene	526-73-8	4/17/96	86000	2940	ug/kg
1,2,3,4-Tetramethylbenzene	488-23-3	4/17/96	78000	3675	ug/kg
FID Surrogate Recovery:		103%		65%-129%	(Limits)
PID Surrogate Recovery:		94%		65%-129%	(Limits)

Notes: Total Xylenes consist of three isomers, two of which co-elute. The Xylene RL is for a single peak.

Comments:

QUALIFIERS and DEFINITIONS:

E = Extrapolated value. Value exceeds calibration range.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit.
RL = Reporting Limit.
NA = Not Available/Not Applicable.
PID = Photoionization detector.
FID = Flame ionization detector.
TVH = Total Volatile Hydrocarbons.


Analyst


Approved

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Methods 602/8020 and 5030/8015 Modified Data Report

Client Sample Number	: VW01(45-46)	Client Project Number	: 726876.71130
Lab Sample Number	: 96-1162-03	Lab Project Number	: 96-1162
Date Sampled	: 4/12/96	Matrix	: SOIL
Date Received	: 4/13/96	Lab File Number(s)	: TVB10417018
Date Prepared	: 4/17/96	Method Blank	: MB1041796
FID Dilution Factor	: 1.0	Soil Extracted?	: NO
PID Dilution Factor	: 1.0	Soil Moisture	: 9.40%

Compound Name	Cas Number	Analysis Date	Sample Concentration	RL	Units
TVH-Gasoline	---	4/17/96	U	0.1	mg/kg
Benzene	71-43-2	4/17/96	U	0.4	ug/kg
Toluene	108-88-3	4/17/96	U	0.4	ug/kg
Chlorobenzene	108-90-7	4/17/96	U	0.4	ug/kg
Ethyl Benzene	100-41-4	4/17/96	U	0.4	ug/kg
Total Xylenes (m,p,o)	1330-20-7	4/17/96	U	0.4	ug/kg
1,3,5-Trimethylbenzene	108-67-8	4/17/96	1.0	0.4	ug/kg
1,2,4-Trimethylbenzene	95-63-6	4/17/96	U	0.4	ug/kg
1,2,3-Trimethylbenzene	526-73-8	4/17/96	0.4	0.4	ug/kg
1,2,3,4-Tetramethylbenzene	488-23-3	4/17/96	U	0.6	ug/kg
FID Surrogate Recovery:		104%		50%-132%	(Limits)
PID Surrogate Recovery:		96%		72%-118%	(Limits)

Notes: Total Xylenes consist of three isomers, two of which co-elute. The Xylene RL is for a single peak.

Comments:

QUALIFIERS and DEFINITIONS:

E = Extrapolated value. Value exceeds calibration range.

U = Compound analyzed for, but not detected.

B = Compound also found in the blank.

J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit.

RL = Reporting Limit.

NA = Not Available/Not Applicable.

PID = Photoionization detector.

FID = Flame ionization detector.

TVH = Total Volatile Hydrocarbons.

K. Hollman

Analyst

Approved

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Methods 602/8020 and 5030/8015 Modified Data Report

Client Sample Number	: MPB(24-25)	Client Project Number	: 726876.71130
Lab Sample Number	: 96-1162-04	Lab Project Number	: 96-1162
Date Sampled	: 4/11/96	Matrix	: SOIL
Date Received	: 4/13/96	Lab File Number(s)	: TVB10417022
Date Prepared	: 4/15/96	Method Blank	: MEB1041596
FID Dilution Factor	: 125	Soil Extracted?	: YES
PID Dilution Factor	: 125	Soil Moisture	: 3.04%

Compound Name	Cas Number	Analysis Date	Sample Concentration	RL	Units
TVH-Gasoline	----	4/17/96	360	13	mg/kg
Benzene	71-43-2	4/17/96	U	52	ug/kg
Toluene	108-88-3	4/17/96	1200	52	ug/kg
Chlorobenzene	108-90-7	4/17/96	600	52	ug/kg
Ethyl Benzene	100-41-4	4/17/96	1900	52	ug/kg
Total Xylenes (m,p,o)	1330-20-7	4/17/96	20000	52	ug/kg
1,3,5-Trimethylbenzene	108-67-8	4/17/96	6900	52	ug/kg
1,2,4-Trimethylbenzene	95-63-6	4/17/96	17000	52	ug/kg
1,2,3-Trimethylbenzene	526-73-8	4/17/96	5000	52	ug/kg
1,2,3,4-Tetramethylbenzene	488-23-3	4/17/96	6400	64	ug/kg
FID Surrogate Recovery:		103%		65%-129%	(Limits)
PID Surrogate Recovery:		92%		65%-129%	(Limits)

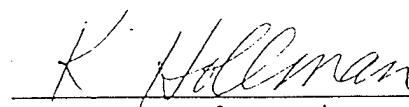
Notes: Total Xylenes consist of three isomers, two of which co-elute. The Xylene RL is for a single peak.

Comments:

QUALIFIERS and DEFINITIONS:

E = Extrapolated value. Value exceeds calibration range.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit.
RL = Reporting Limit.
NA = Not Available/Not Applicable.
PID = Photoionization detector.
FID = Flame ionization detector.
TVH = Total Volatile Hydrocarbons.


Analyst


Approved

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Methods 602/8020 and 5030/8015 Modified Data Report

Client Sample Number	: MPA(37-38)	Client Project Number	: 726876.71130
Lab Sample Number	: 96-1162-05	Lab Project Number	: 96-1162
Date Sampled	: 4/12/96	Matrix	: SOIL
Date Received	: 4/13/96	Lab File Number(s)	: TVB10417023
Date Prepared	: 4/15/96	Method Blank	: MEB1041596
FID Dilution Factor	: 500	Soil Extracted?	: YES
PID Dilution Factor	: 500	Soil Moisture	: 5.83%

Compound Name	Cas Number	Analysis Date	Sample Concentration	RL	Units
TVH-Gasoline	---	4/17/96	1200	53	mg/kg
Benzene	71-43-2	4/17/96	U	212	ug/kg
Toluene	108-88-3	4/17/96	16000	212	ug/kg
Chlorobenzene	108-90-7	4/17/96	2800	212	ug/kg
Ethyl Benzene	100-41-4	4/17/96	13000	212	ug/kg
Total Xylenes (m,p,o)	1330-20-7	4/17/96	79000	212	ug/kg
1,3,5-Trimethylbenzene	108-67-8	4/17/96	17000	212	ug/kg
1,2,4-Trimethylbenzene	95-63-6	4/17/96	47000	212	ug/kg
1,2,3-Trimethylbenzene	526-73-8	4/17/96	14000	212	ug/kg
1,2,3,4-Tetramethylbenzene	488-23-3	4/17/96	13000	265	ug/kg
FID Surrogate Recovery:		101%		65%-129%	(Limits)
PID Surrogate Recovery:		94%		65%-129%	(Limits)

Notes: Total Xylenes consist of three isomers, two of which co-elute. The Xylene RL is for a single peak.

Comments:

QUALIFIERS and DEFINITIONS:

E = Extrapolated value. Value exceeds calibration range.

U = Compound analyzed for, but not detected.

B = Compound also found in the blank.

J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit.

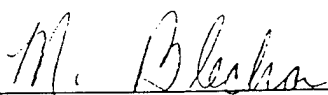
RL = Reporting Limit.

NA = Not Available/Not Applicable.

PID = Photoionization detector.

FID = Flame ionization detector.

TVH = Total Volatile Hydrocarbons.


