Duke Engineering & Services
A Duke Energy Company

9111 Research Boulevard
Austin, TX 78758

512 425-2000
Fax 512 425-2099

July 27, 1999

Ms. Laura Yeh
Naval Facilities Engineering Service Center
Code ESC411
1100 23rd Avenue
Port Hueneme, CA 93043-4370

Subject: Submission of the Final version of the Camp Lejeune PITT Report

Dear Ms. Yeh:

Please find enclosed one copy of the final report *DNAPL Site Characterization using a Partitioning Interwell Tracer Test at Site 88, Marine Corps Base, Camp Lejeune, North Carolina*. Additional copies of this report have also been sent as indicated in the distribution list.

We truly appreciate the opportunity to conduct this investigation for the Navy, and if you have any questions about the content of this report, please call me at 512-425-2037.

Sincerely,

Fred Holzmer

Fred Holzmer
Project Manager

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Final

DNAPL Site Characterization using a Partitioning Interwell Tracer Test at Site 88, Marine Corps Base, Camp Lejeune, North Carolina

Prepared for:

Department of the Navy:

Naval Facilities Engineering Service Center
Restoration Development Center
Port Hueneme, California

and

Naval Facilities Engineering Command
Atlantic Division
Norfolk, Virginia

Prepared by:

Duke Engineering & Services
Austin, Texas

In Cooperation with:

Baker Environmental, Inc
Coraopolis, Pennsylvania

July 1999

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ACRONYMS AND ABBREVIATIONS

4M2P	4-methyl-2-pentanol
AST	above-ground storage tank
amsl	above mean sea level
Baker	Baker Environmental
bgs	below ground surface
Br^-	bromide
BTOC	below top-of-casing
C	concentration of tracer
$CaCl_2$	calcium chloride
CITT	conservative interwell tracer test
CLEAN	Comprehensive Long-Term Environmental Action Navy
CPT	cone penetrometer test
cm/sec	centimeters per second
DAS	data acquisition system
DCE	*cis*-1,2-dichloroethene
DE&S	Duke Engineering & Services
DNAPL	dense nonaqueous phase liquid
DOD	Department of Defense
DSI	Drilling Service Inc.
dyne/cm	dynes per centimeter
EPA	Environmental Protection Agency
ESTCP	Environmental Securities Technology Certification Program
FID	flame ionization detector
ft	feet
ft bgs	feet below ground surface
ft/day	feet per day
f_{oc}	fraction of sedimentary organic carbon in aquifer material (wt/wt)
gal	gallon
GC	gas chromatography
g/cm^3	grams per cubic centimeter
gpm	gallons per minute
IFT	interfacial tension
in	inch
IRP	Installation Restoration Program
kg/m^3	kilogram per cubic meter
k_{avg}	average permeability
K	hydraulic conductivity
K_i	partition coefficient for the i^{th} tracer

Acronyms and Abbreviations, Continued

K_n	partition coefficient for a non-partitioning tracer
K_p	partition coefficient for a partitioning tracer
LANTDIV	Atlantic Division, Naval Facilities Engineering Command
lb	pound
LNAPL	light nonaqueous phase liquid
m	meter
m/s^2	meters per seconds squared
µm	micrometer
MCB	Marine Corps Base
MLS	multilevel sampler
µg/L	micrograms per liter
µg/Kg	micrograms per kilogram
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
NAPL	nonaqueous phase liquid
NAVFAC	Naval Facilities Engineering Command
NFESC	Naval Facilities Engineering Service Center
NRMRL	National Risk Management Research Laboratory
OHM	OHM Remediation Services Corporation
PA	performance assessment
PCE	tetrachloroethene (i.e., perchloroethylene)
PID	photo-ionization detector
PITT	partitioning interwell tracer test
ppb	parts per billion
ppm	parts per million
Q	flow rate
QA/QC	quality assurance/quality control
RAC	Remedial Action Contractor
RI	Remedial Investigation
SEAR	surfactant-enhanced aquifer remediation
SOP	Standard Operating Procedure
TCE	trichloroethene
UST	underground storage tank
VOC	volatile organic compound
XRD	X-ray diffraction

EXECUTIVE SUMMARY

A partitioning interwell tracer test (PITT) was recently completed at Site 88, the location of the Morale, Welfare, and Recreation (MWR) Dry Cleaners at the Marine Corps Base (MCB) Camp Lejeune, North Carolina. This PITT was conducted to estimate the saturation, volume, and spatial distribution of tetrachloroethene (PCE) that is present as a dense non-aqueous phase liquid (DNAPL) within the selected test area. The PITT results provide characterization of the initial DNAPL conditions at the site, in preparation for a surfactant-enhanced aquifer remediation (SEAR) demonstration to remove DNAPL from the surficial (shallow) aquifer at the site. The PITT is the most recent of many field investigations that have been conducted in the past year to characterize the DNAPL contamination at Site 88. The PITT data has confirmed the results of earlier soil and ground-water investigations, which indicated that the highest DNAPL saturations are located in the shallow aquifer regions adjacent to the dry-cleaning building, and within a layer of low-permeability sediments (i.e., clayey silt) just above a clay aquitard. A summary of the DNAPL investigations and other field activities conducted in conjunction with the PITT are provided in this report, along with the PITT results and data analysis.

The DNAPL source-zone investigations at MCB Camp Lejeune have been co-funded by the Environmental Securities and Technology Certification Program (ESTCP) and the Atlantic Division, Naval Facilities Engineering Command (LANTDIV), and were conducted in a teaming arrangement between Duke Engineering & Services and Baker Environmental (the LANTDIV CLEAN program contractor at Camp Lejeune). Additional site support was provided by OHM Remediation Services Corporation (the LANTDIV RAC program contractor at Camp Lejeune). These investigations proceeded in three phases, as described below.

- Phase 1: July – August, 1997

  The objectives of Phase 1 were to: (1) locate the DNAPL zone and (2) perform preliminary characterization of the DNAPL-contaminated geosystem (i.e., hydrostratigraphy, hydraulic and geochemical properties of the aquifer, and approximate DNAPL saturations). The Phase 1 investigation consisted of a small-scale soil-sampling program during which soil borings were pushed continuously to collect detailed lithologic data and soil samples were collected using in-field methanol preservation. This was followed by well installation to conduct hydraulic testing. Borings were completed beneath the building and around the building perimeter to a depth of about 21 feet below ground surface (ft bgs). Following the development of the newly installed wells, free-phase DNAPL was collected in two of the wells. The soil analytical results confirmed the presence of residual PCE DNAPL at a depth interval of approximately 17 to 20 ft bgs. Hydraulic testing demonstrated that the aquifer soils had sufficient permeability for implementation of the SEAR technology.

- Phase 2: November-December, *1997*

  The objectives of Phase 2 were to: (1) roughly delineate the horizontal and vertical extent of DNAPL at the site, (2) establish baseline DNAPL saturations in the selected test area using soil borings and (3) perform additional site characterization to refine the geosystem model for the test well-field design. Phase 2 work combined laboratory and modeling studies to achieve the latter objective. The laboratory studies, using DNAPL and sediments collected from the site, resulted in the selection of a suite of tracers suitable for a PITT under site-specific conditions. Using site data gained from Phase 1 and 2 field investigations as input parameters, a geosystem model of the site was constructed using UTCHEM, a three-dimensional multi-phase flow simulator. Initial simulations with UTCHEM provided the optimum well geometry and spacing for the PITT and the subsequent surfactant flood. The designed well field, sited adjacent to Building 25, consists of a total of three injection and six extraction wells arranged in a 3X3X3 line-drive configuration, with a hydraulic control well located at each end of the row of injection wells. Thus, the test well field comprises 11 wells in total. The test area formed by the 3x3x3 array of injection and extraction wells is 20 ft wide by 30 ft long. Phase 2 activities culminated with the installation of the demonstration wells.

- Phase 3: January-July, 1998

  The objectives of Phase 3 were to measure the DNAPL volume and average saturations within the test zone with a PITT, in preparation for the SEAR demonstration. Phase 3 of the DNAPL source-zone investigation included field implementation of the PITT as well as preparatory field activities. First, free-phase DNAPL recovery was undertaken by means of pumping selected wells that showed DNAPL accumulation. This was followed by a water flood in the test-zone well field. An estimated 30-60 gallons of DNAPL was removed from the subsurface during the free-phase DNAPL recovery effort. Secondly, a conservative interwell tracer test (CITT) was conducted to evaluate the preliminary PITT design (i.e., flow rates, test duration) as determined by the Phase 2 design modeling. Using bromide as the tracer, tracer breakthrough was measured at the six extractor wells to determine the actual tracer residence time in the interwell swept pore volume between a given pair of injection and extraction wells. The results of the CITT showed that only minor revisions were needed in the initial design (i.e., injection and extraction flow rates) to finalize the PITT design.

  The PITT began on May 13, 1998, continued for 40 days, and terminated on June 22, 1998. Data analysis estimated that 74-88 gallons of DNAPL are present in the 4,800-gallon swept pore volume of the test zone. Average DNAPL saturations in the test zone are highest in the area adjacent to the north wall of Building 25, at approximately 4% saturation, and decrease in a northerly direction away from the building to about 0.4% saturation at a distance of approximately 20 ft north of the building. However, the results of soil column studies conducted prior to the PITT suggest that the low-level DNAPL saturation (i.e. 0.4%) measured in the area located approximately 20 ft north of the building is actually the result of tracer sorption to sedimentary organic matter that is observable as peat particles in the sediments. Therefore the area of the test zone 20 ft north of the building is believed to be DNAPL free.

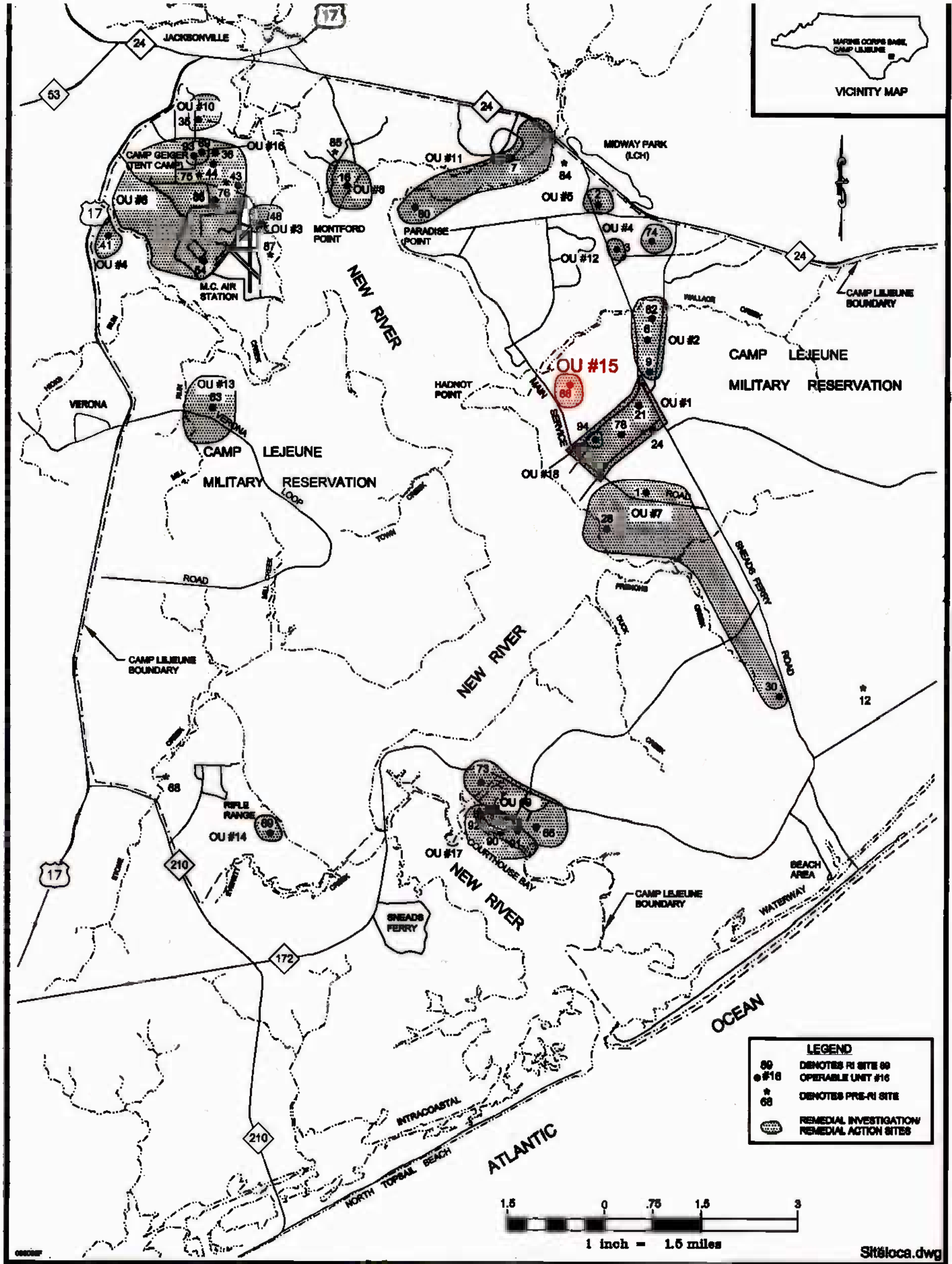
Phase 4, the SEAR demonstration began in April 1999 and is at the time of writing in progress (July 1999). The SEAR demonstration will be followed immediately by a second PITT to measure the volume of DNAPL remaining in the test zone. The results of the pre-SEAR and post-SEAR PITTs will be compared to assess the performance of the surfactant flood in removing DNAPL from the test zone at Site 88. This performance assessment of the SEAR demonstration will also determine the volume of DNAPL remaining in the test zone after the SEAR demonstration. Post-SEAR soil samples will also be collected from the test zone and analyzed for volatile organic compounds to provide additional evidence of the performance of the surfactant flood. The SEAR demonstration and post-SEAR PITT are scheduled for completion in late August 1999.

1.0 INTRODUCTION

A remedial investigation (RI) conducted by Baker Environmental (Baker) during 1996 to 1997 revealed the presence of dissolved phase tetrachloroethene (PCE) in the ground water at Operable Unit No. 15 (Site 88) at Marine Corps Base (MCB) Camp Lejeune, North Carolina (Baker; 1996,1998a). The location of Site 88 is shown in Figure 1.1, and is roughly defined as the area delineated by the extent of the aqueous phase PCE plume. The source of the PCE plume is the Base dry cleaning facility, which is housed in Morale, Welfare, and Recreation (MWR), Building 25. The PCE plume extends generally to the northwest and south from Building 25, as seen in Figure 1.2. Aqueous PCE concentrations were reported in the RI (Baker, 1998a) to range as high as 54.9 mg/L (54,882 μg/L; Figure 1.2) in the shallow aquifer, and also in the Upper Portion of the Castle Hayne Aquifer at concentrations up to 26.6 mg/L (26,592 μg/L; Figure 1.3). The Upper Portion of the Castle Hayne Aquifer has been used as a drinking water aquifer in the vicinity of MCB Camp Lejeune and nearby Jacksonville, NC. However, drinking water supplies do not currently appear to be threatened by the ground-water contaminants related to Site 88.

The RI was conducted by Baker Environmental (under the LANTDIV CLEAN [Comprehensive Long-Term Environmental Action Navy] program) for the Atlantic Division, Naval Facilities Engineering Command (LANTDIV) under the Installation Restoration Program (IRP) at MCB Camp Lejeune. Meanwhile, the Naval Facilities Engineering Service Center (NFESC), located in Port Hueneme, California, was searching for a site to conduct a field demonstration of surfactant-enhanced aquifer remediation (SEAR) with surfactant recycling and reinjection. The SEAR field demonstration is funded by the Department of Defense (DOD) under its Environmental Securities Technology Certification Program (ESTCP) in an effort to promote innovative technologies for effective remediation methods at DOD sites contaminated with dense, non-aqueous liquid (DNAPL). Chlorinated solvents, such as PCE and trichloroethene (TCE), when present in the subsurface as an immiscible liquid (i.e., DNAPL) slowly dissolve and provide a persistent source of aqueous contamination to the subsurface. Such sites are not cost-effectively remediated by traditional pump-and-treat methods (Mackay and Cherry, 1989).

The Site 88 RI reported aqueous PCE concentrations up to 54 mg/L present in the shallow aquifer, which is approximately 23% of the solubility of PCE based upon an aqueous solubility of 240 mg/L (Broholm and Feenstra, 1995; West, 1992). Such aqueous concentrations strongly suggest the presence of PCE DNAPL at Site 88. Based upon such evidence for the likelihood of DNAPL beneath Building 25, Site 88 was chosen by the ESTCP team, with support from LANTDIV, as a candidate site for



LOCATION MAP

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

(modified from Baker Environmental, Inc.)

FIGURE 1.1

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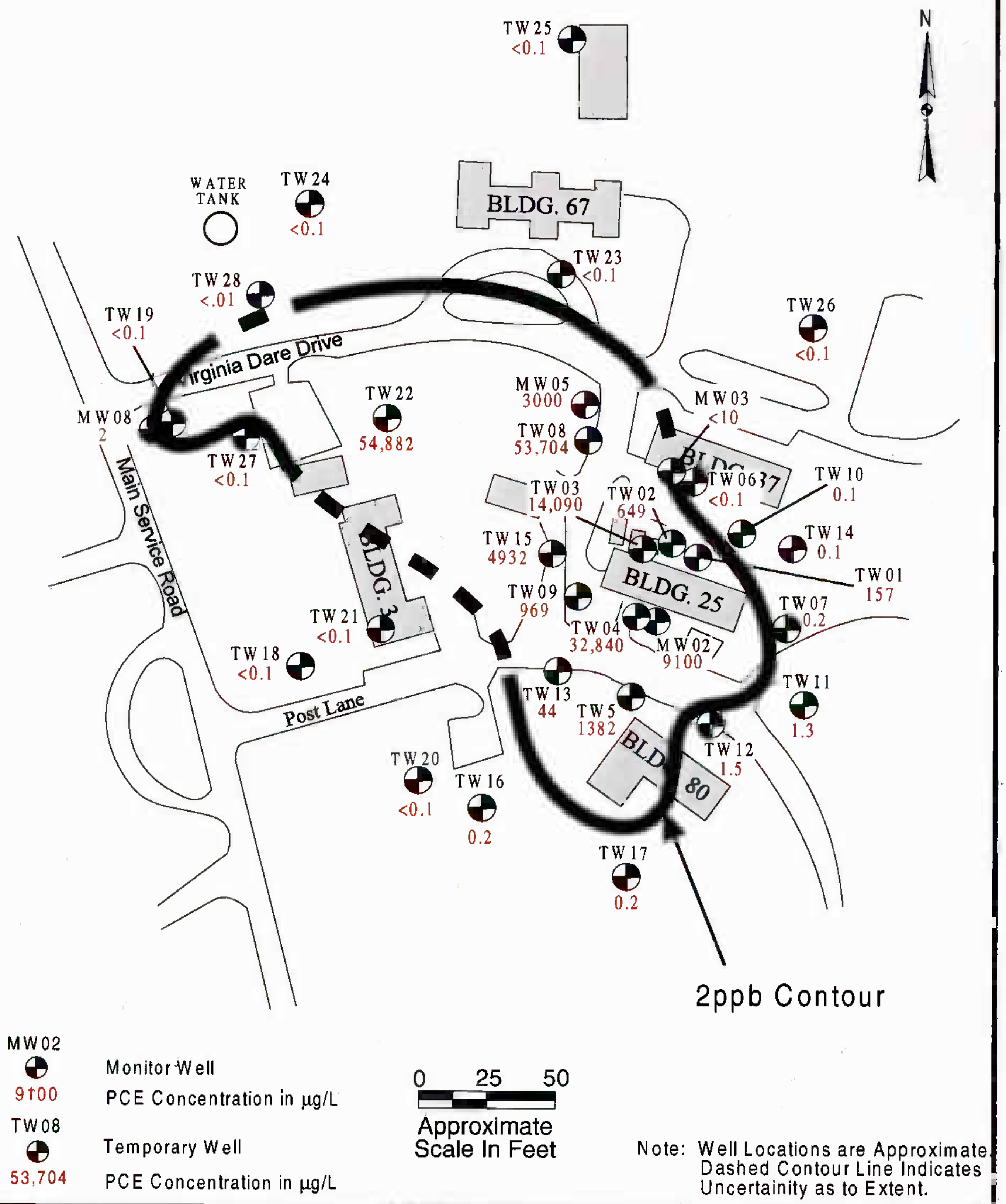

Note: Well Locations are Approximate.
Dashed Contour Line Indicates
Uncertainity as to Extent.