Analyst


Approved

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Methods 602/8020 and 5030/8015 Modified Data Report

Client Sample Number	: FB1:MPC(23-24)	Client Project Number	: 726876.71130
Lab Sample Number	: 96-1162-07	Lab Project Number	: 96-1162
Date Sampled	: 4/11/96	Matrix	: SOIL
Date Received	: 4/13/96	Lab File Number(s)	: TVB10417038,40
Date Prepared	: 4/15,18/96	Method Blank	: MB1041796*
FID Dilution Factor	: 5.0	Soil Extracted?	: YES
PID Dilution Factor	: 5.0,125	Soil Moisture	: 2.83%

Compound Name	Cas Number	Analysis Date	Sample Concentration	RL	Units
TVH-Gasoline	---	4/18/96	37	0.5	mg/kg
Benzene	71-43-2	4/18/96	U	2.1	ug/kg
Toluene	108-88-3	4/18/96	U	2.1	ug/kg
Chlorobenzene	108-90-7	4/18/96	U	2.1	ug/kg
Ethyl Benzene	100-41-4	4/18/96	U	2.1	ug/kg
Total Xylenes (m,p,o)	1330-20-7	4/18/96	U	2.1	ug/kg
1,3,5-Trimethylbenzene	108-67-8	4/18/96	110	2.1	ug/kg
1,2,4-Trimethylbenzene	95-63-6	4/18/96	180	51	ug/kg
1,2,3-Trimethylbenzene	526-73-8	4/18/96	45	2.1	ug/kg
1,2,3,4-Tetramethylbenzene	488-23-3	4/18/96	3100	64	ug/kg
FID Surrogate Recovery:		HI**		65%-129%	(Limits)
PID Surrogate Recovery:		HI**,91%		65%-129%	(Limits)

Notes: Total Xylenes consist of three isomers, two of which co-elute. The Xylene RL is for a single peak.

Comments: * = MEB1041596; ** = Hydrocarbon Interference

QUALIFIERS and DEFINITIONS:

E = Extrapolated value. Value exceeds calibration range.
 U = Compound analyzed for, but not detected.
 B = Compound also found in the blank.
 J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit.
 RL = Reporting Limit.
 NA = Not Available/Not Applicable.
 PID = Photoionization detector.
 FID = Flame ionization detector.
 TVH = Total Volatile Hydrocarbons.

M. B. Bocka
Analyst

K. Hollman
Approved

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Methods 602/8020 and 5030/8015 Modified Data Report

Client Sample Number	: MPA(44-45)	Client Project Number	: 726876.71130
Lab Sample Number	: 96-1162-08	Lab Project Number	: 96-1162
Date Sampled	: 4/12/96	Matrix	: SOIL
Date Received	: 4/13/96	Lab File Number(s)	: TVB10417024
Date Prepared	: 4/15/96	Method Blank	: MEB1041596
FID Dilution Factor	: 500	Soil Extracted?	: YES
PID Dilution Factor	: 500	Soil Moisture	: 3.44%

Compound Name	Cas Number	Analysis Date	Sample Concentration	RL	Units
TVH-Gasoline	----	4/17/96	450	52	mg/kg
Benzene	71-43-2	4/17/96	U	207	ug/kg
Toluene	108-88-3	4/17/96	310	207	ug/kg
Chlorobenzene	108-90-7	4/17/96	980	207	ug/kg
Ethyl Benzene	100-41-4	4/17/96	3100	207	ug/kg
Total Xylenes (m,p,o)	1330-20-7	4/17/96	18000	207	ug/kg
1,3,5-Trimethylbenzene	108-67-8	4/17/96	9400	207	ug/kg
1,2,4-Trimethylbenzene	95-63-6	4/17/96	27000	207	ug/kg
1,2,3-Trimethylbenzene	526-73-8	4/17/96	860	207	ug/kg
1,2,3,4-Tetramethylbenzene	488-23-3	4/17/96	10000	259	ug/kg
FID Surrogate Recovery:		102%		65%-129%	(Limits)
PID Surrogate Recovery:		91%		65%-129%	(Limits)

Notes: Total Xylenes consist of three isomers, two of which co-elute. The Xylene RL is for a single peak.

Comments:

QUALIFIERS and DEFINITIONS:

E = Extrapolated value. Value exceeds calibration range.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit.
RL = Reporting Limit.
NA = Not Available/Not Applicable.
PID = Photoionization detector.
FID = Flame ionization detector.
TVH = Total Volatile Hydrocarbons.


Analyst


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EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Methods 602/8020 and 5030/8015 Modified Data Report

Client Sample Number : FB1:VW01(56.5) Client Project Number : 726876.71130
Lab Sample Number : 96-1162-09 Lab Project Number : 96-1162
Date Sampled : 4/12/96 Matrix : SOIL
Date Received : 4/13/96 Lab File Number(s) : TVB10417020
Date Prepared : 4/17/96 Method Blank : MB1041796
FID Dilution Factor : 1.0 Soil Extracted? : NO
PID Dilution Factor : 1.0 Soil Moisture : 12.26%

Compound Name	Cas Number	Analysis Date	Sample Concentration	RL	Units
TVH-Gasoline	----	4/17/96	U	0.1	mg/kg
Benzene	71-43-2	4/17/96	U	0.5	ug/kg
Toluene	108-88-3	4/17/96	1.0	0.5	ug/kg
Chlorobenzene	108-90-7	4/17/96	0.7	0.5	ug/kg
Ethyl Benzene	100-41-4	4/17/96	1.3	0.5	ug/kg
Total Xylenes (m,p,o)	1330-20-7	4/17/96	3.9	0.5	ug/kg
1,3,5-Trimethylbenzene	108-67-8	4/17/96	2.7	0.5	ug/kg
1,2,4-Trimethylbenzene	95-63-6	4/17/96	4.9	0.5	ug/kg
1,2,3-Trimethylbenzene	526-73-8	4/17/96	8.9	0.5	ug/kg
1,2,3,4-Tetramethylbenzene	488-23-3	4/17/96	7.9	0.6	ug/kg
FID Surrogate Recovery:		95%		50%-132%	(Limits)
PID Surrogate Recovery:		88%		72%-118%	(Limits)

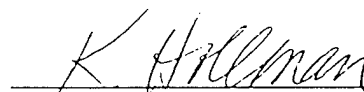
Notes: Total Xylenes consist of three isomers, two of which co-elute. The Xylene RL is for a single peak.

Comments:

QUALIFIERS and DEFINITIONS:

E = Extrapolated value. Value exceeds calibration range.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit.
RL = Reporting Limit.
NA = Not Available/Not Applicable.
PID = Photoionization detector.
FID = Flame ionization detector.
TVH = Total Volatile Hydrocarbons.


Analyst


Approved

EVERGREEN ANALYTICAL, INC.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

**TOTAL EXTRACTABLE HYDROCARBONS (TEH-DIESEL)
C11-C28 Boiling Range**

Date Sampled : 4/11,12/96 Client Project Number : 726876.71130
Date Received : 4/13/96 Lab Project Number : 96-1162
Date Prepared : 4/16/96 Method Number : EPA 3500/8015 Modified

Evergreen Sample #	Dilution Factor	Client Sample #	Matrix	Analysis Date	Surrogate Recovery	Sample * Result	RL *	Units
SB041696	1	Soil Method Blank	Soil	4/16/96	96%	U	10.0	mg/kg
96-1162-02	10	FB1:MPB(48-49)	Soil	4/17/96	[1]	2800	120.0	mg/kg
96-1162-03	1	VW01(45-46)	Soil	4/17/96	80%	U	11.0	mg/kg
96-1162-04	1	MPB(24-25)	Soil	4/17/96	[1]	140	10.0	mg/kg
96-1162-05	1	MPA(37-38)	Soil	4/17/96	[1]	500	11.0	mg/kg
96-1162-07	1	FB1:MPC(23-24)	Soil	4/17/96	90%	150	10.0	mg/kg
96-1162-08	1	MPA(44-45)	Soil	4/17/96	[1]	430	10.0	mg/kg
96-1162-09	1	FB1:VW01(56.5)	Soil	4/17/96	89%	U	11.0	mg/kg

* = Based on dry weight.

[1] = Unable to separate surrogate from analyte.

QUALIFIERS

U = TEH analyzed for, but not detected.

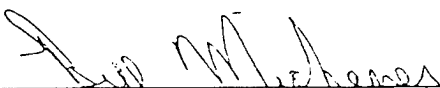
B = TEH-Diesel also found in blank.

E = Extrapolated value. Value exceeds calibration range.

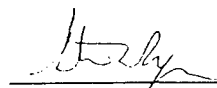
NOTES

Surrogate = TBB

RL = Reporting Limit.



Analyst



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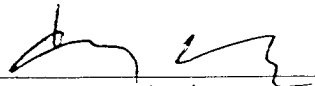
EVERGREEN ANALYTICAL, Inc.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Analysis Report

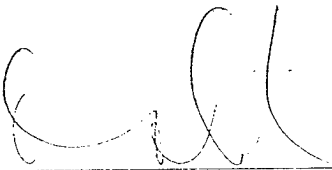
Date Sampled : 4/11,12/96
Date Received : 4/13/96
Date Prepared : 4/16,18/96
Date Analyzed : 4/16,18/96

Client Project ID. : 726876.71130 Fort Bliss
Lab Project Number : 96-1162
Matrix : Soil
Method : EPA 160.3

<u>Evergreen Sample #</u>	<u>Client Sample ID.</u>	<u>Moisture (%)</u>
96-1162-01	FB1: MPB (47-50)	7.50
96-1162-03	VW01 (45-46)	9.40
96-1162-04	MPB (24-25)	3.04



Analyst



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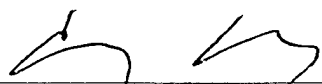
EVERGREEN ANALYTICAL, Inc.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Analysis Report

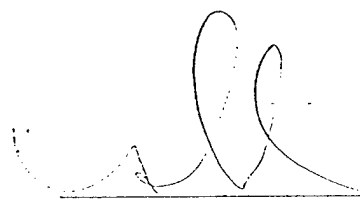
Date Sampled : 4/11,12/96
Date Received : 4/13/96
Date Prepared : 4/18/96
Date Analyzed : 4/18/96

Client Project ID. : 726876.71130 Fort Bliss
Lab Project Number : 96-1162
Matrix : Soil
Method : SW846 9045C

<u>Evergreen Sample #</u>	<u>Client Sample ID.</u>	<u>pH</u>
96-1162-01	FB1: MPB (47-50)	10.23
96-1162-03	VW01 (45-46)	10.18
96-1162-04	MPB (24-25)	10.15



Analyst



Approved



Hazen Research, Inc.
4601 Indiana St. • Golden, Colo 80403
Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

Date April 23 1996
HRI Project 009-93
HRI Series No. D384/96
Date Rec'd. 04/16/96
Cust. P.O. #

Evergreen Analytical Inc.
Carl Smits
4036 Youngfield
Wheat Ridge CO 80033

SCREEN ANALYSIS REPORT

Sample Number: D384/96-1
Sample Identification: 96-1162 FBI-MPB (47-50) 04/11/96 @ 1530

Mesh Size Pass-Retained	Direct Weight.g	Direct Weight. %	Cum Weight % Retained	Cum Weight % Pass
- 4	3.9	1.12	1.12	98.88
4 - 6	2.8	0.80	1.92	98.08
6 - 8	3.4	0.97	2.89	97.11
8 - 10	2.4	0.69	3.58	96.42
10 - 14	3.6	1.03	4.61	95.39
14 - 20	6.8	1.95	6.56	93.44
20 - 28	11.1	3.18	9.74	90.26
28 - 35	24.4	7.00	16.74	83.26
35 - 48	33.7	9.66	26.40	73.60
48 - 65	53.2	15.25	41.65	58.35
65 - 100	61.0	17.49	59.14	40.86
100 - 150	40.9	11.73	70.87	29.13
150 - 200	18.9	5.42	76.29	23.71
200 - 270	8.8	2.52	78.81	21.19
270 - 325	2.4	0.69	79.50	20.50
325 - PAN	71.5	20.50	100.00	0.00
Total	348.8	100.00		

By:

Robert Rostad
Laboratory Manager

Screen sizes are in Tyler Mesh.



Hazen Research, Inc.
4601 Indiana St. • Golden, Colo. 80403
Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

Date April 23 1996
HRI Project 009-93
HRI Series No. D384/96
Date Rec'd. 04/16/96
Cust. P.O. #

Evergreen Analytical Inc.
Carl Smits
4036 Youngfield
Wheat Ridge CO 80033

SCREEN ANALYSIS REPORT

Sample Number: D384/96-2

Sample Identification: 96-1162 VW01(45-46) 04/12/96 @ 1605

Mesh Size Pass-Retained	Direct Weight,g	Direct Weight,%	Cum Weight % Retained	Cum Weight % Pass
- 4	0.0	0.00	0.00	100.00
4 - 6	0.0	0.00	0.00	100.00
6 - 8	0.0	0.00	0.00	100.00
8 - 10	0.0	0.00	0.00	100.00
10 - 14	0.0	0.00	0.00	100.00
14 - 20	0.0	0.00	0.00	100.00
20 - 28	0.8	0.33	0.33	99.67
28 - 35	1.8	0.74	1.07	98.93
35 - 48	10.8	4.45	5.52	94.48
48 - 65	68.6	28.27	33.79	66.21
65 - 100	96.3	39.68	73.47	26.53
100 - 150	41.2	16.98	90.45	9.55
150 - 200	10.1	4.16	94.61	5.39
200 - 270	3.6	1.48	96.09	3.91
270 - 325	0.9	0.37	96.46	3.54
325 - PAN	8.6	3.54	100.00	0.00
Total	242.7	100.00		

By:

Robert Rostad
Laboratory Manager

Screen sizes are in Tyler Mesh.



Hazen Research, Inc.
4601 Indiana St. • Golden, Colo. 80403
Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

Date April 23 1996
HRI Project 009-93
HRI Series No. D384/96
Date Rec'd. 04/16/96
Cust. P.O. # 0

Evergreen Analytical Inc.
Carl Smits
4036 Youngfield
Wheat Ridge CO 80033

SCREEN ANALYSIS REPORT

Sample Number: D384/96-3

Sample Identification: 96-1162 MPB (24-25) 04/11/96 @ 1300

Mesh Size Pass-Retained	Direct Weight,g	Direct Weight, %	Cum Weight % Retained	Cum Weight % Pass
- 4	13.0	4.88	4.88	95.12
4 - 6	10.2	3.83	8.71	91.29
6 - 8	12.3	4.62	13.33	86.67
8 - 10	12.7	4.77	18.10	81.90
10 - 14	14.6	5.49	23.59	76.41
14 - 20	15.4	5.79	29.38	70.62
20 - 28	16.6	6.24	35.62	64.38
28 - 35	24.9	9.36	44.98	55.02
35 - 48	37.5	14.09	59.07	40.93
48 - 65	54.7	20.56	79.63	20.37
65 - 100	23.4	8.79	88.42	11.58
100 - 150	8.8	3.31	91.73	8.27
150 - 200	4.3	1.62	93.35	6.65
200 - 270	3.1	1.16	94.51	5.49
270 - 325	1.0	0.38	94.89	5.11
325 - PAN	13.6	5.11	100.00	0.00
Total	266.1	100.00		

By:

Robert Rostad
Laboratory Manager

Screen sizes are in Tyler Mesh.