DATE: 7/12/99

REF: TDN 30199999

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Dissolved PCE Plume Boundary in the Shallow Aquifer -August 1996

(Modified from Baker Environmental, Inc.)

MCB Camp Lejeune, NC

Figure 1.2

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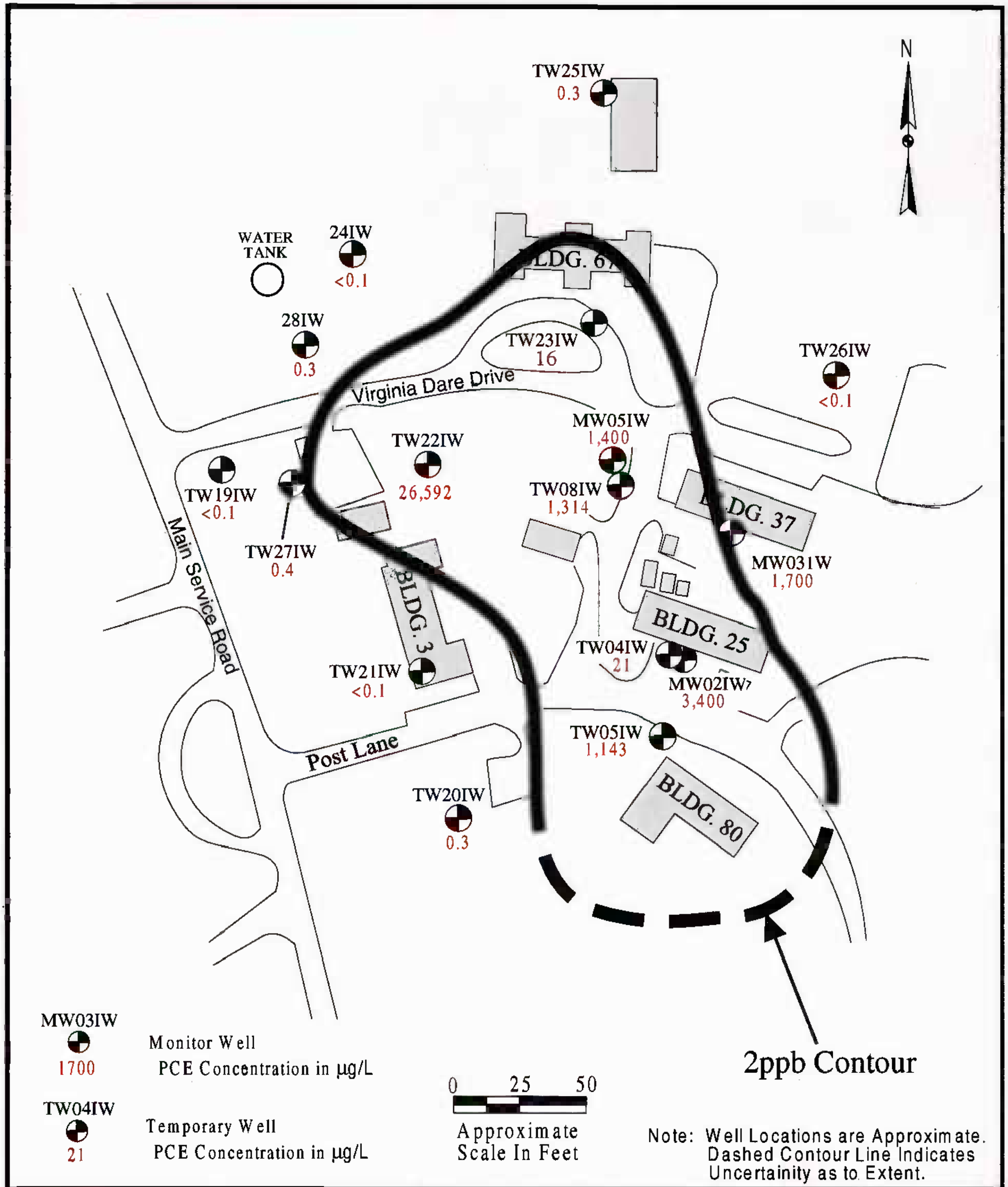

Note: Well Locations are Approximate.
Dashed Contour Line Indicates
Uncertainity as to Extent.

DATE: 7/23/99

REF: TDN 30199999

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Dissolved PCE Plume Boundary in the Upper Portion of the Castle Hayne Aquifer - August 1996

(Modified from Baker Environmental, Inc.)

MCB Camp Lejeune, NC

Figure 1.3

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the ESTCP project pending the results of a preliminary DNAPL site investigation to locate the DNAPL zone beneath Building 25. This preliminary DNAPL source-zone investigation, conducted by Duke Engineering & Services (DE&S) in late 1997, in a teaming arrangement with Baker, confirmed the presence of DNAPL at Site 88. Two subsequent DNAPL investigations were then conducted to delineate the approximate extent of the DNAPL zone at Site 88, and to obtain estimates of aquifer hydraulic properties. The results of these preliminary DNAPL-zone investigations met the site-selection criteria for SEAR, therefore Site 88 was selected to be the demonstration site for the ESTCP project.

The purpose of this report is to summarize the PITT results as well as the results from all earlier DNAPL source-zone investigations conducted by DE&S at Site 88 in preparation for the upcoming SEAR demonstration.

1.1 Goals and Objectives

Performance assessment of the SEAR will be accomplished using PITTs. The PITTs will provide a quantitative comparison of the DNAPL volume and distribution in the test zone before and after the SEAR.

The goals of the pre-SEAR DNAPL investigations were to:

- define the geosystem of the test zone for the purpose of PITT and SEAR design, and;
- measure initial DNAPL conditions in the test zone with a PITT in preparation for the SEAR demonstration.

To meet the above goals, the specific objectives of the pre-SEAR DNAPL investigations were to design and conduct a PITT to:

- measure the total volume and average saturation of DNAPL in the test zone; and
- determine both the horizontal and vertical spatial distribution of DNAPL in the test zone.

1.2 DNAPL Occurrence and Definitions

PCE solvent is considered a DNAPL due to its relatively high density (1.63 g/cm^3) and immiscibility in water (interfacial tension in water = 47.48 dyn/cm; Demond and Lindner, 1993). If spilled in sufficient quantities, PCE DNAPL migrates downward from the

DNAPL entry location, through the vadose and saturated zones until stopped by a low-permeability barrier (i.e., capillary barrier), such as a clay. It can then migrate laterally downslope along the capillary barrier. As DNAPL flows through porous media, it leaves behind a trail of residual DNAPL that partially fills the pore spaces (see Figure 1.4). Residual DNAPL is held in the pore spaces by capillary forces and, due to its low solubility remains as a persistent source of contamination to the ground water. Free-phase DNAPL is defined as DNAPL existing in the subsurface under a positive pressure such that it can flow into a well (EPA, 1992). The Environmental Protection Agency (EPA, 1992) defines those areas containing residual or free-phase DNAPL as DNAPL zones.

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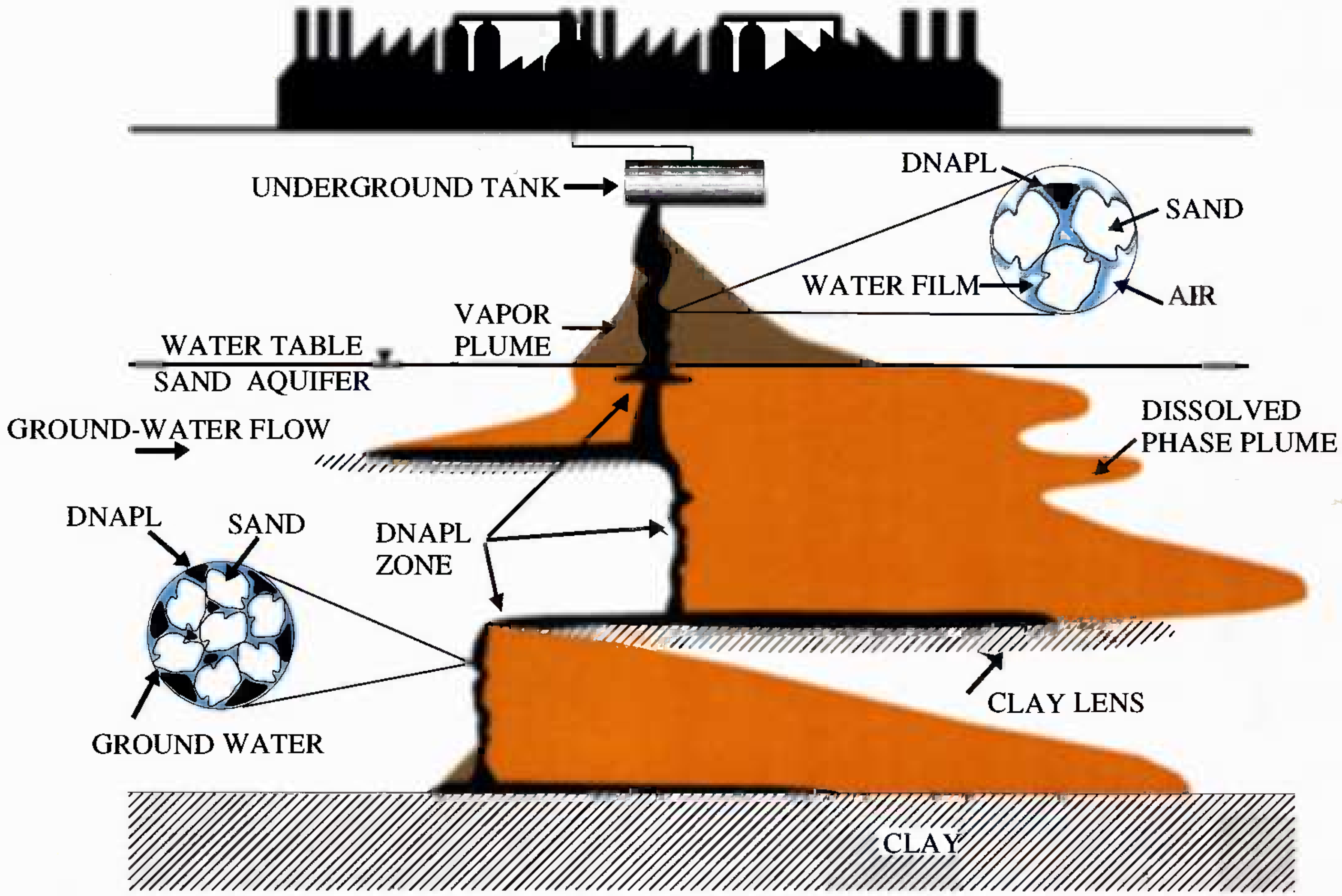

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*Generalized Diagram of DNAPL Migration in Water-Wet Porous Media

*(not intended to represent site specific conditions at Site 88)

Figure 1.4

2.0 SITE BACKGROUND

This section provides a brief description of site historical operations, and general hydrology and hydrogeology for the Site 88 area. This information is provided to acquaint the reader with the general setting of Site 88. However, for more detailed information with respect to the hydrogeology of the SEAR demonstration area, see Section 5.0.

2.1 Site History

Building 25 has been operating as a dry cleaning facility since the 1940s. Varsol™, a petroleum distillate, or "mineral spirit", was used as the dry cleaning fluid from the 1940s through the 1970s. During the 1970s, due to the high flammability of Varsol™, the facility began to use PCE as the dry cleaning fluid. Varsol™ was stored in underground storage tanks (USTs) located on the northern side of the building. The Varsol™ USTs, most probably installed in the 1940s, were removed in November of 1995 by OHM Remediation Services (OHM). PCE was stored on site in the same vicinity as the Varsol™ but in 150-gallon above-ground storage tanks (ASTs).

At the time the USTs were removed in 1995, contamination of the soil and ground water was suspected. During informal interviews conducted during the DNAPL investigation, dry cleaning personnel indicated that historical operating practices included disposal of spent PCE into floor drains. The tanks, floor drains, and associated underground pipes may have provided conduits for contamination to reach the subsurface. The dry cleaners still use PCE, but current practices involve storing PCE in a 150-gallon self-contained AST that is located inside Building 25, and the dry cleaning machines are fully self-contained. The first such unit was brought on line in December 1986, and the second in March 1995.

2.2 Site Stratigraphy

A relatively uniform depositional sequence of sediments has been observed in borings across the site. The surficial aquifer, referred to as the shallow aquifer in this report, consists of fine to very-fine sands and silt which typify the sediments encountered from the surface to a depth of approximately 18 feet below ground surface (ft bgs). The shallow aquifer is bound below by a silty clay layer that varies in thickness across Site 88. Previous investigations have reported that the clay layer is laterally discontinuous in some areas of Site 88 (Baker, 1998a). However, the clay layer appears to be continuous in the vicinity of the DNAPL zone, as discussed in Section 5.0.

Beneath the clay layer is an interval composed of fine to medium sand with some silt to a depth of over 100 ft bgs, based on boring logs for monitor wells completed in the area (Baker, 1998a). This hydrostratigraphic unit is identified in the RI report as the Upper Portion of the Castle Hayne Aquifer (Baker, 1998a). In areas where the clay layer is not present, the shallow aquifer and Castle Hayne Aquifer are in direct hydraulic communication.

2.3 Hydrogeologic Setting

In the demonstration area, the water table varies annually from about 7-9 feet bgs, or about 16-18 feet above mean sea level (amsl), and the shallow aquifer is separated from the Upper Portion of the Castle Hayne Aquifer by the clay layer. As discussed above, the clay layer acts as an aquitard between the two hydrostratigraphic units. Core samples show that the clay layer is approximately 14-16 ft thick in the SEAR demonstration area. This aquitard core was collected through a surface casing, which was installed for the completion of a Castle Hayne Aquifer monitor well located in the DNAPL zone. Cone penetrometer tests conducted outside the DNAPL zone show the aquitard thinning towards the northeast and southwest of Building 25. Further discussion of the clay layer morphology is presented in Section 5.0 of this report.

Water levels in the Castle Hayne Aquifer are approximately seven feet lower than water levels in the shallow aquifer. The difference in water levels between the shallow aquifer and the Upper Portion of the Castle Hayne Aquifer, as well as the fact that DNAPL has pooled on the clay layer, are evidence of the competency of the clay layer as an aquitard in the demonstration area. In the vicinity of Building 25, the direction of ground-water flow in the shallow aquifer is generally to the southwest, which explains the southern extension of the plume from Building 25. However, the plume also extends in a north-northwesterly direction from Building 25 (see Figures 1.2 and 1.3). As mentioned in Section 2.1, historical operating practices at the dry cleaning facility included disposal of spent PCE into floor drains. Therefore, some PCE is suspected to have migrated via leaking sewer lines that flow in a north-northwesterly direction from Building 25. In areas of Site 88 away from Building 25, the ground-water flow direction is variable, as shown in the RI (Figure 3-7; Baker, 1998a) which may explain the complex shape of the PCE plume when considered in conjunction with the sewer line mechanism for lateral PCE migration from Building 25.

2.4 Surface Water

There are no surface water bodies in the immediate vicinity of the site. The nearest bodies of surface water to Site 88 are Beaverdam Creek and The New River, located about 1,500 ft northeast and 3,000 ft west, respectively, from the site.

2.5 Water Supply Wells

There are no active water supply wells located within a one-mile radius of the site. The nearest active water supply well is HP-642, which is located approximately 1.5 miles east of the site. There are no private wells within the confines of Camp Lejeune. All water on base is supplied by the Camp Lejeune water distribution system (analogous to a municipal water supply system).

The closest off-base property and hence the nearest possible private well, is approximately four miles northeast of Site 88.

3.0 DNAPL SOURCE-ZONE INVESTIGATIONS

DNAPL source-zone investigations were conducted in three phases at Site 88 to evaluate the site per NFESC criteria for the SEAR demonstration. The minimum criteria for site selection required that: (1) the site must be contaminated with a sufficient volume of DNAPL to provide a valid test of SEAR technology; and (2) the DNAPL zone must have sufficient permeability to support remediation via injection of surfactants and the subsequent recovery of the surfactant/DNAPL effluent at extraction wells within a reasonable period of time (i.e., economically justifiable timeframe).

Aquifer sediment samples (soil samples) were collected for volatile organic compound (VOC) analysis and for geologic logging during four separate drilling and sampling events to delineate the extent of the DNAPL zone and interpret the hydrostratigraphy of the DNAPL zone. The soil sampling activities during these drilling events are described in Sections 3.1 to 3.3. The analytical results for VOC concentrations for all soil sampling events are summarized in Section 3.4.

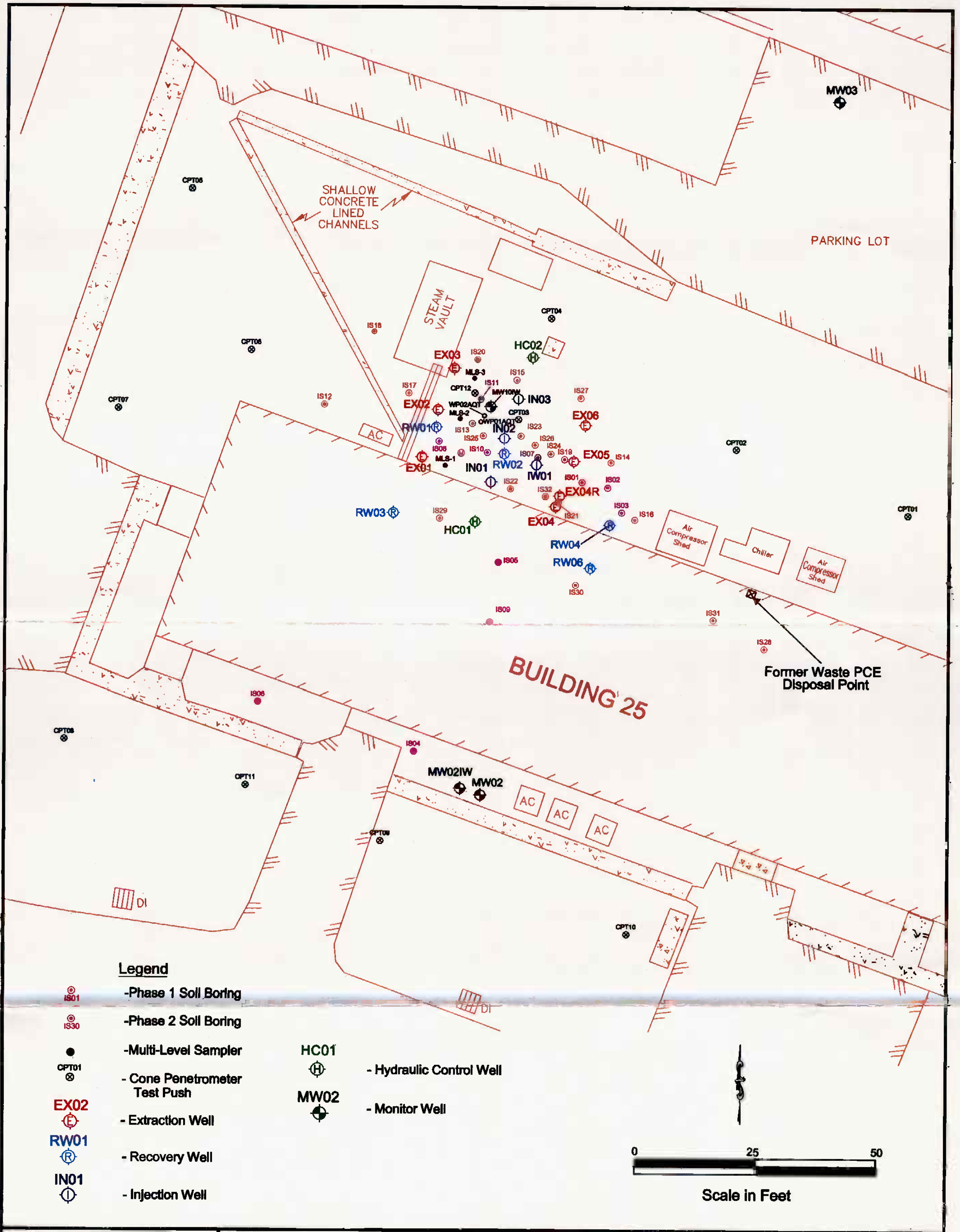
3.1 Phase 1: Initial DNAPL Source-Zone Investigations

The primary objectives of the Phase 1 investigation were to determine whether DNAPL was present at Site 88, and to provide a preliminary evaluation of the site hydrostratigraphy. After confirming the presence of DNAPL at the site, a secondary objective of Phase 1 was to characterize the hydraulic properties of the DNAPL zone.