EVERGREEN ANALYTICAL, Inc.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

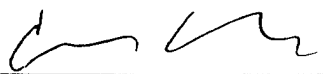
Analysis Report

Date Sampled : 4/11,12/96
Date Received : 4/13/96
Date Prepared : 4/17/96
Date Analyzed : 4/17/96

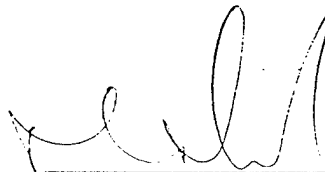
Client Project ID. : 726876.71130 Fort Bliss
Lab Project Number : 96-1162
Matrix : Soil
Method : EPA 310.1

<u>Evergreen Sample #</u>	<u>Client Sample ID.</u>	<u>Total Alkalinity * (mgCaCO₃/Kg)</u>
96-1162-01	FB1: MPB (47-50)	566
96-1162-03	VW01 (45-46)	269
96-1162-04	MPB (24-25)	359

* Results reported on a dry weight basis



Analyst



Approved

EVERGREEN ANALYTICAL, Inc.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

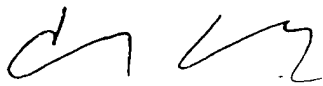
Analysis Report

Date Sampled : 4/11,12/96
Date Received : 4/13/96
Date Prepared : 4/18/96
Date Analyzed : 4/18/96

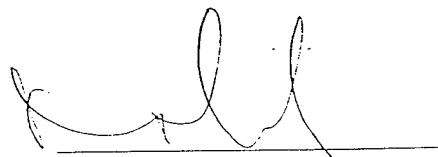
Client Project ID. : 726876.71130 Fort Bliss
Lab Project Number : 96-1162
Matrix : Soil
Method : EPA 351.3

<u>Evergreen Sample #</u>	<u>Client Sample ID.</u>	<u>Total Kjeldahl * Nitrogen</u>	<u>(mg/Kg)</u>
96-1162-01	FB1: MPB (47-50)	<5.0	
96-1162-03	VW01 (45-46)	<5.0	
96-1162-04	MPB (24-25)	<4.6	

* Results reported on a dry weight basis.



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INORGANIC ANALYSIS DATA SHEET

726876.71130
Date Sampled : 4/11-12/96 Client Project : Fort Bliss
Date Received : 4/13/96 Lab Project No. : 96-1162
Date Prepared : 4/25/96 Method : SW-846
Date Analyzed : 4/25-29/96 Matrix : Soil

Units: mg/Kg

Basis: Dry Weight

Client Sample#	FB1:MPB (47-50)	VW01 (45-46)	MPB (24-25)		Reagent Blank	Reporting Limits
Evergreen Sample#	01A	03B	04B			
Fe/6010	6980	3260	4960	<	1.8	1.8
P/6010	208	85.0	138	<	6.1	6.1

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4036 Youngfield Wheat Ridge CO 80033
(303) 425-6021
POLYNUCLEAR AROMATICS ANALYSIS DATA REPORT

Client Sample Number	: FB1:MPB(48-49)	Client I.D.	: 726876.71130
Lab Sample Number	: 96-1162-02	Lab Project No.	: 96-1162
Date Sampled	: 04/11/96	Effective Dilution	: 5.42
Date Received	: 04/13/96	Method	: 8270B
Date Extracted/Prepared	: 04/16/96	Matrix	: SOIL
Date Analyzed	: 04/25/96	Lab File No.	: >30969
Percent Loss on Drying	: 14.97	Method Blank No.	: SB041696

BASE/NEUTRALS

Compound Name	Cas Number	Conc. ug/Kg	EOL* ug/Kg
Naphthalene	91-20-3	28,000	1,800
2-Methylnaphthalene	91-57-6	30,000	1,800
Acenaphthylene	208-96-8	U	1,800
Acenaphthene	83-32-9	U	1,800
Dibenzofuran	132-64-9	U	1,800
Fluorene	86-73-7	U	1,800
Phenanthrene	85-01-8	190 J	1,800
Anthracene	120-12-7	U	1,800
Fluoranthene	206-44-0	U	1,800
Pyrene	129-00-0	U	1,800
Benzo(a) Anthracene	56-55-3	U	1,800
Chrysene	218-01-9	U	1,800
Benzo(b) Fluoranthene	205-99-2	U	1,800
Benzo(k) Fluoranthene	207-08-9	U	1,800
Benzo(a) Pyrene	50-32-8	U	1,800
Indeno(1,2,3-cd) Pyrene	193-39-5	U	1,800
Dibenz(a,h) Anthracene	53-70-3	U	1,800
Benzo(g,h,i) Perylene	191-24-2	U	1,800

Expected Surrogate Recoveries:		Actual Recoveries:	QC Limits
Nitrobenzene-d5	100	ug/Kg 66%	(23-95)
2-Fluorobiphenyl	100	ug/Kg 89%	(32-95)
Terphenyl-d14	100	ug/Kg 79%	(18-131)

QUALIFIERS:

U = Compound analyzed for, but not detected above reporting limits.
Reporting limits are roughly the method detection limits for reagent water.
J = Indicates an estimated value when the compound is detected, but is below the EPA Estimated Quantitation Limit (EQL).
B = Compound found in blank and sample. Compare blank and sample data.
E = Compound is detected at a concentration outside the calibration limits.
* = Estimated Quantitation Limits listed in EPA SW846, Vol. 1B, Part II, pa. 8270B-8. The minimum instrument detection limits are less than the numbers shown in this column.

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4036 Youngfield Wheat Ridge CO 80033
(303)425-6021
POLYNUCLEAR AROMATICS ANALYSIS DATA REPORT

Client Sample Number : MPA(37-38)
Lab Sample Number : 96-1162-05
Date Sampled : 04/12/96
Date Received : 04/13/96
Date Extracted/Prepared : 04/16/96
Date Analyzed : 04/25/96
Percent Loss on Drying : 5.83

Client I.D. : 726876.71130
Lab Project No. : 96-1162
Effective Dilution : 1.06
Method : 8270B
Matrix : SOIL
Lab File No. : >30960
Method Blank No. : SB041696

BASE/NEUTRALS

Compound Name	Cas Number	Conc. ug/Kg	EQL* ug/Kg
Naphthalene	91-20-3	2,200	350
2-Methylnaphthalene	91-57-6	2,600	350
Acenaphthylene	208-96-8	U	350
Acenaphthene	83-32-9	U	350
Dibenzofuran	132-64-9	U	350
Fluorene	86-73-7	U	350
Phenanthrene	85-01-8	U	350
Anthracene	120-12-7	U	350
Fluoranthene	206-44-0	U	350
Pyrene	129-00-0	U	350
Benzo(a)Anthracene	56-55-3	U	350
Chrysene	218-01-9	U	350
Benzo(b)Fluoranthene	205-99-2	U	350
Benzo(k)Fluoranthene	207-08-9	U	350
Benzo(a)Pyrene	50-32-8	U	350
Indeno(1,2,3-cd)Pyrene	193-39-5	U	350
Dibenz(a,h)Anthracene	53-70-3	U	350
Benzo(g,h,i)Perylene	191-24-2	U	350

Expected Surrogate Recoveries:	Actual Recoveries:	QC Limits
Nitrobenzene-d5	100 ug/Kg	28% (23-95)
2-Fluorobiphenyl	100 ug/Kg	32% (32-95)
Terphenyl-d14	100 ug/Kg	33% (18-131)

QUALIFIERS:

U = Compound analyzed for, but not detected above reporting limits.
J = Reporting limits are roughly the method detection limits for reagent water
J = Indicates an estimated value when the compound is detected, but is below the EPA Estimated Quantitation Limit (EQL).
B = Compound found in blank and sample. Compare blank and sample data.
E = Compound is detected at a concentration outside the calibration limits.
* = Estimated Quantitation Limits listed in EPA SW846, Vol. 1B, Part II, pa. 8270B-8. The minimum instrument detection limits are less than the numbers shown in this column.

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4036 Youngfield Wheat Ridge CO 80033
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POLYNUCLEAR AROMATICS ANALYSIS DATA REPORT
Method Blank Report

Method Blank Number : SB041696
Date Extracted/Prepared : 04/16/96
Date Analyzed : 04/24/96

Client I.D. : 726876.71130
Lab Project No. : 96-1162
Effective Dilution : 1.00
Method : 8270B
Lab File No. : >30956

BASE/NEUTRALS

Compound Name	Cas Number	Conc. ug/Kg	EQL* ug/Kg
Naphthalene	91-20-3	U	330
2-Methylnaphthalene	91-57-6	U	330
Acenaphthylene	208-96-8	U	330
Acenaphthene	83-32-9	U	330
Dibenzofuran	132-64-9	U	330
Fluorene	86-73-7	U	330
Phenanthrene	85-01-8	U	330
Anthracene	120-12-7	U	330
Fluoranthene	206-44-0	U	330
Pyrene	129-00-0	U	330
Benzo(a)Anthracene	56-55-3	U	330
Chrysene	218-01-9	U	330
Benzo(b)Fluoranthene	205-99-2	U	330
Benzo(k)Fluoranthene	207-08-9	U	330
Benzo(a)Pyrene	50-32-8	U	330
Indeno(1,2,3-cd)Pyrene	193-39-5	U	330
Dibenz(a,h)Anthracene	53-70-3	U	330
Benzo(g,h,i)Perylene	191-24-2	U	330

Expected Surrogate Recoveries:	Actual Recoveries:	QC Limits
Nitrobenzene-d5	100 ug/Kg	72% (23-95)
2-Fluorobiphenyl	100 ug/Kg	75% (32-95)
Terphenyl-d14	100 ug/Kg	88% (18-131)

QUALIFIERS:

- U = Compound analyzed for, but not detected above reporting limits.
Reporting limits are roughly the method detection limits for reagent water
J = Indicates an estimated value when the compound is detected, but is below the EPA Estimated Quantitation Limit (EQL).
B = Compound found in blank and sample. Compare blank and sample data.
E = Compound is detected at a concentration outside the calibration limits.
* = Estimated Quantitation Limits listed in EPA SW846, Vol. 1B, Part II, pa. 8270B-8. The minimum instrument detection limits are less than the numbers shown in this column.

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(303) 425-6021

Analysis Report

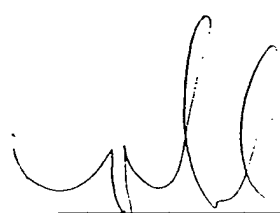
Date Sampled : 4/13/96
Date Received : 4/16/96
Date Prepared : 4/16/96
Date Analyzed : 4/16/96

Client Project ID. : 726876.71130 Fort Bliss
Lab Project Number : 96-1184
Matrix : Soil
Method : EPA 160.3

<u>Evergreen Sample #</u>	<u>Client Sample ID.</u>	<u>Moisture (%)</u>
96-1184-01	MPD (16-17)	10.2
96-1184-02	MPD (31-32)	1.47



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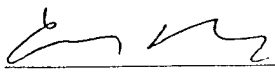
Analysis Report

Date Sampled : 4/13/96
Date Received : 4/16/96
Date Prepared : 4/18/96
Date Analyzed : 4/18/96

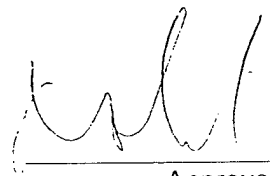
Client Project ID. : 726876.71130 Fort Bliss
Lab Project Number : 96-1184
Matrix : Soil
Method : EPA 351.3

<u>Evergreen Sample #</u>	<u>Client Sample ID.</u>	<u>Total Kjeldahl * Nitrogen</u>	<u>(mg/Kg)</u>
96-1184-01	MPD (16-17)	<5.1	
96-1184-02	MPD (31-32)	<4.7	

* Results reported on a dry weight basis.



Analyst



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AIR TOXICS LTD.

SAMPLE NAME: FB1:MPA-45

ID#: 9604151-01A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name: 6041519 Date of Collection: 4/14/96
Dil. Factor: 5720 Date of Analysis: 4/18/96

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	5.7	19	110	360
Toluene	5.7	22	270	1000
Ethyl Benzene	5.7	25	33	140
Total Xylenes	5.7	25	146	640

TOTAL PETROLEUM HYDROCARBONS**GC/FID**

(Quantitated as Gasoline)

File Name: 6041519 Date of Collection: 4/14/96
Dil. Factor: 5720 Date of Analysis: 4/18/96

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C2+ Hydrocarbons)	57	240	5200	22000

*TPH referenced to Gasoline (MW=100)

Container Type: 1 Liter Summa Canister

AIR TOXICS LTD.

SAMPLE NAME: FB1:VW-01

ID#: 9604151-02A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6041820	Date of Collection:	4/14/96
Dil Factor:	55.0	Date of Analysis:	4/18/96

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.055	0.18	34	110
Toluene	0.055	0.21	32	120
Ethyl Benzene	0.055	0.24	8.8	39
Total Xylenes	0.055	0.24	47	210

TOTAL PETROLEUM HYDROCARBONS**GC/FID**

(Quantitated as Gasoline)

File Name:	6041820	Date of Collection:	4/14/96
Dil Factor:	55.0	Date of Analysis:	4/18/96

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C2+ Hydrocarbons)	0.55	2.3	1400	5800

*TPH referenced to Gasoline (MW=100)

Container Type: 1 Liter Summa Canister

AIR TOXICS LTD.

SAMPLE NAME: FBI:MPB-32

ID#: 9604151-03A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6041823	Date of Collection: 4/14/96		
Dil. Factor:	2240	Date of Analysis: 4/18/96		
	Det. Limit	Det. Limit	Amount	Amount
Compound	(ppmv)	(uG/L)	(ppmv)	(uG/L)
Benzene	2.2	7.3	130	420
Toluene	2.2	8.6	560	2100
Ethyl Benzene	2.2	9.9	140	620
Total Xylenes	2.2	9.9	610	2700

TOTAL PETROLEUM HYDROCARBONS**GC/FID**

(Quantitated as Gasoline)

File Name:	6041823	Date of Collection:	4/14/96	
Dil. Factor:	2240	Date of Analysis:	4/18/96	
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C2+ Hydrocarbons)	22	93	9900	41000

*TPH referenced to Gasoline (MW=100)

Container Type: 1 Liter Summa Canister

AIR TOXICS LTD.

SAMPLE NAME: FB1:MPB-45

ID#: 9604151-04A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6041822	Date of Collection:	4/14/96
Dil. Factor:	2330	Date of Analysis:	4/18/96

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	2.3	7.6	230	750
Toluene	2.3	8.9	910	3500
Ethyl Benzene	2.3	10	210	930
Total Xylenes	2.3	10	940	4100

TOTAL PETROLEUM HYDROCARBONS**GC/FID**

(Quantitated as Gasoline)

File Name:	6041822	Date of Collection:	4/14/96
Dil. Factor:	2330	Date of Analysis:	4/18/96

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C2+ Hydrocarbons)	23	97	15000	62000

*TPH referenced to Gasoline (MW=100)

Container Type: 1 Liter Summa Canister

AIR TOXICS LTD.