During July 24-28, 1997, 11 soil borings (IS-01 to IS-11) were advanced through the shallow, unconfined aquifer to a maximum depth of 21 ft bgs. Soil boring locations are shown in Figure 3.1. Of the 11 borings, seven were located outside Building 25 near the north wall of the building, two were located inside Building 25 (IS-05 and IS-09), and two were located outside of the south facing wall of the building (IS-04 and IS-06). The borings were sampled continuously with a Geoprobe direct-push rig and the soil core was screened throughout with a photoionization detector (PID) meter to obtain a relative measure of VOC contamination with depth. Soil samples were collected from the core at discrete depth intervals that showed high PID readings.

3.1.1 Soil Sampling Method for VOC Analysis

Soil core retrieved from each borehole with the Geoprobe sampler was contained inside clear acetate core-tube liners to reduce volatile losses of VOCs during the sampling and logging process. Both ends of the core-tube liner were plugged immediately upon retrieval from the borehole to minimize volatilization. The sample tube was then labeled according to sample depth, and small holes were drilled through the core-tube liner at



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DNAPL Source-Zone Investigations: Locations of Soil Borings, CPT Pushes, and Wells

MCB Camp Lejeune, NC

Figure 3.1

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six-inch intervals to allow for PID screening of the soil-filled sample tube. Once the PID screening was completed, discrete soil samples were selected for VOC analysis at intervals that indicated the greatest VOC contamination (i.e., highest PID readings). The discrete soil samples were preserved in the field with methanol, which served the dual purpose of (1) minimizing volatile losses of VOCs from the soil samples during sampling and shipping, and (2) extracting VOCs from the soil sample for laboratory analysis. Soil samples were placed into 40-mL sample vials, which contained a preweighed amount of methanol preservative. After adding the soil sample to the methanol-prepared sample vial, the total weight (i.e., soil plus methanol) was recorded to determine the weight of the collected soil sample. The sampling procedure is can be found in Appendix A.

A new core-tube liner was used for each soil sampling push. All other equipment used in the sampling procedure was properly decontaminated before reuse to minimize cross contamination of samples. The decontamination procedure involved washing sampling tools with Alconox, rinsing with potable water, and allowing them to air dry.

All field samples were catalogued in a sample control log that identified each sample collected, date and time of collection, name of the sampler, and the sample's field identification. Samples were shipped off site to a Quanterra Lab for analysis. For shipment to the lab, samples were packed in a cooler chest with ice, and shipped under chain-of-custody.

3.1.2 Results of Initial DNAPL Source-Zone Investigations

DNAPL was confirmed to be present in the subsurface and was found near the north-facing wall of Building 25 at a depth of approximately 16-20 ft bgs. DNAPL migration was limited vertically by the presence of a clay aquitard that typically begins at about 19 ft bgs. Further details of the Phase 1 investigation, including sampling methods, geologic logs, and laboratory analytical results, are included in the DNAPL Investigation Summary Report (Baker, 1997). The Phase 1 geologic logs are also included in Appendix B of this report.

It should be noted that the analytical lab values for soil VOC concentrations that were reported in the DNAPL Investigation Summary Report (Baker, 1997), as well as in the PITT Work Plan (DE&S, 1998a), for Phase 1 soil samples are in error. The mis-reported soil VOC concentrations by the analytical lab did not include consideration for soil water within the total volume of liquid extracted from the soil samples when analyzed. Further discussion of the cause of the error and the corrected soil VOC concentrations are presented in Section 3.3.1 and Appendix F, respectively, of this report. In addition to confirming the presence of DNAPL at Site 88, the Phase 1 investigation also revealed the presence of light non-aqueous phase liquid (LNAPL) contamination at a depth of approximately 7 - 9 ft bgs, which coincides with the depth of the annual variation of the water table. Since LNAPLs are less dense than water, they accumulate at the water table (in contrast with DNAPLs, which are denser than water). The depth at which LNAPL contamination occurs at Site 88 exhibits the classic behavior of an LNAPL that becomes smeared across the water-table zone as ground-water levels rise and fall due to seasonal variations in recharge and discharge of the ground-water flow system. During the Phase 1 investigation, it was surmised that the source of the LNAPL was Varsol™ that had leaked from USTs formerly located nearby. As the water table rises and falls with the floating free-phase LNAPL, a portion of the LNAPL becomes trapped by capillary forces in the pore spaces as residual LNAPL.

As a result of the discovery of Varsol™ contamination, a follow-up investigation was conducted at Site 88 by Baker, as discussed in Section 3.2.2 of this report. The results are found in the Varsol™ Investigation Summary Report (Baker, 1998b).

3.1.3 Expanded DNAPL Source-Zone Investigation and Aquifer Testing

After confirming the presence of DNAPL at Site 88 during the initial DNAPL investigation, the Phase 1 investigation was expanded with the following objectives: (1) further delineate the DNAPL zone; (2) characterize the ground-water chemistry of the DNAPL zone; and (3) estimate the hydraulic conductivity of the DNAPL-contaminated shallow aquifer by means of a pumping test. Fieldwork to satisfy these objectives was completed during August 1997.

3.1.3.1 Additional DNAPL Source-Zone Investigation

Five soil borings were completed with continuous sampling to approximately 20 ft bgs. Soil samples were field screened with a PID meter and collected with methanol preservation as described above in Section 3.1.1. Three of the five borings were completed as wells with a hollow-stem auger drilling rig. These three wells were installed for the purpose of aquifer testing. Two of the wells, RW01 and RW02 were screened from 14-19 ft bgs, and well IW01 was screened from 13-18 ft bgs. Wells RW01 and RW02, which were screened to the top of the clay aquitard, revealed the presence of free-phase DNAPL. The depth to free-phase DNAPL (i.e., depth to the interface between ground water and DNAPL pooled in a well) at these two locations was approximately 18-18.5 ft bgs. Ground-water samples were collected from wells RW01 and RW02 for VOC and major ion analysis.

Geologic logs for the borings (IS-12, IS-13, RW01, RW02, and IW01) are included in Appendix B, and well construction details are tabulated in Table 3.1. Soil VOC concentrations and the results of the ground-water analyses are presented in Section 3.3. The aquifer pumping test is discussed below in Section 3.1.3.2. Additional details for this portion of the investigation are included in the Phase 2 section of the DNAPL Investigation Summary Report (Baker, 1997)

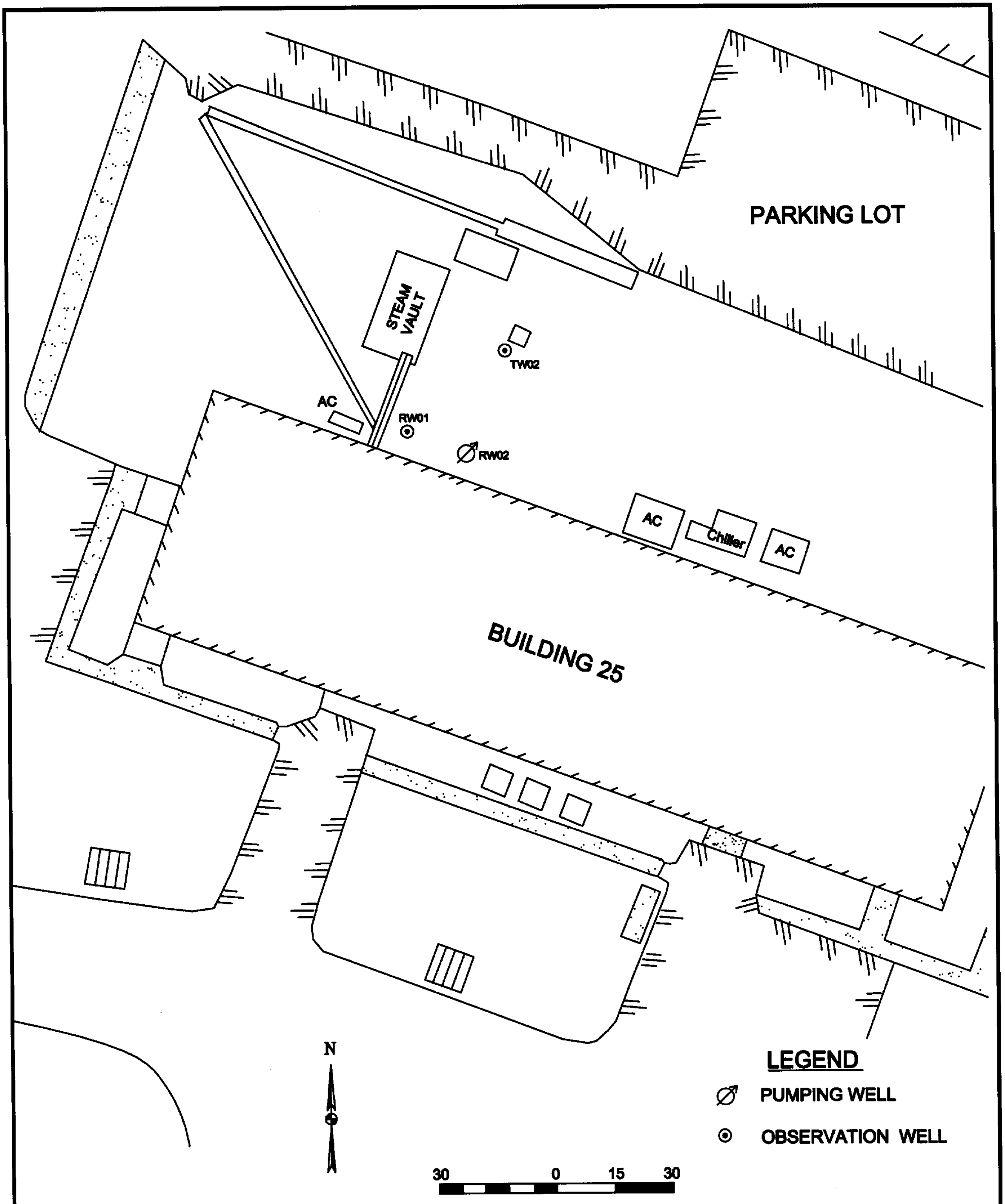
Table 3.1 Well Construction Details

Well ID	Casing Diameter (in)	Elevation (ft amsl)		Well Depth (ft bgs)	Screen Intervals (ft amsl)		Bentonite Seal Interval (ft amsl)	Sand Pack Interval (ft amsl)
		Ground	TOC		Lower	Upper		
EX01	4	25.63	25.59	19.96	6.1-10.6	NA	16.8-12.8	12.8-5.6
EX02	4	25.56	25.66	21.20	4.9-9.5	NA	14.7-11.8	11.8-4.2
EX03	4	25.64	25.98	19.94	6.5-11.0	NA	15.9-12.9	12.9-6.0
EX04	4	25.65	25.59	21.09	4.9-9.5	NA	14.1-11.8	11.8-4.6
EX04R	4	25.65	25.59	19.70	6.3-10.9	NA	16.9-13.1	13.1-5.6
EX05	4	25.22	25.42	21.75	4.1-8.7	NA	13.9-11.2	11.2-4.4
EX06	4	25.45	25.73	20.41	5.7-10.3	NA	15.5-12.5	12.5-5.2
HC01	2	26.42	26.85	22.71	4.5-9.1	5.9-15	13.9-11.9	11.9-4.9
HC02	2	25.87	26.17	20.40	6.1-10.8	13.9-18.4	12.8-11.8	11.8-6.1
IN01	4	25.71	25.54	22.58	3.5-8.0	14.0-18.0	12.1-10.1	10.1-3.0
IN02	4	25.27	25.52	19.65	6.5-11.0	14.5-18.5	12.6-11.6	11.6-5.5
IN03	4	25.34	25.8	19.96	6.4-10.9	14.4-18.4	12.9-11.9	11.9-5.8
RW01	4	25.49	25.24	20.00	6.2-10.4	NA	16.2-13.2	13.2-5.2
RW02	4	25.54	25.35	20.00	6.4-10.9	NA	16.4-13.4	13.4-5.4
RW03	2	26.49	26.84	21.97	5.2-9.9	15.8-19.7	14.0-12.0	12.0-5.0
RW04	4	25.78	26.07	23.39	3.3-7.8	13.7-18.2	13.2-11.2	11.2-4.1
RW06	2	26.46	26.86	21.07	6.1-10.8	14.2-18.7	13.9-12.4	12.4-6.4
IW01	2	25.61	25.24	18.50	6.9-11.4	NA	20.7-17.7	17.7-6.2
MW10IW	¼" tube	25.8*	25.0*	39.00	-12.9 - -8.4	NA	8.2-6.1	-6.1-13.34
WP01AQT	¼" tube	25.6*	NA	23.0	2.6-3.6	NA	10.6-4.0	4.0-2.2
WP02AQT	2	25.6*	NA	25.0	0.6-1.6	NA	10.6-2.6	2.6-0.2

*Estimated from nearby wells

3.1.3.2 Aquifer Testing of the DNAPL-Contaminated Zone

A short-term, constant-rate pumping test was conducted on August 22, 1997 to provide preliminary estimates for hydraulic conductivity as well as specific yield. The pumping test configuration, as shown in Figure 3.2, utilized well RW02 as the pumping well, and wells RW01 and TW02 as observation wells. Water levels were monitored at the observation wells by means of an electronic data acquisition system (DAS) with submersible pressure transducers, and were checked manually with the use of an interface probe. The pressure transducers and the interface probe both provided water level measurements recorded in increments of 0.01 feet. Ground water was extracted at well RW02 by means of a variable-speed electric submersible pump. Flow rates were measured by periodically checking the time required for the pumped ground water to fill a calibrated bucket. The pumping test effluent was captured in a tanker and transported to an air stripper on base for treatment by OHM.



NOTE: THE LOCATIONS OF THE
WELLS ARE APPROXIMATE.

DATE: 7/6/99

REF: TDN 307

File: Pumptest.dwg

Duke Engineering & Services
A Duke Energy Company

Pumping Test Location Map

MCB Camp Lejeune, NC

Figure 3.2

The pumping test was conducted from noon to 7pm with a constant pumping rate of 0.5 gpm. Data analysis of the water level drawdown at wells RW01 and TW02, using the program AQTESOLV^{TM} and the Neuman method (1975), reveals average values of 5×10^{-4} cm/sec for the hydraulic conductivity and 0.01 for the specific yield. Plots of the drawdown data and curve fits as well as the water level data are included in Appendix C.

The averaged results above for aquifer hydraulic properties were used to develop the geosystem model. The estimated values were later confirmed by the model's ability to accurately predict the results of the CITT and PITT. Although the values given above are representative of the majority of the shallow aquifer in the demonstration area, field observation of core samples indicated that the aquifer sediments become significantly finer (e.g. clayey silt) in the bottom 1-1.5 ft of the aquifer directly overlying the aquitard. This observation of expectedly lower hydraulic conductivity at the base of the shallow aquifer was confirmed by analysis of data from the PITT. Samples collected during the PITT from multilevel sampler points installed in this zone show it to be lower in hydraulic conductivity by a factor of approximately four, as discussed in Section 5.0.

3.2 Phase 2: DNAPL Source-Zone Characterization

Results of the Phase 1 DNAPL source-zone investigation showed that Site 88 was a good candidate for the ESTCP SEAR project. A DNAPL zone had been located and aquifer permeability was found to be sufficient for implementation of the SEAR technology. A Phase 2 DNAPL zone investigation was then conducted to delineate the horizontal extent of DNAPL contamination at Site 88, and to further characterize the clay aquitard. Because DNAPLs are denser and less viscous than water, they tend to migrate downward past the water table until encountering a capillary barrier, such as a clay layer. Consequently, it was important to map the upper surface and thickness of the clay aquitard in the vicinity of the DNAPL zone.

3.2.1 Cone Penetrometer Tests

Cone penetrometer tests (CPTs) were conducted at 12 locations around the periphery of Building 25 to map the upper and lower surfaces of the clay aquitard. Cone penetrometry is a direct-push technology that can be used to provide low cost, rapid characterization of soil types (e.g. sand, silt, clay) versus depth. Different soil types can be inferred by CPT, based upon the inherent properties of a given soil and the forces exerted on the cone-tipped rod as it is pushed downward through the soil column. The method consists of a metal rod equipped with a cone-shaped tip that is pushed downward into the subsurface at a constant rate. A pressure transducer measures and records the pressure exerted on the cone (i.e., tip pressure) which occurs as a function of the physical resistance of the soil to the cone-tipped rod as it is pushed downward through the sediments. At the same time, the sleeve resistance exerted on the drive rod just above the tip is also measured. For example, pushing a cone-tipped rod through sand creates a greater tip pressure than pushing through clay, whereas the sleeve resistance on the rod as it is pushed downward is greater for clay than sand due to the shear forces exerted by the clay. The combined data logs of tip pressure and sleeve resistance are used to generate a soil column log to characterize soil type versus depth.

CPT push locations are shown in Figure 3.1. Of the 12 CPT pushes, six were terminated after about two feet of penetration into the clay layer. These shallow CPT pushes provided the necessary data to map the upper surface of the clay layer, yet prevented downward DNAPL migration through the aquitard since the push did not penetrate the full thickness of the aquitard (CPT02, 03, 05, 07, 09, and 12). At six locations known to be outside the DNAPL zone, CPT pushes were advanced completely through the clay aquitard until encountering sand below the aquitard, in order to map the approximate thickness of the shallow clay layer (i.e., capillary barrier) around Building 25 (CPT01, 04, 06, 08, 10, and 11).

CPT logs are included in Appendix D. Results of the CPT investigation indicate that the clay layer varies in thickness from about 8-14 ft thick on the north side of Building 25. On the south side of the building, clay thickness generally ranges from about 2-10 ft, but thins to only about four inches at CPT08 which is located near the southwest corner of the building.

After each CPT push, the rig moved approximately one foot, and then repeated the push to collect discrete, one-foot soil core samples from two depth intervals, as directed by the DE&S geologist on site. Soil samples were collected in one-inch ID X 12-inch long acetate core liners at a depth interval of 8-9 ft bgs for Varsol™ analysis, and also from just above the clay interface for DNAPL analysis. Varsol™ concentrations in the CPT soil samples are included in the Varsol™ Investigation Summary Report (Baker, 1998b), and VOC concentrations in the CPT soil samples are discussed in Section 3.4 of this report.

3.2.2 Soil Borings to Delineate Extent of DNAPL Zone

During November 1997, 18 soil borings (IS-14 to IS-31) were completed at Site 88 to delineate the horizontal extent of the DNAPL zone at Building 25. The total depth of the soil borings ranged from 20-22 ft bgs, and the borings were generally terminated after penetrating the clay layer by about one to two feet. Soil sampling was conducted with a Geoprobe direct push macrosampler tube. Continuous soil sampling was completed from ground surface to the clay aquitard for borings IS-14 and IS-15, whereas at the remaining borings (IS-16 to IS-31) core samples were collected only at discrete depth intervals, from 8-10 ft bgs for Varsol™ analysis and from ~16-21 ft bgs for VOC analysis. All core samples were field screened with a PID, and VOC soil samples were field-preserved with methanol, as described in Section 3.1.1. Soil cores were described according to soil type. The geologic logs are included in Appendix B. Soil boring locations for IS-14 to IS-31 are shown in Figure 3.1. Soil VOC concentrations are presented in Section 3.4

The purpose of the Varsol™ investigation was twofold – first, to investigate the presence of LNAPL Varsol™ which could potentially affect the SEAR process, and second, to provide baseline information for the remediation of Varsol™ contamination. The details and results of this investigation are found in the Varsol™ Investigation Summary Report (Baker, 1998b). Varsol™ was reported as high as 4,900 mg/kg in soil samples and 7,100 µg/L in ground-water samples. Free-phase Varsol™ has not been observed in any wells on site.