SAMPLE NAME: FBI:MPC-32

ID#: 9604151-05A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name: 6041824 Date of Collection: 4/14/96
Dil. Factor: 1400 Date of Analysis: 4/18/96

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	1.4	4.5	120	390
Toluene	1.4	5.4	520	2000
Ethyl Benzene	1.4	6.2	190	840
Total Xylenes	1.4	6.2	1000	4400

TOTAL PETROLEUM HYDROCARBONS

GC/FID

(Quantitated as Gasoline)

File Name: 6041824 Date of Collection: 4/14/96
Dil. Factor: 1400 Date of Analysis: 4/18/96

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C2+ Hydrocarbons)	14	58	8500	35000

*TPH referenced to Gasoline (MW=100)

Container Type: 1 Liter Summa Canister

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank

ID#: 9604151-06A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6041809	Date of Collection: NA		
Dil. Factor:	1.00	Date of Analysis: 4/18/96		
	Det. Limit	Det. Limit	Amount	Amount
Compound	(ppmv)	(uG/L)	(ppmv)	(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 Gasoline)

File Name:	6041809	Date of Collection: NA		
Dil. Factor:	1.00	Date of Analysis: 4/18/96		
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C2+ Hydrocarbons)	0.010	0.042	Not Detected	Not Detected

*TPH referenced to Gasoline (MW=100)

Container Type: NA

APPENDIX C
HYPERVENTILATE® AIR PERMEABILITY
CALCULATION CARDS

Fort Bliss Air Permeability Test Calculations

MPA-16

MPB-16

MPC-16

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points → $r =$ (ft)

② Enter measured times and gauge vacuums →

	(min)	(in H ₂ O)	
	0.5	0.9	↑
	1	1.0	
	2	1.3	
	3	1.4	
	4	1.5	
	5	1.6	
	6	1.6	
	7	1.7	
	8	1.8	
	9	1.8	↓

③ Enter (optional):

a) flowrate (SCFM)

b) screened interval thickness (ft)

$k =$ darcy (A)
 $k =$ darcy (B)

$r =$ (ft)

	(min)	(in H ₂ O)	
	0.5	0	↑
	1	0.3	
	2	0.4	
	3	0.5	
	5	0.6	
	6	0.6	
	7	0.7	
	9	0.8	
	10	0.8	
	12	0.8	↓

$k =$ darcy (A)
 $k =$ darcy (B)

$r =$ (ft)

	(min)	(in H ₂ O)	
	1	0.08	↑
	2	0.28	
	3	0.35	
	4	0.46	
	5	0.52	
	7	0.60	
	8	0.68	
	9	0.70	
	12	0.70	
	15	0.76	↓

$k =$ darcy (A)
 $k =$ darcy (B)

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points → $r =$ (ft)

② Enter measured times and gauge vacuums →

	(min)	(in H ₂ O)	
	9	1.8	↑
	10	1.8	
	12	1.8	
	15	1.9	
	20	2.0	
	25	2.0	
	30	2.0	
	40	2.0	
	50	2.05	
	60	2.05	↓

③ Enter (optional):

a) flowrate (SCFM)

b) screened interval thickness (ft)

$k =$ darcy (A)
 $k =$ darcy (B)

$r =$ (ft)

	(min)	(in H ₂ O)	
	12	0.8	↑
	15	0.9	
	20	0.95	
	30	1.0	
	40	1.0	
	50	1.0	
	60	1.0	
	90	1.1	
	120	1.1	↓

$k =$ darcy (A)
 $k =$ darcy (B)

$r =$ (ft)

	(min)	(in H ₂ O)	
	15	0.76	↑
	20	0.84	
	25	0.86	
	30	0.88	
	40	0.90	
	50	0.90	
	60	0.90	
	90	0.96	
	120	0.98	↓

$k =$ darcy (A)
 $k =$ darcy (B)

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points → $r =$ (ft)

② Enter measured times and gauge vacuums →

	(min)	(in H ₂ O)	
	15	1.9	↑
	20	2.0	
	25	2.0	
	30	2.0	
	40	2.0	
	50	2.05	
	60	2.05	
	90	2.10	
	120	2.10	↓

③ Enter (optional):

a) flowrate (SCFM)

b) screened interval thickness (ft)

$k =$ darcy (A)
 $k =$ darcy (B)

$r =$ (ft)

	(min)	(in H ₂ O)	
	20	0.95	↑
	30	1.0	
	40	1.0	
	50	1.0	
	60	1.0	
	90	1.1	
	120	1.1	↓

$k =$ darcy (A)
 $k =$ darcy (B)

$r =$ (ft)

	(min)	(in H ₂ O)	
	25	0.86	↑
	30	0.88	
	40	0.90	
	50	0.90	
	60	0.90	
	90	0.96	
	120	0.98	↓

$k =$ darcy (A)
 $k =$ darcy (B)

Fort Bliss Air Permeability Test Calculations

MPA-32

MPB-32

MPC-32

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points → $r =$ 10 (ft) ② Enter measured times and gauge vacuums → <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>(min)</th> <th>(in H₂O)</th> <th></th> </tr> </thead> <tbody> <tr><td></td><td>0.5</td><td>1.0</td><td>↑</td></tr> <tr><td></td><td>1</td><td>1.6</td><td></td></tr> <tr><td></td><td>2</td><td>1.9</td><td></td></tr> <tr><td></td><td>3</td><td>2.3</td><td></td></tr> <tr><td></td><td>4</td><td>2.3</td><td></td></tr> <tr><td></td><td>5</td><td>2.45</td><td></td></tr> <tr><td></td><td>6</td><td>2.55</td><td></td></tr> <tr><td></td><td>7</td><td>2.60</td><td></td></tr> <tr><td></td><td>8</td><td>2.7</td><td></td></tr> <tr><td></td><td>9</td><td>2.8</td><td>↓</td></tr> </tbody> </table> ③ Enter (optional): a) flowrate 45.8 (SCFM) b) screened interval thickness 33 (ft) clear $k =$ 32.518953 darcy (A) $k =$ 349.737032 darcy (B) --> Calculate <--		(min)	(in H ₂ O)			0.5	1.0	↑		1	1.6			2	1.9			3	2.3			4	2.3			5	2.45			6	2.55			7	2.60			8	2.7			9	2.8	↓	① Enter radial distances of monitoring points → $r =$ 24.5 (ft) ② Enter measured times and gauge vacuums → <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>(min)</th> <th>(in H₂O)</th> <th></th> </tr> </thead> <tbody> <tr><td></td><td>0.5</td><td>0.2</td><td>↑</td></tr> <tr><td></td><td>1</td><td>0.6</td><td></td></tr> <tr><td></td><td>2</td><td>0.8</td><td></td></tr> <tr><td></td><td>3</td><td>0.7</td><td></td></tr> <tr><td></td><td>5</td><td>1.0</td><td></td></tr> <tr><td></td><td>6</td><td>1.1</td><td></td></tr> <tr><td></td><td>7</td><td>1.15</td><td></td></tr> <tr><td></td><td>9</td><td>1.3</td><td></td></tr> <tr><td></td><td>10</td><td>1.3</td><td></td></tr> <tr><td></td><td>12</td><td>1.4</td><td>↓</td></tr> </tbody> </table> ③ Enter (optional): a) flowrate 45.8 (SCFM) b) screened interval thickness 33 (ft) clear $k =$ 45.9248 darcy (A) $k =$ 188.681429 darcy (B) --> Calculate <--		(min)	(in H ₂ O)			0.5	0.2	↑		1	0.6			2	0.8			3	0.7			5	1.0			6	1.1			7	1.15			9	1.3			10	1.3			12	1.4	↓	① Enter radial distances of monitoring points → $r =$ 40.5 (ft) ② Enter measured times and gauge vacuums → <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>(min)</th> <th>(in H₂O)</th> <th></th> </tr> </thead> <tbody> <tr><td></td><td>1</td><td>0.20</td><td>↑</td></tr> <tr><td></td><td>2</td><td>0.44</td><td></td></tr> <tr><td></td><td>3</td><td>0.56</td><td></td></tr> <tr><td></td><td>4</td><td>0.68</td><td></td></tr> <tr><td></td><td>5</td><td>0.78</td><td></td></tr> <tr><td></td><td>7</td><td>0.84</td><td></td></tr> <tr><td></td><td>8</td><td>0.94</td><td></td></tr> <tr><td></td><td>9</td><td>0.98</td><td></td></tr> <tr><td></td><td>12</td><td>1.0</td><td></td></tr> <tr><td></td><td>15</td><td>1.0</td><td>↓</td></tr> </tbody> </table> ③ Enter (optional): a) flowrate 45.8 (SCFM) b) screened interval thickness 33 (ft) clear $k =$ 73.309517 darcy (A) $k =$ 775.966149 darcy (B) --> Calculate <--		(min)	(in H ₂ O)			1	0.20	↑		2	0.44			3	0.56			4	0.68			5	0.78			7	0.84			8	0.94			9	0.98			12	1.0			15	1.0	↓
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Fort Bliss Air Permeability Test Calculations