Fourteen of the soil borings during this investigation were located on the north side of Building 25, and four borings were located inside the building. Boring locations were chosen based on data gaps from the previous soil sampling events so that the approximate horizontal extent of the DNAPL zone could be mapped as a result of this soil sampling event. Soil samples were also collected from four soil borings located in an area already known to contain DNAPL. The purpose of collecting soil samples from these four borings was to provide pre-SEAR data that would allow a performance assessment (PA) of the effectiveness of the surfactant flood. The four PA borings are IS-22, IS-23, IS-25, and IS-26. Baseline DNAPL conditions for the four borings were determined by collecting soil samples from three discrete depths near the bottom of each boring. After the surfactant flood is completed, soil samples will be collected at the same depths near these borings for VOC analysis. The post-SEAR soil VOC concentrations will then be compared to soil VOC concentrations for the pre-SEAR soil samples.

A second objective for this Phase 2 round of soil sampling was to provide further characterization of the DNAPL-zone geosystem, including: (1) improved mapping of the depth to the upper surface of the clay layer; (2) analysis of soil samples to determine mineral content; and (3) analysis of the fraction of sedimentary organic carbon (f_{oc}) in soil samples. The results of mineral and f_{oc} analyses are presented in Section 3.3.1. Mapping of the upper surface and thickness contours of the clay layer is discussed in Section 5.0.

3.2.3 Soil Sampling during Installation of Test Zone Wells

The test zone wells and associated recovery wells were installed on the north side of Building 25 during December 1997, and included three wells that were installed inside the building. Soil samples were collected from the DNAPL zone at the well locations to measure the pre-SEAR DNAPL saturations in the test zone. Soil sampling intervals from soil borings at the well locations are discussed here, and well installation methods are discussed in Section 4.0.

Soil borings were drilled at each well location and core samples were collected continuously, typically from about 16-21 ft bgs. Soil samples were collected by split spoon sampling from the borings at EX01, EX02, EX03, RW03, RW06 and HC01, whereas the remaining borings, EX04, EX05, EX0, IN01, IN02, and IN03, were sampled continuously with a Geoprobe macrosampler. Core sampling depth intervals, PID readings and descriptions of the soil types were recorded on a geologic log for each well location. The geologic logs are included in Appendix B.

Soil cores were field screened immediately upon retrieval with a PID meter to obtain a relative measure of VOC contamination with depth. The specific objective of this PID screening was to locate the interface where PID readings became non-detectable or decreased to near zero. This provided an indication of the extent of VOC contamination with depth, which coincided with the upper portion of the clay layer. Once the zero-VOC/clay-layer interface was located, three discrete soil samples were collected from each borehole for VOC analysis; one sample was collected at six inches above the interface, one at 1.5 feet above the interface and one at three feet above the interface. Each soil sample was collected into a jar and preserved in the field with methanol, as described in Section 3.1.1.

3.3 Soil and Water Analysis

The analytical results from soil and ground-water samples collected during the DNAPL source-zone investigations are presented in this section of the report. The analytical chemistry data is used to build a geosystem model of the site for the purposes of characterizing the DNAPL zone and to provide the necessary input for designing a PITT and surfactant flood (as part of SEAR). The geosystem of the test zone at Site 88 is described in Section 5.0. The raw analytical data (e.g., soil VOC concentrations, soil moisture content, and f_{oc}) are used to estimate the percent DNAPL saturation (S_n) for each soil sample collected in the DNAPL zone, as discussed in Section 3.3.1. Soil samples were also collected for analysis by X-ray diffraction (XRD) to determine the mineral composition of sediments in the DNAPL zone.

Ground-water and source-water (i.e., site potable water) samples were also analyzed to characterize VOC and major-ion concentrations in the DNAPL zone ground water and source water. The ionic composition of the ground water and source water must be determined for PITT and SEAR design purposes. Site source water will be used to mix tracer and surfactant injectate solutions.

3.3.1 Soil Analysis

Soil samples collected during the DNAPL investigations and well installations were shipped to Quanterra Inc., in Knoxville, Tennessee and analyzed for VOCs to evaluate the spatial distribution of the PCE, TCE, and DCE contamination in the subsurface. For a given soil sample, the reported concentration represents the bulk VOC concentration in a wet soil sample, which is the sum of VOCs associated with four phases: air (if in the vadose zone), water, soil, and nonaqueous phase liquid (NAPL). The bulk soil VOC concentration data reported by the lab were analyzed using NAPLANAL, a computer code developed by DE&S (Mariner et. al., 1997). The program estimates the aqueous VOC concentrations originally present in the wet soil samples and determines if any NAPL is present. NAPLANAL calculates the distribution of the measured total soil VOC concentrations from a bulk sample to the various VOC phases: fluid (i.e., water and air), solid (i.e., sorption to soil), and NAPL. Partitioning of VOCs between the air, water, soil, and NAPL phases depends upon well-established partition coefficients and solubility constants. If the calculations indicate that aqueous concentrations exceed the solubility and sorption constraints, then the NAPLANAL algorithm estimates the NAPL saturation. The NAPLANAL output includes the calculated VOC concentration in each phase and the NAPL saturation. If there is no NAPL present, a dilution factor can be calculated to provide a measure of how dilute the sample is with respect to the aqueous solubility of the VOC.

In addition to the soil VOC analyses, soil samples were also collected to determine the f_{oc} and soil moisture content. These parameters are needed to conduct the NAPLANAL calculations. Three samples were analyzed for f_{oc} by AnalySys, Inc., of Austin, Texas. The f_{oc} analyses were performed using EPA method ASA 29-3.5.2. This method measures non-purgeable organic carbon and includes a special pretreatment procedure to remove inorganic carbon (i.e., carbonate minerals) that could interfere with the f_{oc} measurement. The method requires the sample to be dried before analysis to remove water and purgeable organic carbon (i.e., VOCs). Traditional f_{oc} analyses have potential interferences that cannot be tracked, and which tend to overestimate the f_{oc} measurements (Caughey et al., 1995). The results of the f_{oc} analyses are shown in Table 3.2. The measured f_{oc} in the DNAPL zone ranges from 1510 to 6420 mg/kg and increases with depth and increasing fineness of the aquifer sediments. These values are equivalent to 0.00151 and 0.00642, respectively, when represented as the fraction of organic carbon relative to the bulk soil mass. A significant difference in f_{oc} was noted between the sandy versus clayey sediments, which is consistent with the geologic logs that indicate increasing peat content with depth in the clayey sediments. The analytical results can be found in Appendix E.

Table 3.2 Fraction of Organic Carbon (f_{oc}) in Selected Soil Samples

Sample ID	Depth (ft bgs)	Texture	f_{oc} (mg/kg)
IS26-04	16.5	Fine sand	1510
IS26-05	18.0	Clayey silt	5560
IS26-06	19.0	Silty clay	6420

Soil moisture, or water content, was determined for five soil samples collected at various boring locations and depths. The analysis was performed by Quanterra Inc., Knoxville, Tennessee using method MCAWW 160.3 MOD. The water content was in the range of 17.3 % to 21.2% (by weight). The results are given in Table 3.3. The laboratory data is in Appendix E.

Table 3.3 Soil Water Content

Sample ID	Depth (ft bgs)	Texture	Water Content (% by weight)
IW01-04	4.2	Clayey fine sand	17.3
IW01-05	9.2	Fine sand	17.5
IW01-09	18.2	Silty clay	20.2
RW02-04	9.2	Fine sand	18.1
IS13-08	18.2	Fine sand	21.2

Soil VOC concentrations are listed in Table 3.4 for all samples collected during the DNAPL source-zone investigations described in Sections 3.1 to 3.3. Percent NAPL saturation is also shown in Table 3.4, which is discussed in Section 3.4.2.

As mentioned previously in Section 3.1.2, the soil VOC values shown in Table 3.4 have been corrected from the earlier erroneous values reported by the lab and summarized in the initial DNAPL Investigation Summary Report (Baker, 1997) and in the PITT Work Plan (DE&S, 1998a). The erroneous values, based upon VOC concentrations in the methanol preservative/extraction solvent, did not include soil water content in the conversion calculation performed to estimate soil VOC concentrations. The corrections, however, reflect the addition of soil water content to the conversion calculation. A detailed description of the correction calculation process and a sample calculation are provided in Appendix F. Laboratory reports of the soil core VOC analyses can be found in Appendix H.

3.3.2 NAPLANAL Estimates of DNAPL Saturations

The corrected soil VOC concentrations shown in Table 3.4 were used as input to the NAPLANAL program to estimate the percent DNAPL saturation, i.e., the percentage of pore space that is occupied with DNAPL, for each soil sample. The calculated DNAPL saturation is a function of the porosity (i.e., volume of pore space per unit volume of soil) and the f_{oc} (i.e., related to adsorption potential) of the soil matrix. Porosity was calculated based upon measured water content from soil samples collected during the DNAPL source-zone investigations. A soil water content of 20% was used for the porosity calculation, which implies a porosity of 0.40. This value is consistent with reported values of porosity for fine sand and silt (Freeze and Cherry, 1979), and is considered representative for the soil samples collected at Site 88. The porosity calculation is included in Appendix G.

Table 3.4 Soil VOC Concentrations of Subsurface Soils at Building 25

Sample ID	Sample Date	Depth (ft bgs)	Soil Concentration (mg/kg)			f_{oc}	Calculated % NAPL Saturation
			PCE	TCE	DCE		
IR88-IS01-1	7/25/97	5.3	ND	ND	19	0.0015	0.0
IR88-IS01-2	7/25/97	8.1	72.8	6.9	43.3	0.0015	0.0
IR88-IS01-3	7/25/97	8.6	101.4	38.6	49.9	0.0015	0.0
IR88-IS01-4	7/25/97	10.1	114.0	8.4	35.1	0.0015	0.0
IR88-IS02-1	7/25/97	8.1	13.1	2.1	15.1	0.0015	0.0
IR88-IS02-2	7/25/97	8.6	0.7	3.0	3.2	0.0015	0.0
IR88-IS02-3	7/25/97	8.9	64.8	ND	49.5	0.0015	0.0
IR88-IS02-4	7/25/97	16.3	0.1	ND	ND	0.0015	0.0
IR88-IS03-1	7/25/97	2.6	16.9	0.5	ND	0.0015	0.0
IR88-IS03-2	7/25/97	5.9	1.2	ND	ND	0.0015	0.0
IR88-IS03-3	7/25/97	7.6	7.2	ND	0.2	0.0015	0.0
IR88-IS04-1	7/26/97	12.1	7.3	ND	ND	0.0015	0.0
IR88-IS05-1	7/26/97	2.6	209	ND	ND	0.0015	0.02
IR88-IS05-2	7/26/97	5.7	653	ND	ND	0.0015	0.2
IR88-IS05-3	7/26/97	8.2	3,508	ND	ND	0.0015	1.0
IR88-IS05-4	7/26/97	10.3	372	25.4	ND	0.0015	0.1
IR88-IS06-1	7/26/97	9.2	3.2	ND	ND	0.0015	0.0
IR88-IS07-1	7/26/97	5.1	0.1	ND	3.6	0.0015	0.0
IR88-IS07-2	7/26/97	8.6	195	6.9	81.5	0.0015	.02
IR88-IS07-3	7/26/97	11.0	58.0	4.0	32.6	0.0015	0.0
IR88-IS07-4	7/26/97	18.4	1,901	ND	ND	0.0060	0.4
IR88-IS08-1	7/27/97	17.6	13,748	ND	ND	0.0015	4.2
IR88-IS08-2	7/27/97	18.7	5,997	ND	ND	0.0060	1.7
IR88-IS08-3	7/27/97	19.4	2,617	ND	ND	0.0060	0.7
IR88-IS08-4	7/27/97	4.7	1,268	133	ND	0.0015	0.4
IR88-IS08-5	7/27/97	7.3	1,577	258	ND	0.0015	0.5
IR88-IS09-1	7/27/97	10.6	188	ND	ND	0.0015	0.01
IR88-IS09-2	7/27/97	14.7	24	ND	ND	0.0015	0.00
IR88-IS10-1	7/27/97	15.4	80	3.7	3.7	0.0015	0.0
IR88-IS10-2	7/27/97	16.2	20	0.6	0.8	0.0015	0.0
IR88-IS10-3	7/27/97	17.2	25,829	ND	ND	0.0015	7.9
IR88-IS010-4	7/27/97	17.7	3,841	ND	ND	0.0060	1.0
IR88-IS11-1	7/27/97	16.4	12,169	ND	ND	0.0060	3.6
IR88-IS12-01	8/19/97	15.6	52	ND	ND	0.0015	0.0
IR88-IS12-02	8/19/97	16.1	22	0.18	ND	0.0060	0.0
IR88-IS12-03	8/19/97	17.1	32	ND	ND	0.0015	0.0
IR88-IS13-01	8/19/97	17.1	7,760	ND	ND	0.0015	2.3
IR88-IS13-02	8/19/97	17.6	25,411	ND	ND	0.0015	7.9
IR88-IS13-03	8/19/97	18.1	6,226	ND	ND	0.0015	1.9

Table 3.4, continued

Sample ID	Sample Date	Depth (ft bgs)	Soil Concentration (mg/kg)			f_{oc}	Calculated % NAPL Saturation
			PCE	TCE	DCE		
IR88-RW01-01	8/19/97	17.1	31	ND	ND	0.0015	0.0
IR88-RW01-02	8/19/97	18.1	11,337	ND	ND	0.0060	3.3
IR88-RW01-03	8/19/97	20.1	1,483	ND	ND	0.0060	0.3
IR88-RW02-01	8/19/97	17.1	16	ND	ND	0.0015	0.0
IR88-RW02-02	8/19/97	18.1	1049	ND	ND	0.0015	0.3
IR88-RW02-03	8/19/97	18.6	4,634	ND	ND	0.0060	1.3
IR88-IW01-01	8/20/97	17.6	138	ND	ND	0.0015	0.0
IR88-IW01-02	8/20/97	18.1	33,572	ND	ND	0.0060	10.2
IR88-IW01-03	8/20/97	18.6	5,140	ND	ND	0.0060	1.4
IR88-IW01-06	8/20/97	4.2	1.7	ND	22	0.0015	0.0
CPT01-2	11/15/97	15.2	ND	ND	ND	NA	0.0
CPT02-2	11/15/97	17.2	ND	ND	ND	NA	0.0
CPT03-2	11/15/97	18.2	32	ND	ND	0.0060	0.0
CPT04-2	11/15/97	18.2	60	ND	ND	0.0060	0.0
CPT05-2	11/15/97	19.5	1.3	0.1	ND	0.0060	0.0
CPT07-2	11/15/97	17.0	3.9	0.3	ND	0.0015	0.0
CPT08-2	11/15/97	21.0	8.0	0.3	ND	0.0060	0.0
CPT09-2	11/15/97	17.6	3.0	ND	ND	0.0015	0.0
CPT10-2	11/15/97	18.4	0.5	ND	ND	0.0015	0.0
IS14-2	11/18/97	18.0	0.05	ND	ND	0.0060	0.0
IS15-2	11/18/97	19.0	3.4	0.05	ND	0.0015	0.0
IS16-2	11/19/97	18.5	3,261	ND	ND	0.0060	0.9
IS17-2	11/19/97	18.0	5,930	ND	ND	0.0015	1.8
IS18-2	11/19/97	18.4	5.4	.1	ND	0.0060	0.0
IS19-2	11/19/97	17.4	0.1	ND	ND	0.0015	0.0
IS20-2	11/19/97	18.5	2.9	ND	ND	0.0015	0.0
IS21-3	11/20/97	19.7	908	ND	ND	0.0015	0.2
IS21-4	11/20/97	18.7	8763	ND	ND	0.0015	2.6
IS22-2	11/20/97	17.0	3,603	ND	ND	0.0015	1.1
IS22-3	11/20/97	18.0	2,815	ND	ND	0.0015	0.8
IS22-4	11/20/97	19.0	909	ND	ND	0.0060	0.1
IS23-1	11/20/97	17.5	9.3	ND	ND	0.0015	0.0
IS23-2	11/20/97	18.2	1,476	ND	ND	0.0015	0.4
IS23-3	11/20/97	19.0	311	ND	ND	0.0060	0.0
IS25-2	11/21/97	17.0	1,709	ND	ND	0.0015	0.5
IS25-3	11/21/97	18.0	10,851	ND	ND	0.0060	3.2
IS25-4	11/21/97	19.0	814	ND	ND	0.0060	0.1
IS26-1	11/21/97	17.0	208	ND	ND	0.0060	0.0
IS26-2	11/21/97	17.7	1,611	ND	ND	0.0060	0.4

Table 3.4, continued

Sample ID	Sample Date	Depth (ft bgs)	Soil Concentration (mg/kg)			f_{oc}	Calculated % NAPL Saturation
			PCE	TCE	DCE		
IS26-3	11/21/97	18.5	106	ND	ND	0.0060	0.0
IS29-2	11/22/97	18.8	4,361	ND	ND	0.0060	1.2
IS30-2	11/22/97	18.8	3,212	ND	ND	0.0060	0.8
IS31-2	11/22/97	16.8	54	ND	ND	0.0060	0.0
EX01-1	12/3/97	16.5	3,013	ND	ND	0.0015	0.9
EX01-2	12/3/97	17.5	44,352	ND	ND	0.0015	13.7
EX01-3	12/3/97	18.5	29,763	ND	ND	0.0015	9.1
EX03-1	12/4/97	16.0	1.2	ND	ND	0.0015	0.0
EX03-2	12/4/97	17.5	19	ND	ND	0.0015	0.0
EX03-3	12/4/97	19.0	96	ND	ND	0.0015	0.0
EX04-1	12/4/97	17.0	122	1.8	2.2	0.0015	0.0
EX04-2	12/4/97	18.5	25	ND	ND	0.0015	0.0
EX04-3	12/4/97	19.5	11,743	ND	ND	0.0015	3.6
EX05-1	12/4/97	18.0	2.3	ND	0.4	0.0015	0.0
EX05-2	12/4/97	19.0	0.8	ND	3.1	0.0015	0.0
EX05-3	12/4/97	20.0	86	ND	ND	0.0015	0.0
EX06-1	12/5/97	16.5	0.7	ND	0.5	0.0015	0.0
EX06-2	12/5/97	18.0	0.8	ND	ND	0.0015	0.0
EX06-3	12/5/97	19.0	0.5	ND	ND	0.0015	0.0
HC01-1	12/8/97	18.5	1,540	ND	ND	0.0015	0.4
HC01-2	12/8/97	20.0	10,489	ND	ND	0.0015	3.2
HC01-3	12/8/97	21.0	712	ND	ND	0.0060	0.1
IN01-1	12/8/97	18.0	13,406	ND	ND	0.0015	4.1
IN01-2	12/8/97	19.5	15,553	ND	ND	0.0060	4.6
IN01-3	12/8/97	20.5	708	ND	ND	0.0015	0.2
IN03-1	12/8/97	16.0	5.2	0.1	0.6	0.0015	0.0
IN03-2	12/8/97	17.5	2.7	ND	ND	0.0015	0.0
IN03-3	12/8/97	19.0	18	0.2	ND	0.0015	0.0
HC02-1	12/9/97	16.0	1.2	0.1	0.1	0.0015	0.0
HC02-2	12/9/97	17.0	9.4	0.1	ND	0.0015	0.0
HC02-3	12/9/97	18.5	25	0.2	ND	0.0015	0.0
RW03-2	12/9/97	21.6	287	1.7	ND	0.0015	0.04
RW04-1	12/9/97	18.0	25	0.1	ND	0.0015	0.0
RW04-2	12/9/97	19.5	23,057	ND	ND	0.0015	7.1
RW04-3	12/9/97	20.5	448	ND	ND	0.0060	0.0

Notes: PCE = tetrachloroethene
TCE = trichloroethene

DCE = *cis*-1,2-dichloroethene

f_{oc} = fraction of sedimentary organic carbon
Calculated % NAPL saturation = fraction of the pore space occupied by NAPL calculated using NAPLANAL
ND = compound not detected

Measured f_{oc} in the DNAPL zone was noted to increase with depth from sandy to clayey sediments, as shown in Table 3.2. This is consistent with field observations of soil cores, where peat content was found to be more heavily associated with the clayey sediments, which increases the sedimentary organic carbon content. It should be noted that the peat was observed to be present as peat particles dispersed within the finer-grained sediments, and not as layers or lenses of peat. Two values for f_{oc} were used input into the NAPLANAL calculations; a value of 0.0015 (1,500 mg/kg) was used for samples collected in predominately sandy soils, and a value of 0.006 (6,000 mg/kg) was used for samples collected in silty or clayey soils. Results from the NAPLANAL calculations are presented in Table 3.4, as well as the f_{oc} value used, based on the soil type of the sample, for each NAPLANAL calculation. The algorithm used in NAPLANAL to calculate DNAPL saturations is described fully by Mariner et. al. (1997); a copy of this paper is included in Appendix G.

The analysis indicates that DNAPL is present directly underneath Building 25 and in an area adjacent to the north side of building. The DNAPL saturation is in the range of 0.01 to 13.7%. The approximate horizontal extent of the DNAPL zone is shown in Figure 3.3. The DNAPL-zone boundary line (see Figure 3.3) is based upon measured soil VOC concentrations and the resulting DNAPL saturations calculated by NAPLANAL. Cross sections were constructed to show the soil VOC concentrations and DNAPL saturations at Site 88. The plan view locations of cross-section transects A-A' and B-B' are shown in Figure 3.3. Cross sections A-A' and B-B' are depicted in Figures 3.4 and 3.5. The cross sections provide insight into the vertical distribution of DNAPL in the contaminated zone, which indicates that the DNAPL saturation generally increases with depth from about 16 to 20 ft bgs. DNAPL saturation data in Table 3.4 and in the cross sections in Figures 3.4 and 3.5 show that the horizontal distribution of the DNAPL zone is most concentrated along the north side of Building 25.

3.3.3 Ground-Water and Source-Water Characterization

Ground-water samples collected from wells RW01 and RW02 were shipped to Quanterra Inc., Knoxville, Tennessee for VOC analysis. The results are given in Table 3.5 and reveal that the PCE concentrations are in the range of 150 to 170 mg/L. The laboratory reports can be found in the initial DNAPL Investigation Summary Report (Baker, 1997; App C)

Table 3.5 Ground-Water VOC Concentrations

Well	Sample Date	PCE (mg/L)	TCE (mg/L)	DCE (mg/L)
RW01	8/21/97	170.0	*3.2	11.0
RW02	8/22/97	150.0	*3.5	10.0

*concentration below calibration range.

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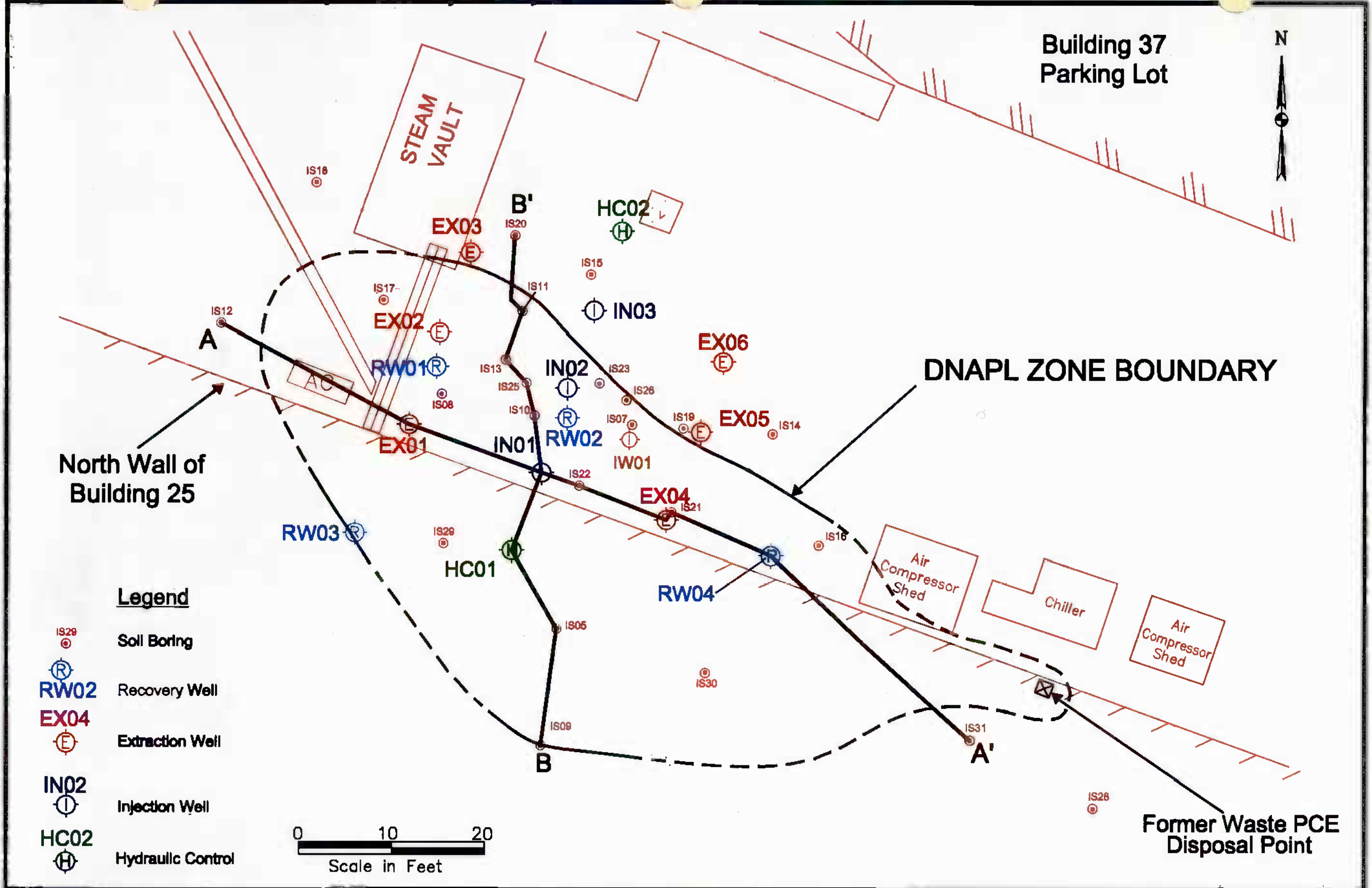

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DNAPL Zone Boundary and Cross Section Transect Locations

(Boundary delineation based upon soil sample analyses and NAPLANAL estimates for DNAPL saturations)

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Figure 3.3

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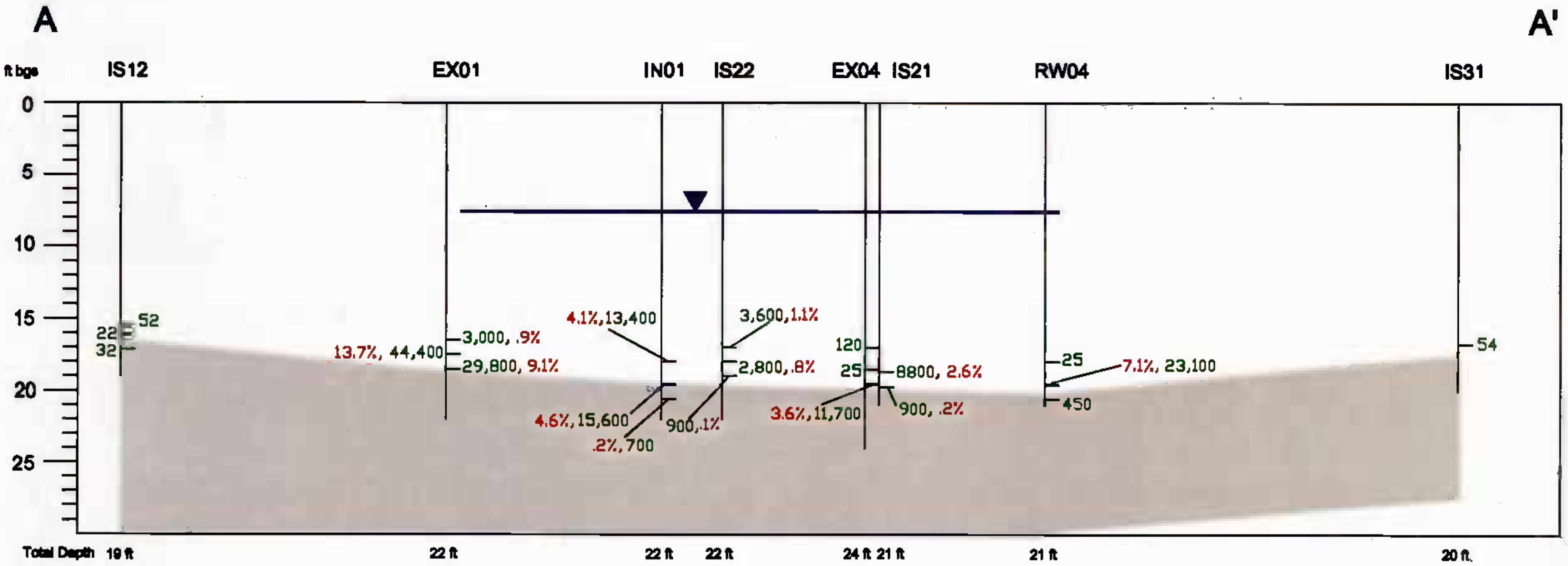

Legend

44,400	PCE concentration in mg/kg wet soil basis
13.7%	DNAPL saturation expressed as percent of porosity
▼	Approximate Static Water Level (7.80 ft bgs)
▨	Clay Aquitard: Aquitard thickness extends below bottom of figure except where shown otherwise.

0 5 10
Scale in Feet

DATE: 7/20/99
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Cross Section A-A' with Soil PCE Concentrations and Estimated DNAPL Saturations

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Figure 3.4

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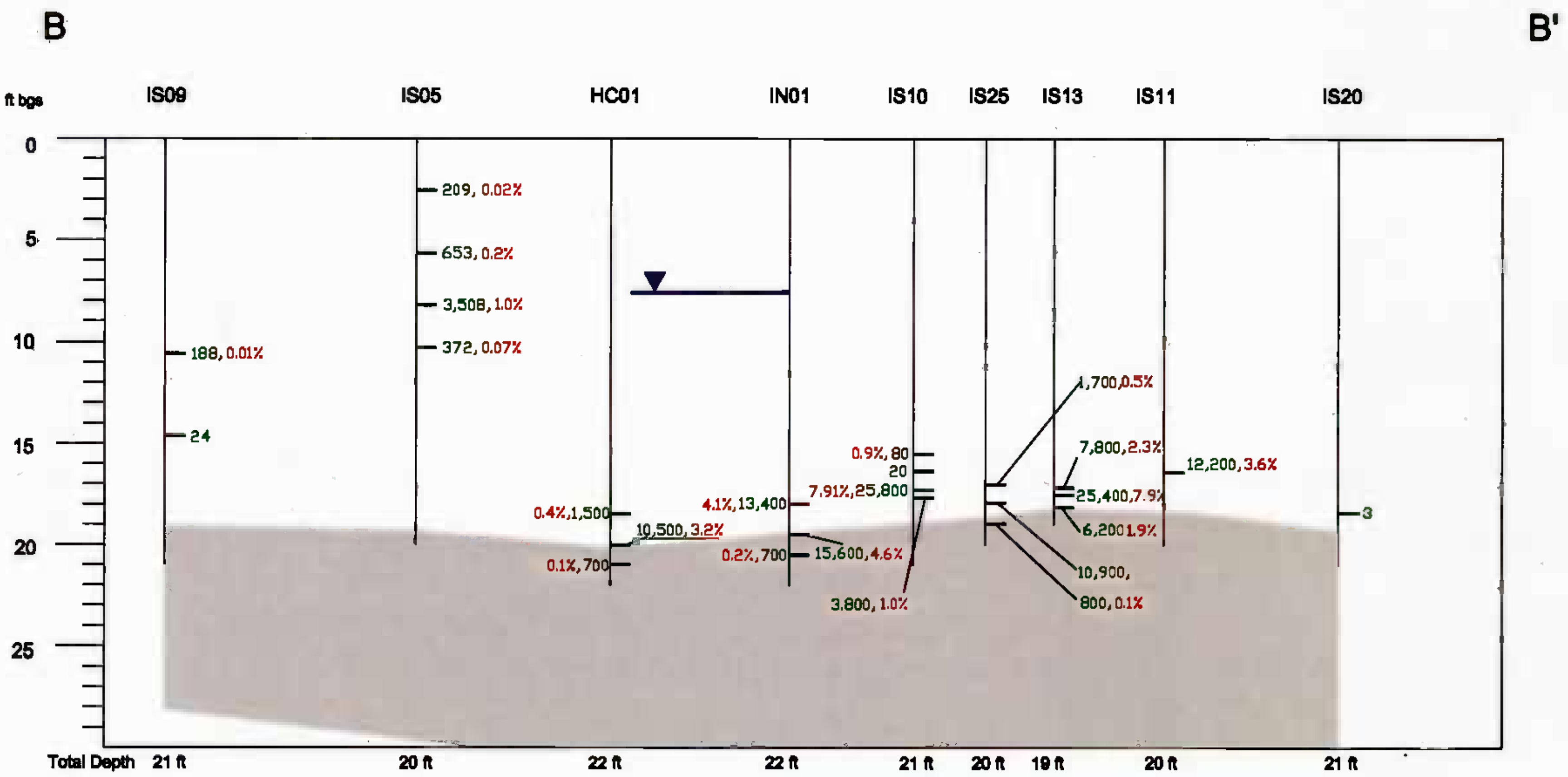

Legend

700 PCE concentration in mg/kg wet soil basis

0.1% DNAPL saturation expressed as percent of porosity

▼ Approximate Static Water Level

▨ Clay Aquitard: Aquitard thickness extends below bottom of figure except where shown otherwise.

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Cross Section B-B' with Soil PCE Concentrations and Estimated DNAPL Saturations

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Figure 3.5

Ground-water and source-water samples were collected from Site 88 on November 17, 1997 and were analyzed for major ion composition to characterize both waters for tracer and surfactant design considerations. Ground-water samples collected from wells RW01 and RW02, and a source-water sample collected from a potable water outlet inside Building 25 were shipped to Quanterra Inc., Knoxville, Tennessee for major anion and cation analyses. Major ion concentration data is summarized in Table 3.6. These analyses indicate that the ground water is probably anoxic because of the abundance of dissolved iron.

Table 3.6 Major Ion Concentrations in Ground-Water and Source-Water Samples

ION		Sample location		
		RW01	**RW02**	**Source Water**
Cations (mg/L)	*Aluminum*	0.28	0.33	0.20
	Calcium	15.7	15.1	26.9
	Iron	25.8	6.1	ND
	Potassium	ND	9.9	ND
	Magnesium	ND	5.3	ND
	Manganese	0.094	0.10	ND
	Sodium	19.7	30.9	9.0
	Zinc	0.023	.039	ND
Anions (mg/L)	*Chloride*	66.0	45.5	12.4
	Sulfate	16.1	46.7	5.4
Total Alkalinity (mg/L)		28.2	ND	63.9

ND = non detect

4.0 TEST ZONE WELL-FIELD INSTALLATION

4.1 Test Zone Wells and DNAPL Recovery Wells

The primary objective of this drilling program was to install the well field to be used in the PITT/SEAR demonstration. The goal was to locate the PITT/SEAR injection and extraction wells in the area with the highest known DNAPL saturations on the north side of Building 25. The test zone well-field location was chosen based on analysis of data obtained from reconnaissance soil borings completed during Phases 1 and 2 of the DNAPL source-zone investigations, as discussed in Section 3.0. Several recovery wells were also installed outside the test zone well field to provide a means of removing free-phase DNAPL from areas beyond the test zone wells. Numerical modeling was performed to optimize the well-field configuration (total number of wells and interwell distances), as discussed in Section 8.2.1.

A second objective was to collect soil samples during the well installations to determine DNAPL saturations in sediments collected from the well locations. All boreholes drilled during the well-field installation, along with all other boreholes and monitor points are shown on Figure 3.1. Soil borings at EX01, EX02, EX03, EX04, EX05, and EX06 were completed as extraction wells, and soil borings at IN01, IN02, and IN03 were completed as injection wells. HC01 and HC02 were completed as hydraulic control wells. RW01, RW02, RW03, RW04, and RW06 were completed as recovery wells, the primary purpose of which is to recover free-phase DNAPL, and a secondary purpose for use as monitor wells during the SEAR demonstration. Wells RW01 and RW02, the first two wells installed during the DNAPL investigations, were installed with a two-fold intent: (1) for aquifer testing in the DNAPL zone, and (2) for potential use as PITT wells. The final PITT design, however, precluded the use of RW01 and RW02 as PITT/SEAR wells due to their location. Well EX04R was installed as a replacement well for EX04, which was fouled during installation and not effective as an extraction well. Well MW10IW was installed within the test zone well field, screened in the Upper Portion of the Castle Hayne Aquifer as a monitor well for the surfactant flood. Also, two aquitard monitor points were installed adjacent to MW10IW in the clay layer during the surfactant flood. To summarize, the following well types have been installed at Site 88 that are related to the PITT/SEAR demonstration, and are shown in Figure 3.1:

Test Zone Wells:

• six extraction wells	EX01 to EX06
• one replacement extraction well	EX04R
• three injection wells	IN01 to IN03

• two hydraulic control wells	HC01 and HC02

Recovery Wells:

• five DNAPL recovery wells	RW01 to RW04, and RW06

Monitor Points/Wells:

• three multilevel samplers	MLS-1, MLS-2, and MLS-3
• two aquitard well points	WP01AQT and WP02AQT
• one Castle Hayne monitor well	MW10IW

4.2 Drilling Methods for Well-Field Installation

All of the well installations outside Building 25 were drilled with a six-inch ID hollow stem auger. Due to overhead limitations for drilling inside the building, wells installed inside Building 25 were drilled using a six-inch steel drive casing, an electric powered 300-pound hammer with telescopic tower, and a hand auger. After coring through the concrete floor inside the building, five-foot lengths of casing were driven into the soil beneath the concrete slab of Building 25. A hand auger was used to excavate the soils from within the casing until the water table was reached. Below the water table, the fine-grained sand and silt was removed from the borehole by injecting potable water into the casing, causing a slurry to spill out of the drive casing at the surface. This slurry was contained in a settling tank adapted to fit around the well casing to allow drill cuttings to settle out from the slurry. Drilling fluids were then transferred to a wastewater tanker for later treatment.

All equipment entering the borings and any tools used during the drilling process, including augers and samplers, were thoroughly decontaminated between borings using a heated pressure washer at a decontamination pad located near the northwest side of Building 25. All fluids resulting from decontamination of equipment were transferred to the wastewater tanker located on site. Contents of the tanker were periodically transferred by OHM personnel to the wastewater treatment plant operated by OHM on Base. Drill cuttings were segregated and contained in a roll-off bin for characterization by Baker for appropriate disposal.

4.3 Well Configuration and Construction

The well-field configuration and well construction details for the test zone well field and recovery wells are described in Section 4.3.1. Installation and construction details for three multilevel samplers, two aquitard monitor points, and a Castle Hayne Aquifer monitor well are described in Section 4.3.2. Tabulated well construction details and geologic logs for all wells are included in Appendix B.