MPA-45

MPB-45

MPC-24

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points → $r =$ (ft)

② Enter measured times and gauge vacuums →

	(min)	(in H ₂ O)	
	0.5	0.9	↑
	1	1.2	
	2	1.4	
	3	1.6	
	4	1.9	
	5	2.1	
	6	2.2	
	7	2.25	
	8	2.40	
	9	2.50	↓

③ Enter (optional):

a) flowrate (SCFM)

b) screened interval thickness (ft)

--> Calculate <--

$k =$ darcy (A)
 $k =$ darcy (B)

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points → $r =$ (ft)

② Enter measured times and gauge vacuums →

	(min)	(in H ₂ O)	
	9	2.50	↑
	10	2.50	
	12	2.55	
	15	2.60	
	20	2.80	
	25	2.90	
	30	2.95	
	40	3.10	
	50	3.10	
	60	3.20	↓

③ Enter (optional):

a) flowrate (SCFM)

b) screened interval thickness (ft)

--> Calculate <--

$k =$ darcy (A)
 $k =$ darcy (B)

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points → $r =$ (ft)

② Enter measured times and gauge vacuums →

	(min)	(in H ₂ O)	
	12	2.55	↑
	15	2.60	
	20	2.80	
	25	2.90	
	30	2.95	
	40	3.10	
	50	3.10	
	60	3.20	
	90	3.25	
	120	3.30	↓

③ Enter (optional):

a) flowrate (SCFM)

b) screened interval thickness (ft)

--> Calculate <--

$k =$ darcy (A)
 $k =$ darcy (B)

APPENDIX D

RESPIRATION TEST DATA AND CALCULATION SHEETS

$$K_b = \frac{K_o * A * D_o * c}{100}$$

	Variable	Description	Units	Constants
where:	K_b	Biodegradation rate	mg/kg/day	
	K_o	Oxygen utilization rate	%/day	
	A	Volume of air/kg soil	1/kg	
	D_o	Density of Oxygen	mg/L	1330mg/L
	c	mass ratio of hydrocarbon to Oxygen for mineralization	dimensionless	1/3.5
	SG	for quartz (to calculate porosity)	dimensionless	2.65

MPA-45

	K_o	5.05 % per day	(from respiration test results)
moisture	=	9.4 %	(soil moisture content from sampling)
	c	0.286	(1/3.5)
	D_o	1330 mg/L	
bulk density = bd	=	1.6 kg/L	sand
porosity	=	0.396	$1.0 - (bd/2.65)$ dimensionless
water wt	=	0.150 kg water/liter soil	(moisture*bd/100)
water vol	=	0.150 liters	
air filled vol	=	0.246 liters air/liters soil	(porosity-water volume)
	A	0.154 liters air/kg soil	(air filled volume/bd)

$$K_b = \frac{(5.05 * 0.154 * 1330 * 0.2 \text{ mg hydrocarbon})}{100 \text{ kg soil*day}}$$

$$K_b = 2.95 \text{ mg hydrocarbon/kg soil/day}$$

$$K_b = 1076.2 \text{ mg hydrocarbon/kg soil/year}$$

$$K_b = \frac{K_o * A * D_o c}{100}$$

	Variable	Description	Units	Constants
where:	K_b	Biodegradation rate	mg/kg/day	
	K_o	Oxygen utilization rate	%/day	
	A	Volume of air/kg soil	1/kg	
	D_o	Density of Oxygen	mg/L	1330mg/L
	c	mass ratio of hydrocarbon to Oxygen for mineralization	dimensionless	1/3.5
	SG for quartz (to calculate porosity)		dimensionless	2.65

MPB-32

	K_o	5.63 % per day	(from respiration test results)
moisture	=	3.04 %	(soil moisture content from sampling)
	c	0.286	(1/3.5)
	D_o	1330 mg/L	
bulk density = bd	=	1.6 kg/L	sand
porosity	=	0.396	1.0-(bd/2.65) dimensionless
water wt	=	0.049 kg water/liter soil	(moisture*bd/100)
water vol	=	0.049 liters	
air filled vol	=	0.348 liters air/liters soil	(porosity-water volume)
A	=	0.217 liters air/kg soil	(air filled volume/bd)

$$K_b = \frac{(5.63 * 0.217 * 1330 * 0.2 \text{ mg hydrocarbon})}{100 \text{ kg soil*day}}$$

$$K_b = 4.65 \text{ mg hydrocarbon/kg soil/day}$$

$$K_b = 1696.4 \text{ mg hydrocarbon/kg soil/year}$$

$$K_b = \frac{K_o \cdot A \cdot D_o \cdot c}{100}$$

	Variable	Description	Units	Constants
where:	K_b	Biodegradation rate	mg/kg/day	
	K_o	Oxygen utilization rate	%/day	
	A	Volume of air/kg soil	1/kg	
	D_o	Density of Oxygen	mg/L	1330mg/L
	c	mass ratio of hydrocarbon to Oxygen for mineralization	dimensionless	1/3.5
	SG	for quartz (to calculate porosity)	dimensionless	2.65

MPB-45

	K_o	5.56 % per day	(from respiration test results)
moisture	=	7.5 %	(soil moisture content from sampling)
	c	0.286	(1/3.5)
	D_o	1330 mg/L	
bulk density = bd	=	1.6 kg/L	sand
porosity	=	0.396	$1.0 - (bd/2.65)$ dimensionless
water wt	=	0.120 kg water/liter soil	(moisture*bd/100)
water vol	=	0.120 liters	
air filled vol	=	0.276 liters air/liters soil	(porosity-water volume)
A	=	0.173 liters air/kg soil	(air filled volume/bd)

$$K_b = \frac{(5.56 \cdot 0.173 \cdot 1330 \cdot 0.2)}{100} \frac{\text{mg hydrocarbon}}{\text{kg soil} \cdot \text{day}}$$

$$K_b = 3.65 \text{ mg hydrocarbon/kg soil/day}$$

$$K_b = 1331.4 \text{ mg hydrocarbon/kg soil/year}$$

$$K_b = \frac{K_o * A * D_o * c}{100}$$

	Variable	Description	Units	Constants
where:	K_b	Biodegradation rate	mg/kg/day	
	K_o	Oxygen utilization rate	%/day	
	A	Volume of air/kg soil	1/kg	
	D_o	Density of Oxygen	mg/L	1330mg/L
	c	mass ratio of hydrocarbon to Oxygen for mineralization	dimensionless	1/3.5
	SG for quartz	(to calculate porosity)	dimensionless	2.65

MPC-32

	K_o	5.63 % per day	(from respiration test results)
moisture	=	3.04 %	(soil moisture content from sampling)
	c	0.286	(1/3.5)
	D_o	1330 mg/L	
bulk density = bd	=	1.6 kg/L	sand
porosity	=	0.396	$1.0 - (bd/2.65)$ dimensionless
water wt	=	0.049 kg water/liter soil	(moisture*bd/100)
water vol	=	0.049 liters	
air filled vol	=	0.348 liters air/liters soil	(porosity-water volume)
A	=	0.217 liters air/kg soil	(air filled volume/bd)

$$K_b = \frac{(5.63 * 0.217 * 1330 * 0.2)}{100} \frac{\text{mg hydrocarbon}}{\text{kg soil} * \text{day}}$$

$$K_b = 4.65 \text{ mg hydrocarbon/kg soil/day}$$

$$K_b = 1696.4 \text{ mg hydrocarbon/kg soil/year}$$

Figure 8-1. Typical Record Sh

SITE Fort Bliss, Bldg 675

DATE 4/15/96

LOCATION El Paso TX

SAMPLER(S) Brian Vandenberg, Dan Switell

MONITORING POINTS mPB-32

O₂ METER NO. 9304035

HYDROCARBON METER NO. 9304032

SHUT DOWN DATE	TIME
4/15/96	0700

CO, METER NO. 9304035

[illegible]

Figure 8-1. Typical Record Sh

SME For + Bliss, Bldg 675

DATE 4/15/96

LOCATION	El Paso TX
1	10/10/68
2	10/10/68
3	10/10/68
4	10/10/68
5	10/10/68
6	10/10/68
7	10/10/68
8	10/10/68
9	10/10/68
10	10/10/68
11	10/10/68
12	10/10/68
13	10/10/68
14	10/10/68
15	10/10/68
16	10/10/68
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91	10/10/68
92	10/10/68
93	10/10/68
94	10/10/68
95	10/10/68
96	10/10/68
97	10/10/68
98	10/10/68
99	10/10/68
100	10/10/68

SAMPLER(S) Brian Vandergas, Dan Switell

MONITORING POINTS MPC-32

O, METER NO. 9304035

HYDROCARBON METER NO. 9304032

SHUT DOWN DATE 4/15/96 TIME 0700[illegible]

for In Situ Respiration Test.