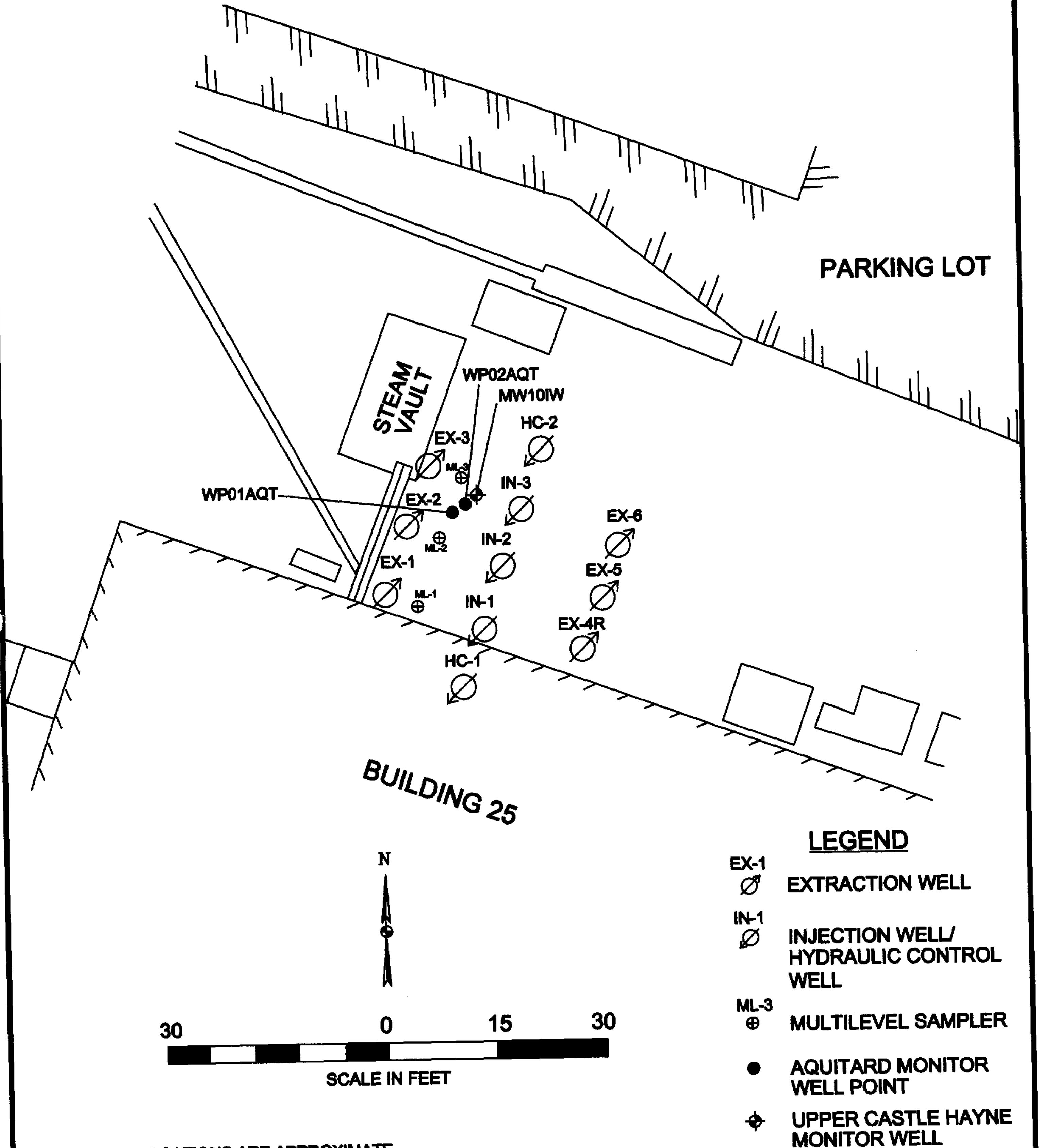
4.3.1 Test Zone Wells and Recovery Wells

The injection, extraction and hydraulic control wells installed for the demonstration were designed and built for their specific functions during the PITT. The following paragraphs provide a brief description of the configuration, construction and completion of these wells.

The test zone well array is shown in Figure 4.1. The injection and extraction wells are configured in a divergent-flow, line drive pattern to induce flow of the injected fluids bi-directionally, i.e., divergently, from the centrally located line of injection wells towards the two lines of extraction wells.

Schematics of general well construction details for the injection and extraction wells are shown in Figures 4.2 and 4.3, respectively. The injection, extraction and recovery wells installed have an inside diameter of four inches and were constructed with a combination of Schedule 40 PVC casing and five-foot long stainless steel wire-wrapped screen with 0.01-inch slots. Flush-threaded stainless steel sumps, approximately five inches long, were installed at the bottoms of the wells. The injection wells were installed with two, five-foot screened intervals per well, one at the bottom of the well and one spanning the water table. The recovery wells were also completed with two screens per well, except for wells RW01 and RW02, which were installed with a single screen per well during Phase 2 for aquifer testing. Extraction wells were installed with only one screened interval located at the bottom of each well. The hydraulic control wells installed have an inside diameter of two inches and were constructed with a similar combination of Schedule 40 PVC and stainless steel screen. The hydraulic control wells were also constructed with two screened intervals per well, one at the bottom of the well and one spanning the water table. A summary of well completion details is provided in Table 3.1 (in Section 3.0).

Sand filter packs were installed around all well screens using Drilling Service Inc (DSI) #1 sand, which is approximately equivalent to 20/40 sieved sand. The filter packs were installed to a minimum of one to two feet above the well screens, as determined by measuring to the top of the filter packs with a weighted tape measure. One to two feet of 1/4-inch bentonite pellets were placed on top of the sand pack and hydrated with potable water. The bentonite seal was allowed to hydrate for a minimum of two hours before well construction continued. Dual screen wells required two sand filter packs and two bentonite seals per well to provide hydraulic separation between the upper- and lower-screen intervals. Concrete grout was then pumped into the remainder of the well annulus above the uppermost bentonite seal. The cement grout mixture consisted of four 50-lb bags of Bonsal Type I cement and 1/4 bag of high yield bentonite with water mixed into a 55-gallon drum.



NOTE: WELL LOCATIONS ARE APPROXIMATE

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Location and Configuration of the Demonstration Well Array

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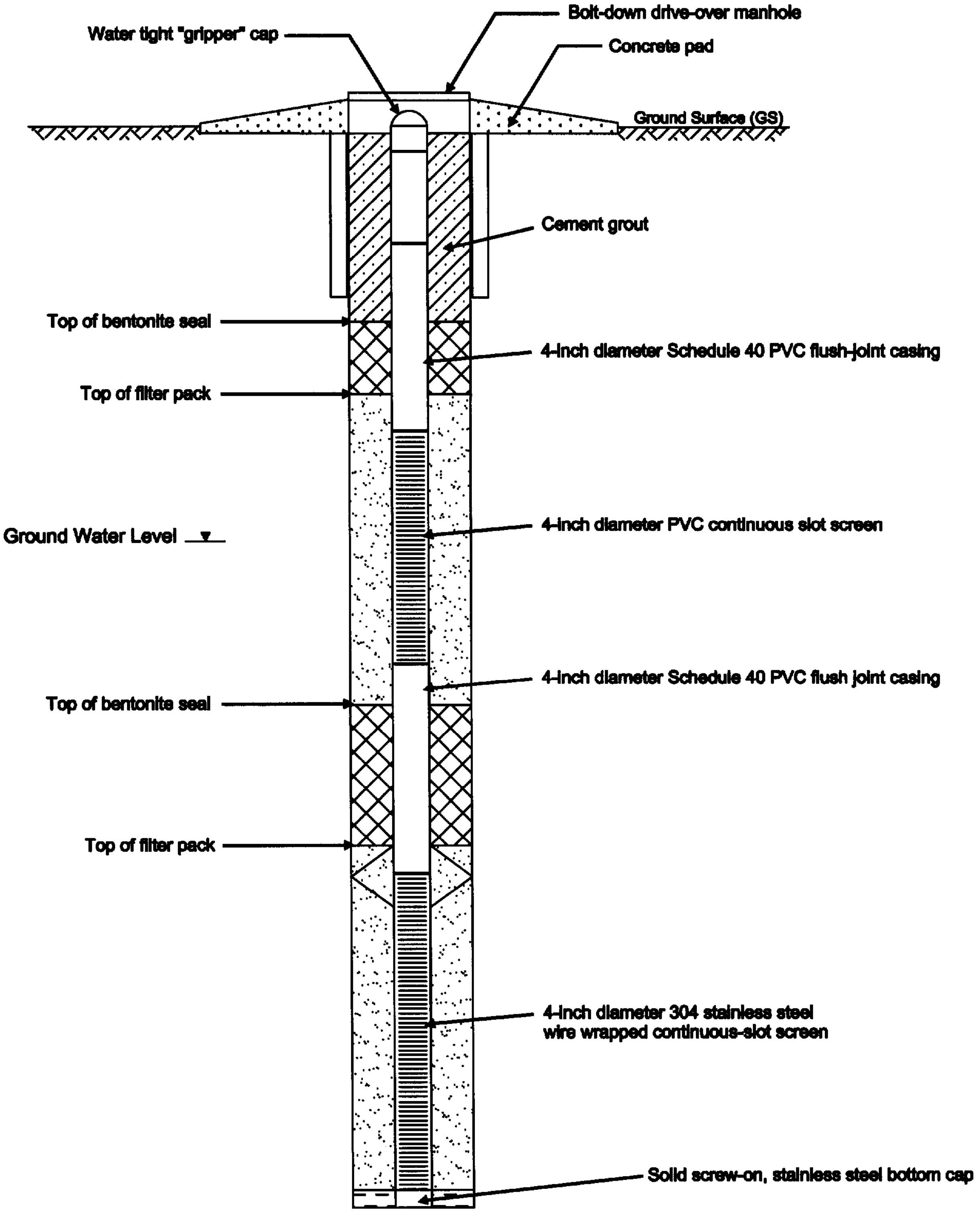
Figure 4.1



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Injection Well Construction Detail

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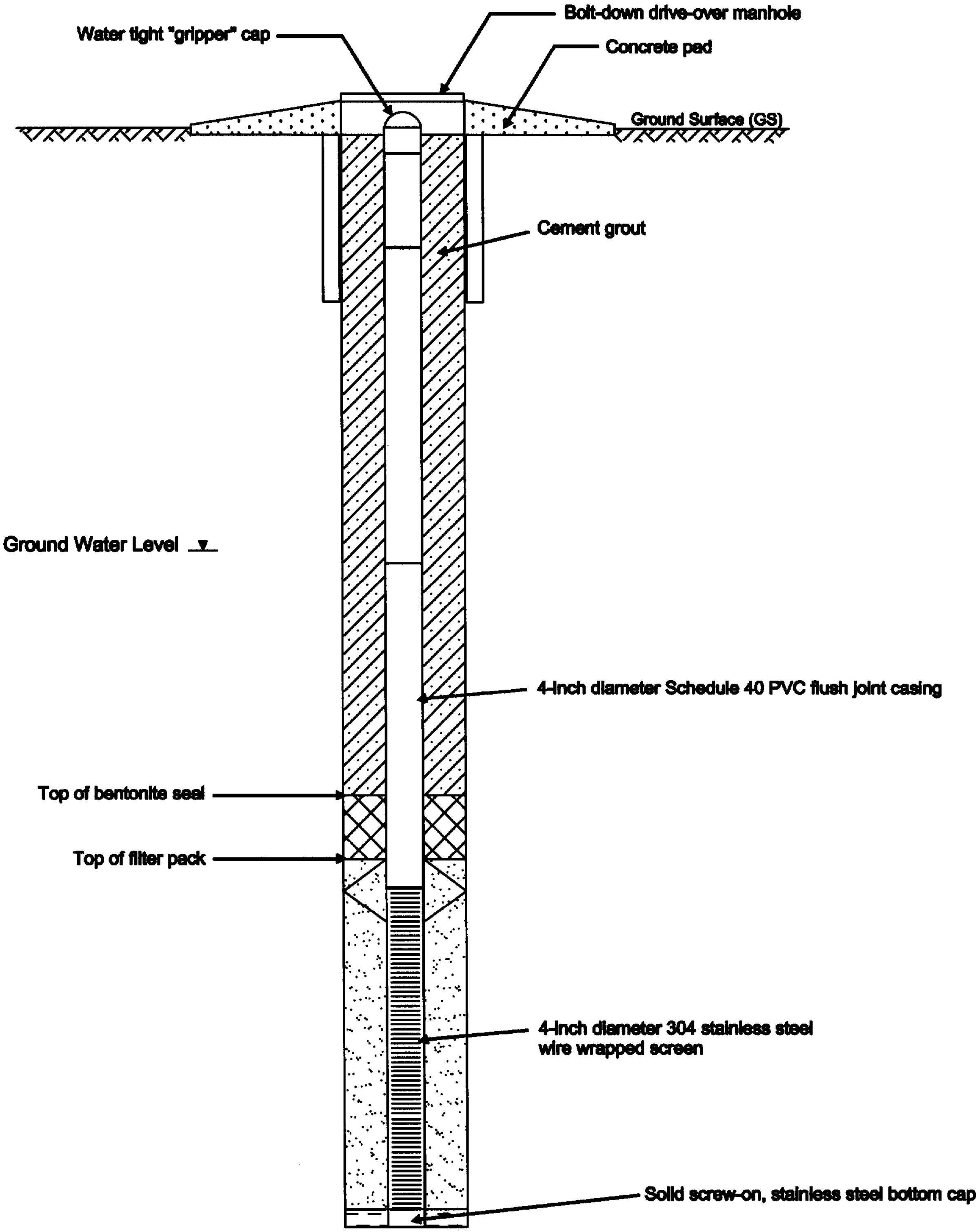
Figure 4.2



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Extraction Well Construction Detail

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Figure 4.3

Surface completions for all outside wells were constructed with two-foot square concrete pads and eight-inch flush mount covers. Surface completions for the wells inside Building 25 were constructed with six-inch flush mounted covers.

4.3.2 Multilevel Sampler Installations

Three multilevel samplers (MLS) were installed to monitor the interwell zone between the injection and extraction wells. Each MLS is located in-line between an injection and extraction well, approximately ten feet from the injection well and five feet from the extraction well. The MLS locations are shown in Figure 4.1, where MLS-1, MLS-2, and MLS-3 are located approximately five east of extraction wells EX01, EX02, and EX03, respectively.

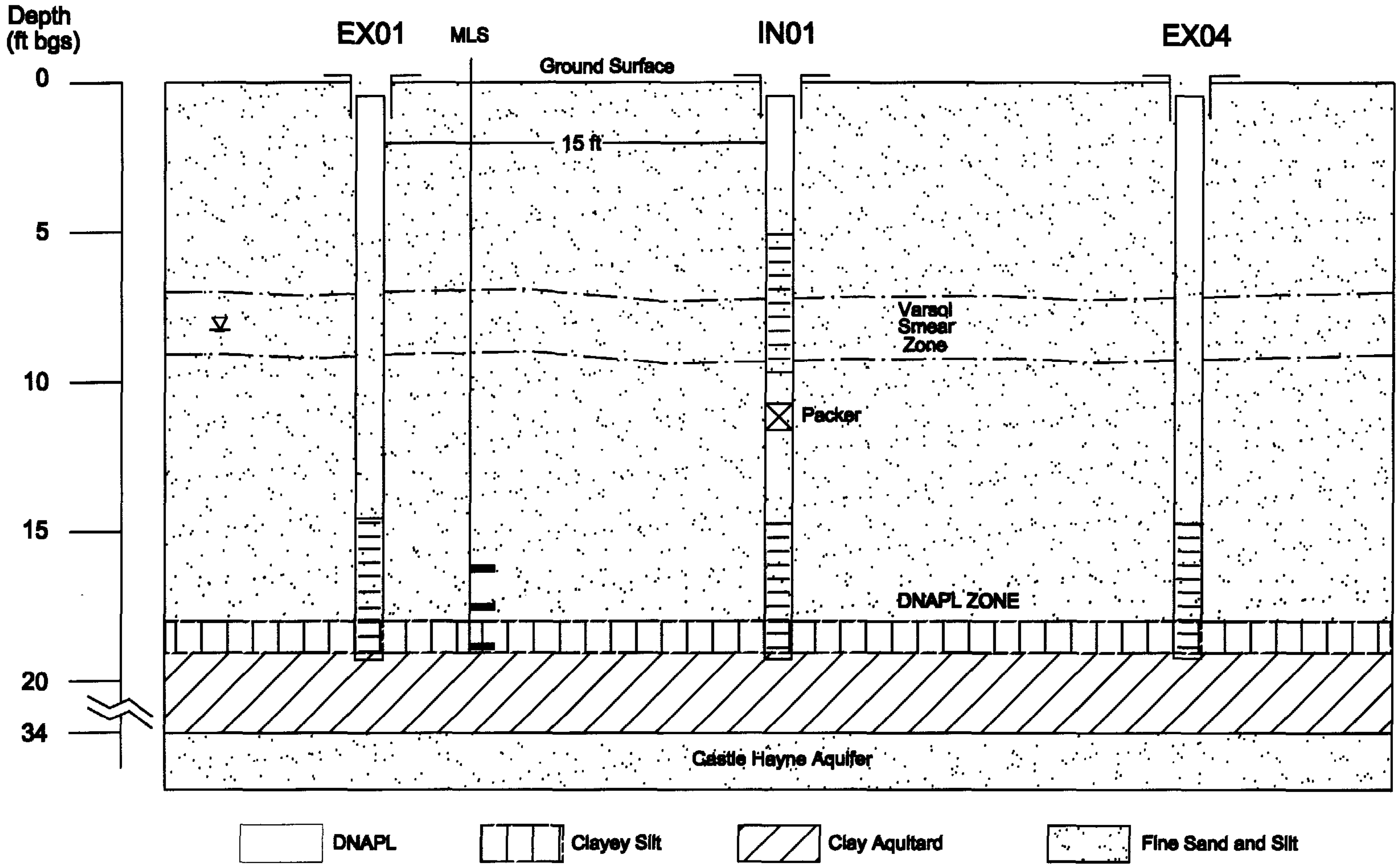
Each MLS has three discrete sampling points to monitor the PITT and SEAR tests relative to depth; the sampling points are installed to monitor the bottom three feet of the DNAPL zone at approximately 17, 18.5, and 20 ft bgs. Each MLS sampling point is constructed with a porous cup (similar to an air stone) at the bottom, with 1/8-inch diameter stainless steel tubing connecting the porous cup to the surface for sampling. An MLS is composed of a bundle of three sampling points, with 1.5 feet between sampling points, as described above.

Each MLS bundle was installed by using a drill rig to push a 1.75-inch ID drill rod, with a sacrificial point on the end, into the aquifer to the desired total depth. The drill rod then functioned as a small diameter "drill casing" to hold the borehole open while the MLS bundle was lowered through the casing to the bottom of the hole. Then the drill rod (casing) was pulled out of the hole, leaving the sacrificial point at the bottom and allowing the aquifer to close in around the MLS sampling points. The upper portion of the borehole (which did not close), from approximately 8 ft bgs to the surface, was sealed with bentonite chips.

The bottom sampling point of each MLS bundle was installed approximately six inches above the clay aquitard, in the basal silt layer. The other two sampling points were installed above this, in the overlying fine sand and also in the transition zone between the basal silt and the overlying fine sand. The depth configuration of the MLS sampling points is shown in Figure 4.4, in the generalized cross section of the Site 88 geosystem.

4.3.3 Castle Hayne and Aquitard Monitor Points

After the PITT was completed, three additional monitor points were installed to prepare the SEAR demonstration area for the surfactant flood. Two well points were installed into the clay layer, and one well was installed into the Upper Portion of the Castle Hayne Aquifer to monitor for possible downward migration of surfactant fluids into the aquitard or into the Upper Portion of the Castle Hayne Aquifer during the upcoming surfactant flood.



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Generalized Geosystem Cross Section of DNAPL Zone at Site 88

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Figure 4.4

The aquitard well points, WP01AQT and WP02AQT, were constructed with Geoprobe implant screens that are pushed into the ground with a Geoprobe drive casing and a sacrificial drive point at the bottom. Each well point consists of a small screen, approximately 0.5-inch diameter X 12-inches long, which is connected to the surface with 0.25-inch diameter Teflon®-lined plastic tubing. The well points were installed through a three-inch diameter steel pipe which was pushed into the approximately 1.5-2 feet clay aquitard as a surface casing for the well-point installations.

The Castle Hayne monitor well, MW10IW, was also completed through a surface casing. The surface casing was installed through the shallow aquifer and sealed at the upper surface of the clay aquitard with bentonite and grout to protect from potential downward migration of contaminants via the well installation. The well was completed with a five-foot screen length into the Upper Portion of the Castle Hayne Aquifer, just below the lower contact of the clay aquitard.

4.4 Well Development

After all the wells had been installed, a minimum of 24 hours was allowed to pass before each well was developed. To develop each well, a surge block was used to force water across consecutive 1.5-foot sections of the well screen and filter pack. A Watera pump was used to periodically evacuate the wellbore of sediment-laden ground water. The progress of the development effort was monitored by observing the amount of sediment in the purge water and measuring the pH, conductivity, and temperature of water samples collected from the Watera pump after each borehole volume of water was removed from the well.

A well was considered to be developed when at least three borehole volumes had been removed from the well, the purge water was relatively free of sediment, and the pH, conductivity, and temperature had stabilized to within 10% of the previous set of readings. The water produced at each well during development was collected in 55-gallon drums, and then transferred into the onsite wastewater tanker.

5.0 SITE GEOSYSTEM

After all the data from the DNAPL investigations was evaluated, it was compiled and interpreted to construct the site geosystem. The site geosystem is the basis of the model used for PITT design simulations with UTCHEM.

The geosystem is primarily composed of, but not limited to, the following site-specific properties:

- physical and chemical properties of the aquifer (hydrostratigraphy, permeability, and mineralogy);
- ground-water chemistry of the aquifer (organic and inorganic solutes);
- physical properties of the capillary barrier (aquitard); and
- physical and chemical properties of the DNAPL: density, viscosity, interfacial tension, chemical composition, and spatial distribution of the DNAPL.

The geosystem of the test zone at Site 88 is described below.

The test zone is in a shallow unconfined aquifer. This aquifer is bound at its base in the demonstration area by a clay layer of variable thickness that separates it from the underlying Castle Hayne Aquifer. The sediments of the shallow aquifer consist of fine to very-fine sands, grading with depth into a clayey-sandy silt directly overlying the clay layer. The top of the clay layer is found at a depth of approximately 19 to 20 ft bgs. Since the depth to water in the shallow aquifer is approximately 8 ft, the saturated thickness of the aquifer is on the order of 11 to 12 ft. The results of a short-term constant rate pumping test, discussed in Section 3.2, show the average hydraulic conductivity of the aquifer to be $5x10^{-4}$ cm/sec (1.4 ft/day). Results from MLS samples collected during the PITT show that the hydraulic conductivity of the basal clayey-sandy silt is lower than that of the overlying fine sands by a factor of approximately four. This implies a hydraulic conductivity of $1x10^{-4}$ cm/sec (0.4 ft/day) for the basal silt layer.

Two soil samples were collected at soil boring IS-25 for analysis by x-ray diffraction to determine mineral percentages of the shallow aquifer. The samples, collected at depths of 17.2 and 19.1 ft bgs, show very similar mineralogy. Both samples were greater than 80% quartz with some feldspar and pyrite. Clay minerals comprised 7% and 9% of the samples respectively with kaolinite, illite, chlorite, and smectite all represented. The XRD analyses were performed by PTS Laboratories, Houston, Texas; the laboratory report is included in Appendix E.

The characterization of organic and inorganic solutes in the site geosystem are discussed in Section 3.3, but are summarized as follows. The organic solutes are predominately PCE, which is reported as high as 170 mg/L in the test zone (Table 3.5). With respect to inorganic solutes, the ground water is characterized as having low total dissolved solids, ranging from about 160 to 170 mg/L, based on the major ions reported in Table 3.6.

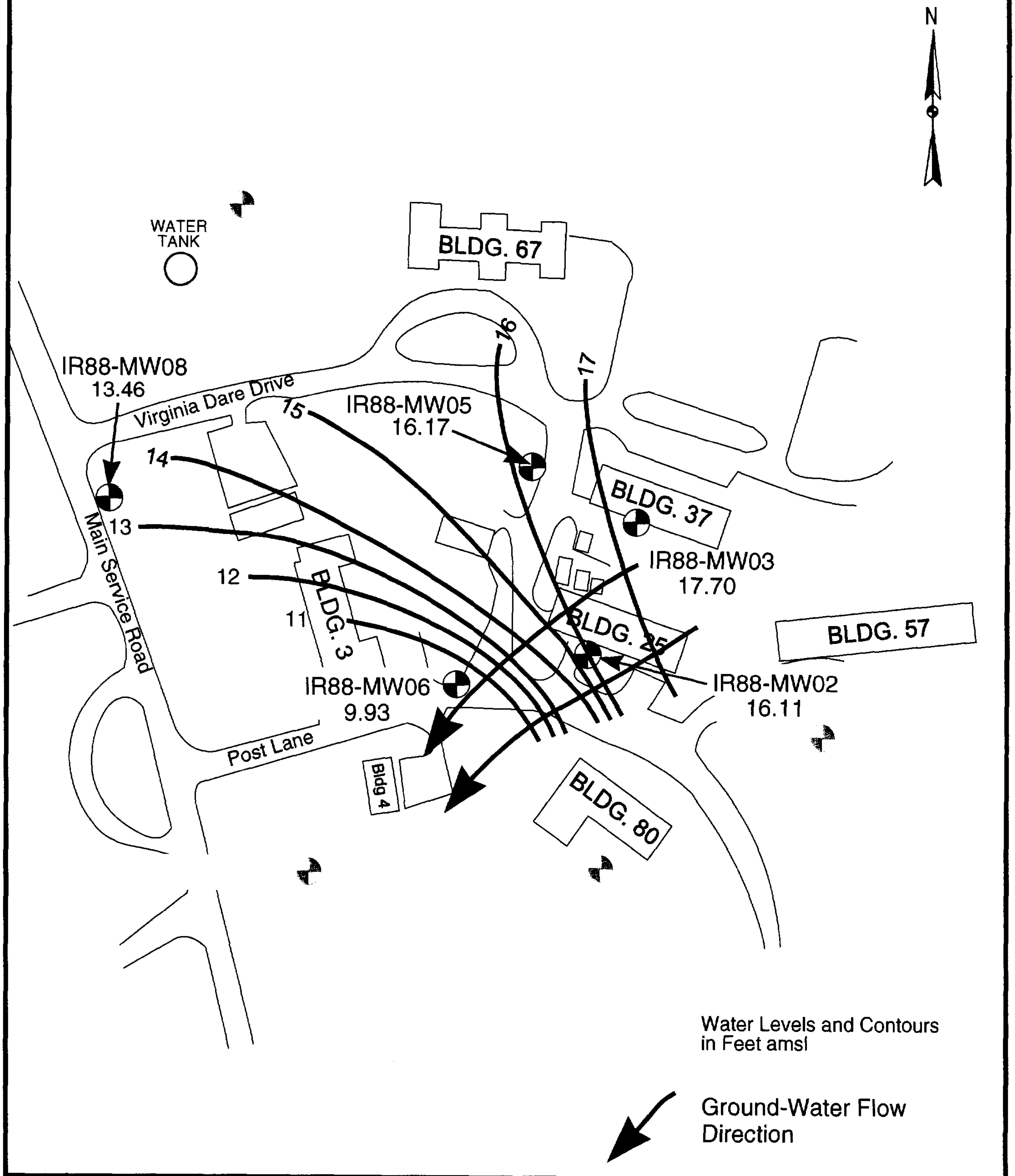
Ground-water flow in the shallow aquifer in the vicinity of the PITT/SEAR demonstration area is generally to the southwest, as shown in Figure 5.1. The figure shows that the ground-water gradient is relatively low in the immediate area of the demonstration but increases to the southwest.

The underlying Castle Hayne Aquifer is confined in the immediate area of the investigation. Ground-water levels in the Upper Portion of the Castle Hayne are on the order of seven feet lower than those in the shallow aquifer, producing a vertical hydraulic gradient across the clay layer separating them. Wells completed in the vicinity of the demonstration area show that the sediments of the Upper Portion of the Castle Hayne Aquifer are fine to medium sands. The Castle Hayne Aquifer is used as a regional source of potable water.

One of the primary concerns in a DNAPL-contaminated field site is the vertical migration of the DNAPL. Such vertical migration is usually arrested by the presence of clay aquitards, which have much lower permeabilities than the aquifer materials. The lower permeabilities impart a greater ability to resist further invasion and migration of DNAPL. This also accounts for the pooling of DNAPL at greater than residual saturations above formations with low permeabilities, i.e., a capillary trap. The ability of an aquitard to prevent entry and downward flow of DNAPL is determined by the pore size distribution of the medium, the head of DNAPL on the aquitard, and the wetting nature of the mineral surfaces in contact with the DNAPL.

The clay layer separating the shallow aquifer from the Castle Hayne Aquifer is variable in thickness. Figure 5.2 shows the elevation of the top of the clay layer, as determined from soil cores and cone penetrometer logs. The dominant feature to be noted on the figure is the depression in the clay surface. It is this depression in which the PCE DNAPL has accumulated.

A number of cone penetrometer pushes were completed through the clay layer to determine the aquitard thickness. These pushes were located outside the area of known residual- and free-phase DNAPL contamination as determined by detailed soil sample collection and analysis. This information was combined with soil logging data to establish the depth to the bottom of the clay layer and hence its total thickness. Figure 5.3 shows the total thickness of the aquitard, which is greater than 12 ft thick in the demonstration area. However, it does decrease in thickness significantly to the southwest.



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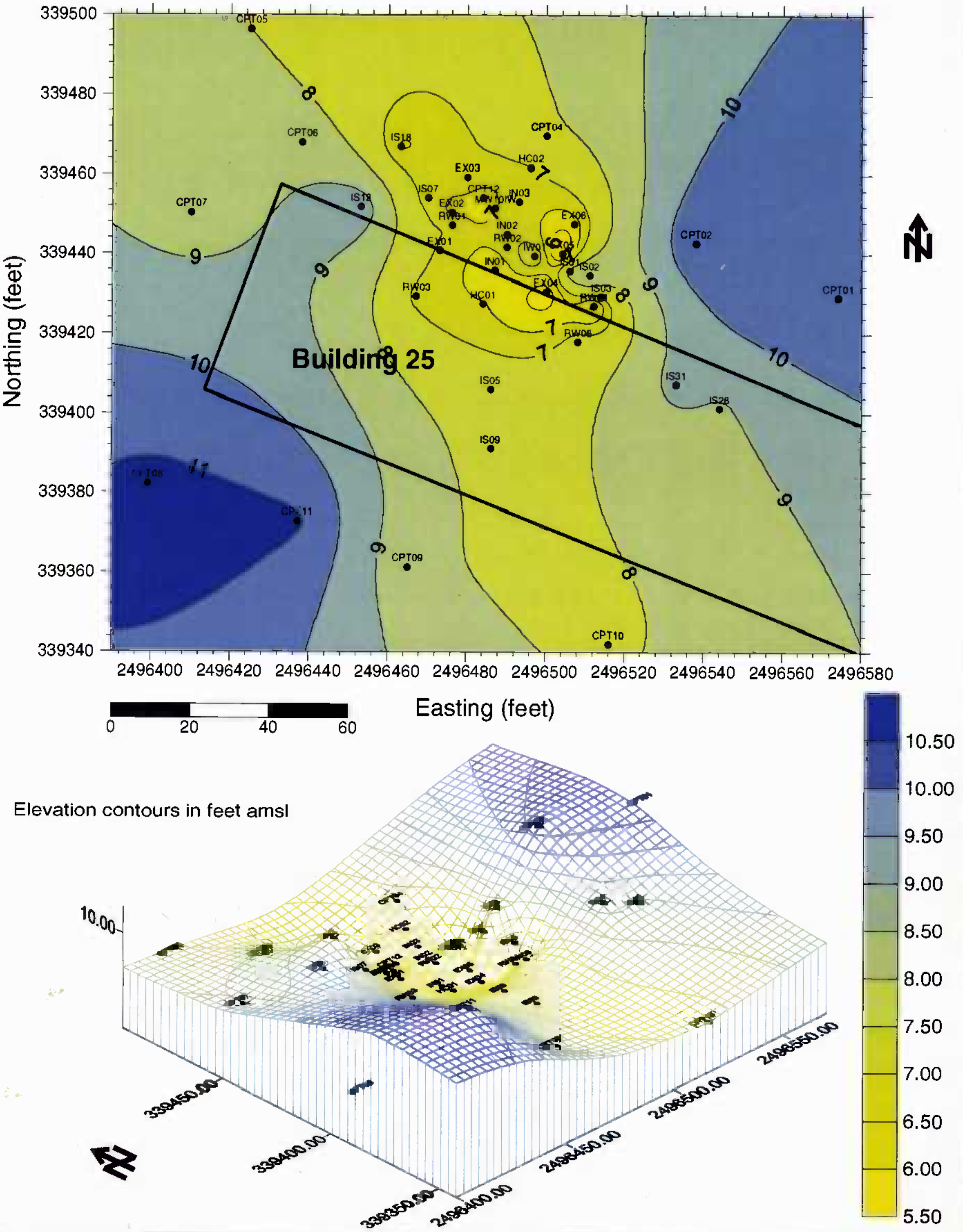
Water Level Elevation in the Shallow Aquifer

Water levels measured 9/16/97

MCB Camp Lejeune, NC

Figure 5.1



Date: 07/23/99	MCB Camp Lejeune, NC	FIGURE 5.2
Produced By: KJS Checked By: FJH File Name: CLAY-T.SRF	**Upper Surface of Clay Aquitard Beneath Building 25**	Duke Engineering & Services A Duke Energy Company

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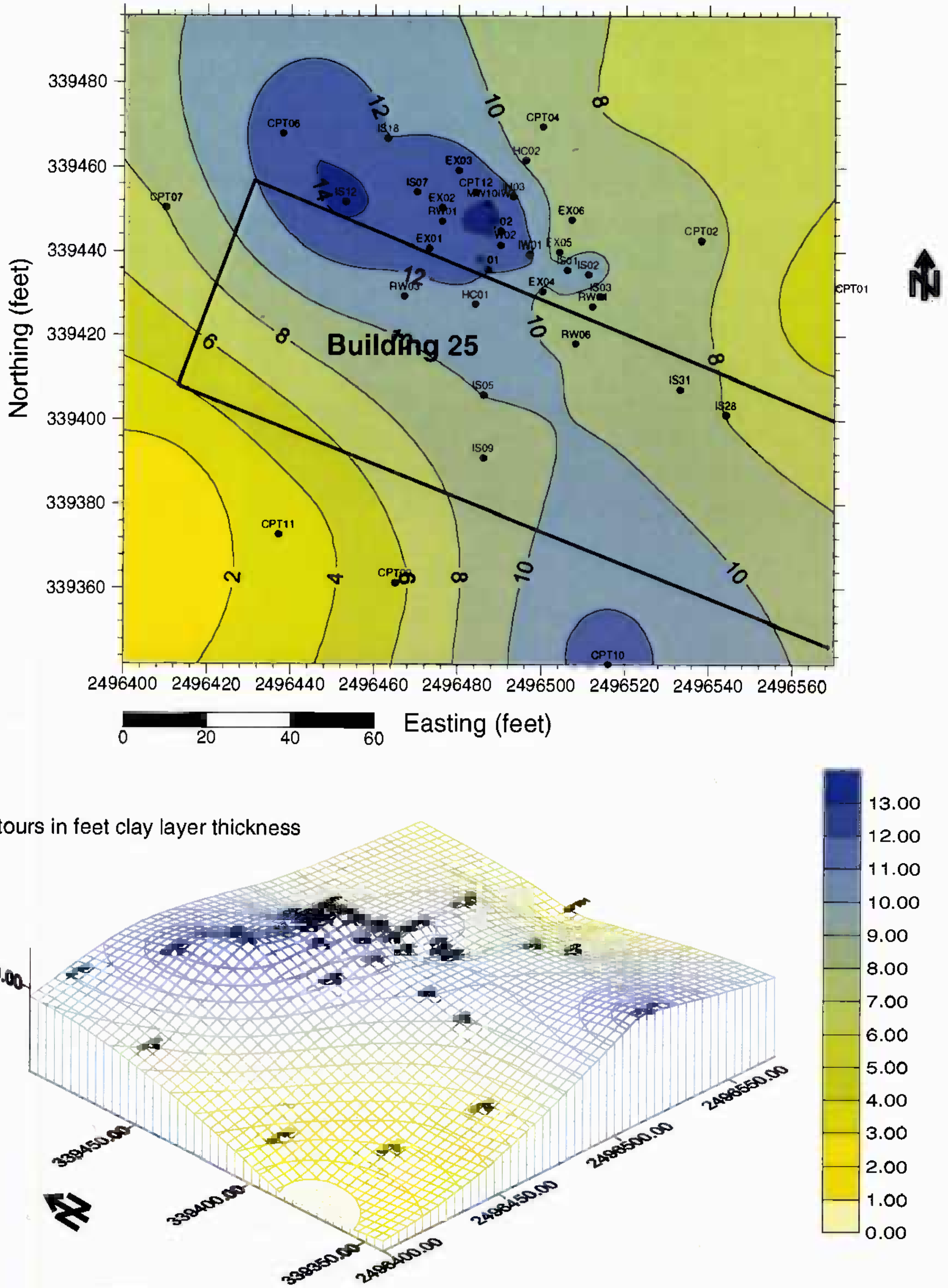

Date: 07/23/99	MCB Camp Lejeune, NC
Produced By: KJS	**Total Thickness of Clay Aquitard Beneath Building 25**
Checked By: FJH	
File Name: CLAY_T-B.SRF	

FIGURE 5.3

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Samples of the clay layer were collected and submitted for vertical hydraulic conductivity, porosity, and capillary pressure testing. Samples from two boring locations were submitted to PTS Laboratories in Houston, Texas for vertical hydraulic testing; IS22-06 at 21 ft bgs and IS23-04 at 19.5 ft bgs. The averaged results show a vertical hydraulic conductivity for the clay layer of 2.0 x 10^{-7} cm/sec (5.6 x 10^{-4} ft/day) which compares favorably with the 1.0 x 10^{-4} ft/day reported in the RI (Baker, 1998a).

Clay samples from the boring at well IN01 were submitted to TerraTek, Salt Lake City, Utah for porosity and capillary pressure tests. The measured porosity for the IN01 sample at 21.1 ft bgs was 49.6%. The results of the capillary pressure experiment for the IN01 sample at 21.0 ft bgs show that the aquitard is an effective capillary barrier that can support up to 20 ft (6 m) of PCE-DNAPL while allowing negligible DNAPL penetration.

For further details, see Appendix I, which includes a discussion of capillary effects at DNAPL sites, data analysis and interpretation of the capillary pressure test, and laboratory reports for the vertical hydraulic conductivity, porosity, and capillary pressure tests.

5.1 DNAPL Distribution

More than 100 soil samples were collected during the investigative phase and analyzed for the presence of VOCs. These samples were preserved in methanol in the field to minimize losses through volatilization. The results of the soil core VOC and NAPLANAL analysis, as presented in Section 3, reveal trends in the vertical and horizontal distribution of DNAPL. The majority of the DNAPL was at depths greater than 15 ft bgs. The results also indicate that once encountered, DNAPL saturations increase with depth until the clay layer (aquitard) is encountered. DNAPL saturations are generally greatest just above the aquifer/aquitard interface and along the top of the clay layer. Samples collected deeper in the clay exhibit a sharp decline to non-detect with depth. This supports the assumption that the clay layer is acting as a capillary barrier, effectively restricting the downward migration of PCE. The occurrence of DNAPL and Varsol™ in the test zone is shown in Figure 4.4, a generalized cross section of the geosystem.

The data is consistent with a scenario in which the DNAPL migrated laterally into the test zone along the sloping surface of an aquitard from a limited number of vertical migration pathways bringing the DNAPL down from the entry location to the aquitard. DNAPL that migrated into the test zone in this way would be encountered near the aquifer/aquitard interface with little or no DNAPL found higher in the shallow aquifer. The vertical migration pathways are likely beneath the building, outside the test zone.

6.0 FREE-PHASE DNAPL RECOVERY AT SITE 88

Free-phase DNAPL has been observed in a number of the wells installed at Site 88 during the DNAPL source-zone investigations. Recall from Section 1.2 that *free-phase* DNAPL is defined as DNAPL existing in the subsurface under a positive pressure such that it can flow into a well. In contrast, *residual* DNAPL occurs at a lower DNAPL saturation as disconnected ganglia that are held in the pore spaces by capillary forces. Residual DNAPL is not free to flow into a well. Free-phase DNAPL accumulation should be removed, to the extent possible, from the test zone before conducting a PITT in order to improve the accuracy of the PITT. PITTs are designed to measure the volume and saturation of residual DNAPL in the test zone and the presence of free-phase DNAPL reduces their accuracy (see Jin et al., 1997).