MONITORING POINTS MPA-45

O, METER NO. 9304035 CO

HYDROCARBON METER NO. 930403

SHUT DOWN DATE 4/15/16 TIME

[illegible]

Figure 8-1. Typical Record Sh

SITE Fort Bliss, Bldg 675

DATE 4/15/96

LOCATION E1 Paso, TX

SAMPLER(S) Binan Vanderkas, Dan Switek

MONITORING POINTS

O. METER NO. 9304035

HYDROCARBON METER NO. 9304032

SHUT DOWN DATE	4/15/96	TIME	0700
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Date/ Time	Total Hydrocarbon	Hellum	Comments
4/14/86/ 0839	>10,000	-	Initial
4/15/86 112 745 PM	2900	0.17	
08-10	2800	0.36	
0909	2800	0.57	
1109	4000	1.30	
1510	7600	2.10	
1905	>10,000	2.00	
4/16/86 0707	>10,000	2.20	* Leaking bag + misreading suspected
1908 0709 PM	>10,000	2.00	
4/17/86 0737	>10,000	0.61	
1908	>10,000	0.45	
4/18/86 0710	>10,000	1.3	CO ₂ meter on malfunction

APPENDIX E
FIELD ACTIVITY REPORT (FORM TWC-0017)

Texas Water Commission
PRODUCT STORAGE TANK
FIELD ACTIVITY REPORT

Complete All Applicable Blanks.

Date: 5-28-96

GENERAL INFORMATION

TEST ID No.: 98508 Assigned TWC Coordinator: unassigned
Facility ID No.: 05147
Responsible Party: Dr. James Hartman
Facility Name: Commander USAA - DACENFB
Facility Address: Directorate of Environment, Attn. ATZC-DOE-M
Facility City: Fort Bliss, TX 79916-6816 County: Fort Bliss
Activity: ☒ Assessment ☒ RAP Implementation ☐ RAP Addendum ☐ Abatement (check appropriate box)

ASSESSMENT

How many borings and/or monitor wells have been installed? One vent well/monitoring well
and four monitoring points each containing three 0.5' screened intervals have been installed.

Has the extent of assessment directed/authorized by the TWC been completed? ☒ YES or ☐ NO (check one) If no, explain:

Are any assessment activities ongoing? ☒ YES or ☐ NO (check one) If yes, directed by whom:
Brian Vanderglas, Parsons Engineering Science (CAPM 00758)

Describe activities: A one-horsepower blower is currently injecting air at a rate
of approximately 16.5 acfm. Radius of influence extends over 50 feet.
Air injection will continue until April, 1997.

ASSESSMENT (continued)

Are there any proposed or necessary assessment activities? ☐ YES or ☒ NO (check one) If yes, explain:

If any additional monitor wells or soil borings are necessary, please indicate the proposed locations on a site map.

RAP IMPLEMENTATION

Date Remedial Action Plan was submitted to TWC: _____

Was the RAP approved by the TWC? ☐ YES or ☒ NO (check one) If yes, by whom: _____

If yes, date of approval: _____

Date RAP installation was completed: _____

Type of remedial system installed: Bioventing system consisting of a one-horsepower
blower and vent well. Three monitoring points each containing 3
0.5' screened intervals were installed to collect soil gas samples.
Screened intervals are 16, 32, and 45 for two monitoring points and
16, 24, and 32 feet bgs for the third monitoring point.

Provide a brief description of the completed remedial actions: A 1.0 horsepower blower has
been installed to inject air into a newly installed vent well. Air
injection started on April 18, 1996. Air injection has been proven
to increase hydrocarbon biodegradation rates.

RAP IMPLEMENTATION (continued)

Indicate the operating parameters of the remedial system (pumping rates, air flow rates, etc.):

The one-horsepower blower is injecting air at 16.5 acfm. Injected air pressure is 4 inches of water. Discharged air temperature = 95 degrees farenheit (ambient air temperature = 82 degrees farenheit. Vacuum inlet air pressure = -4 inches of water.

With 33 feet of screened interval, the estimated flow rate for injection is 0.5 cfm per foot of screened interval.

Was the remedial system installed in the time frame originally outlined in the RAP? ☐ YES or ☒ NO (check one) If no, explain: The client is not pursuing reimbursement, so no RAP was submitted. The bioventing pilot test was included with the site assessment to determine if bioventing is feasible in the arid conditions encountered at Fort Bliss.

Was the cost of the remedial system installation equal to or less than the projected cost itemized in the RAP? ☐ YES or ☒ NO (check one) If no, explain: No costs were proposed because Fort Bliss is not pursuing reimbursement.

Proposed installation cost of the remedial system: none- client not pursuing reimbursement.

Actual installation cost of the remedial system: \$25 000

REMEDIAL ACTION PLAN ADDENDUM

Reason for the RAP addendum: _____

_____Was the RAP addendum requested by the TWC? ☐ YES or ☒ NO (check one) If yes, indicate by whom and when: _____

_____Discuss the proposed changes: _____

Projected cost of addendum: _____

ABATEMENT MEASURES

Provide a brief description of the situation requiring abatement measures: _____

_____Have all potential threats to human health and safety been abated? ☒ YES or ☐ NO (check one) If no, describe: _____

ABATEMENT MEASURES (continued)

Method of abatement:

Provide a brief description of equipment installed or utilized:

Are there any proposed additional abatement measures? ☐ YES or ☒ NO (check one) If yes, describe:

WASTE DISPOSITION

Discuss the method of treatment and/or disposal for all wastes generated: Twelve 55 gallon

drums containing soil cuttings will be disposed of at the Camino

Real landfill in New Mexico.

REPORT PREPARATION

Prepared by: Brian Vanderglas (CAPM 00758)

Company: Parsons Engineering Science

Date prepared: 5-28-96

Telephone No.: 512-719-6000

Fax No.: 512-719-6099

Signature: *Brian Vanderglas*

Name of Responsible Party contact: Dr. James Hartman

Telephone No.:

Fax No.:

Date:

Signature:

Provide The Following Attachments For The Corresponding Completed Sections:

ASSESSMENT

A hydrocarbon distribution map/groundwater gradient map with analytical results of all installed wells. Include any proposed boring/monitoring well locations
Copies of soil boring logs/well construction diagrams for the newly installed soil borings/monitoring wells
Cost breakdown sheet(s) for any proposed activities

RAP IMPLEMENTATION

Photographic documentation of the installed remediation system
As-built construction details of the entire remediation system
Cost breakdown sheet(s) of the installed remediation system

RAP ADDENDUM

Supporting field test data for RAP addendum if applicable
Cost breakdown sheet(s) for any proposed activities

ABATEMENT MEASURES

List of analytical results
Copies of signed laboratory reports and chain-of custody documentation
Site diagram with sample locations indicated
Cost breakdown sheet(s) for any proposed activities
Waste disposal, treatment or recycling documentation