Table 6.1 lists the wells that have produced free-phase DNAPL and the approximate depth to the DNAPL/water interface in each well before DNAPL recovery operations were initiated. Plots of the DNAPL/water interface elevations during all field activities can be found in Appendix J.

Table 6.1 DNAPL Levels in Wells at Site 88

Well	Depth to DNAPL (ft BTOC)	DNAPL Elevation (ft amsl)	Approx. DNAPL Thickness (ft above top of clay)
EX01	17.1	8.5	1.6
EX02	20.2	5.4	> 0.3 *
IN01	19.4	6.3	0.3
HC01	21.0	5.4	> 0.3 *
RW01	18.6	6.6	> 0.3 *
RW02	18.2	7.2	0.5
RW04	17.2	8.6	2.8
RW06	16.8	9.7	2.3

* DNAPL was consistently present in these wells, but the measured elevation of the water/DNAPL interface was equal to or less than the estimated elevation of the clay aquitard. It is not believed that the water/DNAPL interface is actually below the clay aquitard. The discrepancy is expected to lie in the soil coring and logging process. When soil cores are retrieved from a borehole for geologic logging (e.g. to determine the depth to clay), the recorded core depth for a given sample has a typical error of approximately ±0.3 ft bgs, and in some cases the error may be greater when sample recovery is less than 100%. Some error may also be associated with geologic interpretation.

In February 1998, a DNAPL recovery system was installed to remove as much free-phase DNAPL as possible from the test zone by pumping. Wells EX01, IN01, HC01, RW01, RW04, and RW06 were used as DNAPL recovery wells. The DNAPL recovery process was conducted in two stages. The first stage involved preliminary pumping of

DNAPL that had accumulated in the recovery wells with a peristaltic pump. This process began on February 18 and concluded on February 20.

A second stage of the DNAPL recovery process started immediately after completing the first stage and terminated in late March. It was conducted by pumping the six DNAPL recovery wells listed above simultaneously in order to create a hydraulic gradient, which would help to induce the free-phase DNAPL to flow to the recovery wells. The pumped fluids were composed primarily of contaminated ground water along with a much smaller component of DNAPL. The recovered wastewater/DNAPL was then transferred to the waste tanker on site. The pumping rate was controlled by keeping drawdown in the wells to a maximum of about four feet. The combined total flow from the six recovery wells to the tanker during recovery operations was approximately 1.3 gpm.

Attempts to quantify the volume of recovered DNAPL were generally unsuccessful. An interface probe was unsuccessful in measuring the depth of accumulated DNAPL in the bottom of the wastewater tanker; this was probably because the DNAPL levels in the bottom of the 8,800 gallon tanker were too shallow to be measured. Grab samples of effluent from the recovery wells were also collected in an attempt to volumetrically quantify the DNAPL recovery rate. Several five-gallon grab samples indicated that the effluent contained on average about 0.2% DNAPL and 99.8% ground water. However, modeling of DNAPL recovery under the site hydraulic conditions showed that DNAPL recovery could be expected to decrease over time; therefore, this method of measurement was not considered worthwhile due to the low, decreasing rates of DNAPL recovery.

Free-phase DNAPL recovery activities continued under water-flooding conditions (i.e., simultaneous injection and extraction operations) for 14 days during the CITT (April 15-28, 1998) and for 40 days during the PITT (May 13-June 22, 1998). During these periods, source water with 1000 mg/L $CaCl_2$ was injected continuously into IN01, IN02, IN03, HC01, and HC02, along with KBr as a tracer during the beginning of the CITT and alcohol tracers during the beginning of the PITT. Pumping was from the six extraction wells (EX01 to EX06), and there was no pumping from RW04 and RW06. CITT and PITT operations are discussed in detail in Sections 9 and 10.

It is believed that the total amount of DNAPL recovered at Site 88 is probably in the range of tens of gallons; about 30 to 60 gallons of DNAPL recovery is likely, and probably less than 100 gallons. The low permeability of the shallow aquifer greatly limits the rate at which free-phase DNAPL can be recovered by pumping. However, both free-phase and residual-phase DNAPL can be recovered by SEAR, i.e., their solubilization within a microemulsion formed by a surfactant-alcohol micelle and the solubilized DNAPL (Pope and Wade, 1995). This is the objective of the surfactant flood to be undertaken by the ESTCP team at Site 88 in 1999.

7.0 LABORATORY STUDIES AND TRACER SELECTION

7.1 Laboratory Scale Studies

This section of the report discusses the results from laboratory studies to measure the preliminary properties of the Camp Lejeune DNAPL and to select partitioning tracers for the PITT. All laboratory DNAPL studies discussed below were conducted with a DNAPL sample collected from well RW02, on August 22, 1997.

7.1.1 Preliminary Laboratory Studies

The preliminary studies focused on determining the physical properties of the DNAPL. These were necessary not only for the identification of DNAPL constituents, but also for the selection of tracers and surfactants. The density of the DNAPL was measured using a pycnometer; the procedure is included in Appendix K. This measurement was done three times to ensure repeatability. The density of the field DNAPL sample from Site 88 was 1.588 g/cm^3. This is very close to the density of pure PCE (1.63 g/cm^3) which suggests that the DNAPL contained a small fraction of dissolved mineral oils and grease.

The viscosity of the DNAPL was measured using a Contraves low shear viscometer. The measurement of the viscosity of deionized water was used as a means for ensuring quality control. The measured viscosities of the Camp Lejeune DNAPL sample varied between 0.85 centipoise and 1.10 centipoise between shear rates of 0.01 sec^{-1} and 128 sec^{-1}. The viscosity of deionized water under similar conditions was measured at 0.9 centipoise, which agrees with the value reported in the literature.

A spinning drop tensiometer (Cayais et al., 1975) was used to measure the interfacial tension (IFT) between the Site 88 DNAPL and water. This instrument has been used extensively by the petroleum industry to measure IFTs down to 10^{-3} dyne/cm. The IFT between the Site 88 DNAPL and water was measured at 10.36 dynes/cm. This is much lower that the IFT between PCE and water of 47.48 dynes/cm (Demond and Lindner 1993). This suggests that the DNAPL may have dissolved surface/active agents which bring about a lowering in the IFT, or that the low IFT is caused by the solubilized oil and grease noted above.

7.2 Partitioning Tracer Selection

When selecting PITT tracers for field applications, there are a number of tracer performance criteria that must be met. These include:

- Environmental acceptability

- Chemical and biological stability
- Insensitivity to small variations in the composition of the DNAPL
- Low detection limits
- Cost effectiveness
- Reasonable market availability

Aliphatic alcohols fulfill all the above performance criteria and are commonly used by DE&S as partitioning tracers. Theoretically, only two tracers, one nonpartitioning and one partitioning, are required for an interwell test. In practice, however, a suite of tracers with different partition coefficients is used to improve the accuracy of the tracer test results. This is especially true when there is a large range of uncertainty in the quantity and distribution of the DNAPL in the pore space to be swept by the test, because the partition coefficient of each alcohol effectively controls how fast that tracer moves across the test zone in the presence of DNAPL. If the residual saturation is known to be relatively high, tracers with smaller partition coefficients are sufficient, and it is not mandatory to continue the test to obtain the response curves for the tracers with larger partition coefficients. If the residual saturation is lower than expected, the tracers with larger partition coefficients can ensure good separation of the tracer response curves, thereby giving a better estimate of DNAPL saturation. Aliphatic alcohols fulfill these criteria and have been used in several PITTs (Jin, 1997a, b; Young et al., 1999; Annable et al., 1998).

This section of the report presents the results of partition coefficient measurements conducted to identify the partitioning tracers required for the PITT at Site 88. The objective of these experiments was to determine the partition coefficients of the alcohol partitioning tracers between the Site 88 DNAPL and water. This section also contains the results of a series of soil column partitioning tracer experiments designed to evaluate the performance of each of these candidate partitioning tracers in both contaminated and uncontaminated aquifer sediment from Site 88.

7.2.1 Measurement of Static Partition Coefficients

The individual tracers in the PITT tracer suite are chosen on the basis of their partition coefficients given the travel time through the swept pore space during a PITT. The partition coefficients of the tracers chosen for a PITT should result in a retardation factor of between 1.2 and 4.0 to obtain good separation of the nonpartitioning and partitioning tracers for a reasonable test duration (Jin et al., 1995). Previous site investigations in the source area indicate that DNAPL is mainly present on top of the capillary barrier at the base of the shallow aquifer. Therefore, tracers with larger partition coefficients were needed for DNAPL estimation since much of the injected tracer will flow through the uncontaminated sediment above the DNAPL and be relatively unaffected by the presence of the DNAPL. Static or batch partition coefficient experiments were conducted with the DNAPL sample from Site 88 and a total of six aliphatic alcohols were selected. Some experiments were also conducted with stock PCE to ensure quality control of the experimental measurements. This was done to ensure that tracers with an acceptably wide range of partition coefficients were identified for use in the PITT.

The accurate measurement of tracer partition coefficients is critical for the success of a PITT. The partition coefficient (K_i) for a tracer 'i' is defined as:

$$K_i = \frac{C_{i,DNAPL}}{C_{i,water}} \qquad (7.2.1\text{-}1)$$

where:

$C_{i,DNAPL}$ = equilibrium concentration of the tracer 'i' in the DNAPL (mg/L)
$C_{i,water}$ = equilibrium concentration of the tracer 'i' in the aqueous phase (mg/L)

The accuracy of the experimental measurements was checked by using the equivalent alkaline carbon number (EACN) approach, developed by Dwarakanath and Pope (1998) to estimate partition coefficients. Both the measured and estimated static partition coefficients are presented in Table 7.1. A close match between the measured and predicted static partition coefficients is observed, within the experimental uncertainty, suggesting that the accuracy of the partition coefficient measurements was acceptable.

Table 7.1 Partition Coefficients of Alcohols with Camp Lejeune Site 88 DNAPL

Alcohol	Measured Partition Coefficient	% Uncertainty	Estimated Partition Coefficient
1-Methanol	0.0	--	0.1
1-Propanol	0.0	--	0.1
4-Methyl-2-Pentanol	4.2	3.8	4.4
1-Hexanol	8.1	3.6	7.6
2-Ethyl-1-Butanol	6.0	3.9	5.7
5-Methyl-2-Hexanol	24.1	8.7	24.4
1-Heptanol	35.0	9.3	34.5
2-Ethyl-1-Hexanol	115	2.6	115

7.2.3 Soil Column Experiments

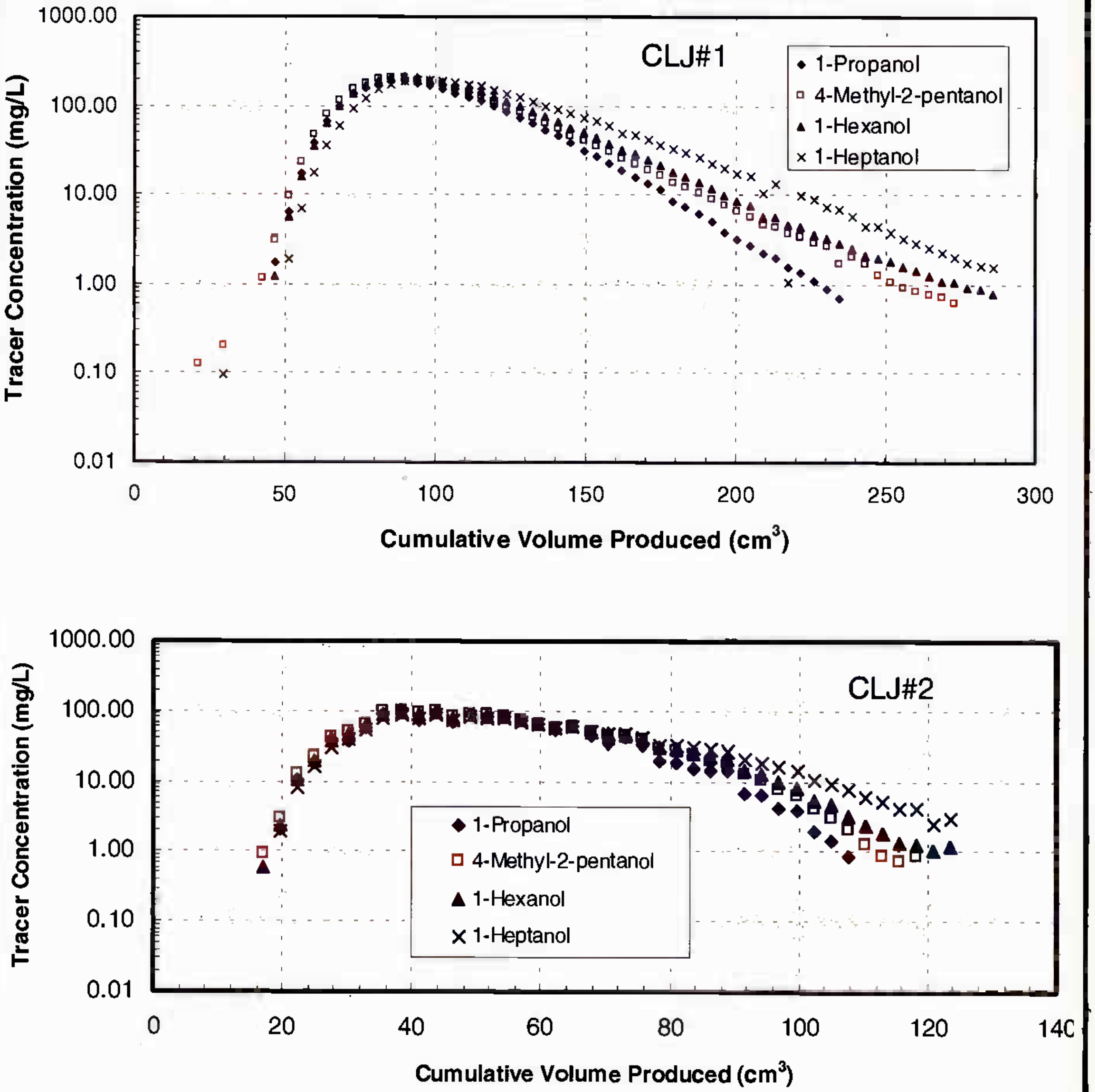
Once the partition coefficients of several candidate partitioning tracers were identified using the static partition coefficient experiments, their behavior in the presence of Site 88 soil and DNAPL was evaluated under dynamic conditions in soil column experiments. The approach used was to first conduct partitioning tracer experiments in columns containing uncontaminated shallow aquifer material from the test site at Camp Lejeune. In these experiments 1-propanol was used as the conservative tracer. The relative retardation of the partitioning tracers with respect to 1-propanol was measured and the apparent DNAPL saturation caused by tracer sorption was estimated. Partitioning tracer experiments were then conducted in columns with a known volume of DNAPL to determine their ability to accurately estimate the volume of DNAPL under dynamic conditions in the presence of Site 88 aquifer sediments. Two column experiments in uncontaminated Site 88 sediments and two column experiments in DNAPL-contaminated sediments were conducted to evaluate the performance of the partitioning tracers. The experimental procedures followed for the soil column experiments are presented in Appendix K, as well as the techniques used to analyze the data from the experiments. The results obtained from the soil column experiments are presented below.

7.3 Results from Soil Column Experiments

This section discusses the results from laboratory partitioning tracer experiments in both contaminated and uncontaminated aquifer sediments from Site 88, and discusses the implications of these results in the analysis and interpretation of field partitioning tracer data.

7.3.1 Partitioning Tracers in Uncontaminated Soil

Partitioning tracer experiments were conducted in uncontaminated soil in columns CLJ#1 and CLJ#2. The main purpose in conducting these experiments was to determine whether naturally occurring organic matter would interfere with the accuracy of DNAPL measurement by partitioning tracers. During initial floods through the Site 88 soil columns, plugging by clay fines was observed. This problem was alleviated by the addition of 0.1% $CaCl_2$ to the injected solutions of tracer and water. Thus, in all subsequent soil column experiments, $CaCl_2$ was included as a constituent of the injected solution. The tracer response curves for both these experiments in uncontaminated soils are shown in Figure 7.1. Reference to this figure suggests that partitioning tracers such as 1-hexanol and 1-heptanol are retarded with respect to the conservative tracer 1-propanol. The heavier alcohol tracers with higher partition coefficients show a greater degree of retardation compared to the lighter alcohol tracers. The method of moments, as discussed in Appendix K, was used to estimate



DATE: 7/23/99	Partitioning Tracer Response in Uncontaminated Soil Experiment CLJ#1 and CLJ#2
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Duke Engineering & Services A Duke Energy Company	MCB Camp Lejeune, NC — Figure 7.1

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the apparent DNAPL saturation and the retardation of the partitioning tracers in the column tests.

Both the tracer retardation and the estimated DNAPL saturation, using the measured DNAPL partition coefficients, are given in Table 7.2. Based upon these experimental observations it is evident that both columns have an apparent DNAPL saturation between 0.3% and 0.5%. This apparent detection of DNAPL by the partitioning tracers can be attributed to the adsorption and retention of the partitioning tracers by the sedimentary organic carbon in the aquifer sediments. Such retention of partitioning tracers has been observed in uncontaminated aquifer material from other sites (Edgar, 1997). Interference by sorption to sedimentary organic carbon is typically significant in sediments with f_{oc} values greater than about 1000 mg/kg (Schwarzenbach and Westall, 1981). The f_{oc} of Site 88 soil samples used in these column experiments ranged from 1200 to 2100 mg/kg, with a visible component present as small peat particles. This will account for the observed retardation (Figure 7.1) due to sorption of the partitioning tracers to sedimentary organic carbon despite the absence of DNAPL. A detailed description of the retardation of the partitioning tracers by uncontaminated soils in laboratory column experiments and an experimental correlation between the f_{oc} and the retardation of the partitioning tracers is given in Edgar (1997).

Table 7.2 Retardation of Partitioning Tracers in Uncontaminated Camp Lejeune Soil

Column	Tracer	Retardation	Apparent DNAPL Saturation (%)
CLJ#1	4-Methyl-2-Pentanol	1.015	0.38
	1-Hexanol	1.025	0.31
	1-Heptanol	1.119	0.34
CLJ#2	4-Methyl-2-Pentanol	1.025	0.50
	1-Hexanol	1.035	0.44
	1-Heptanol	1.137	0.39

7.3.2 Partitioning Tracers in Contaminated Soil

Partitioning tracer experiments were conducted in columns CLJ#2 and CLJ#3 after both columns were contaminated with the Site 88 DNAPL. The main purpose of conducting these experiments was to determine the ability of the partitioning tracers to accurately estimate the residual DNAPL saturation. An additional objective of these experiments was to determine an adequate residence time for the partitioning tracers in the subsurface. Providing an adequate residence time for the tracers in the subsurface during a PITT is essential because this allows the partitioning tracer molecules to partition into and out of the trapped DNAPL and reach equilibrium. Nonequilibrium partitioning should be avoided since it can lead to incomplete characterization of the tail portions of partitioning tracer breakthrough curves, which can potentially cause errors in estimating the DNAPL saturation.

Based upon mass balance measurements, the DNAPL saturation in column CLJ#2 was 5.06%, and 6.35% in column CLJ#3. The response of the partitioning tracers is shown in Figure 7.2. The tracer breakthrough curves show retardation of the partitioning tracers with respect to the conservative tracer 1-propanol. This is an indication of the presence of DNAPL. The method of moments, as discussed in Appendix K, was used to estimate the DNAPL saturation. The estimates of DNAPL saturation based upon the method of moments for columns CLJ#2 and CLJ#3 are given in Tables 7.3 and 7.4. In column CLJ#2, an average DNAPL saturation of 4.42±0.50% was estimated by the partitioning tracers compared to the mass balance value of 5.06±0.50%. Similarly in column CLJ#3, the tracer estimate of DNAPL saturation was 7.21±0.80% compared to the mass balance value of 6.35±0.50%. Within experimental uncertainty, it is evident that the partitioning tracers can accurately determine the residual DNAPL saturation in Site 88 sediments.

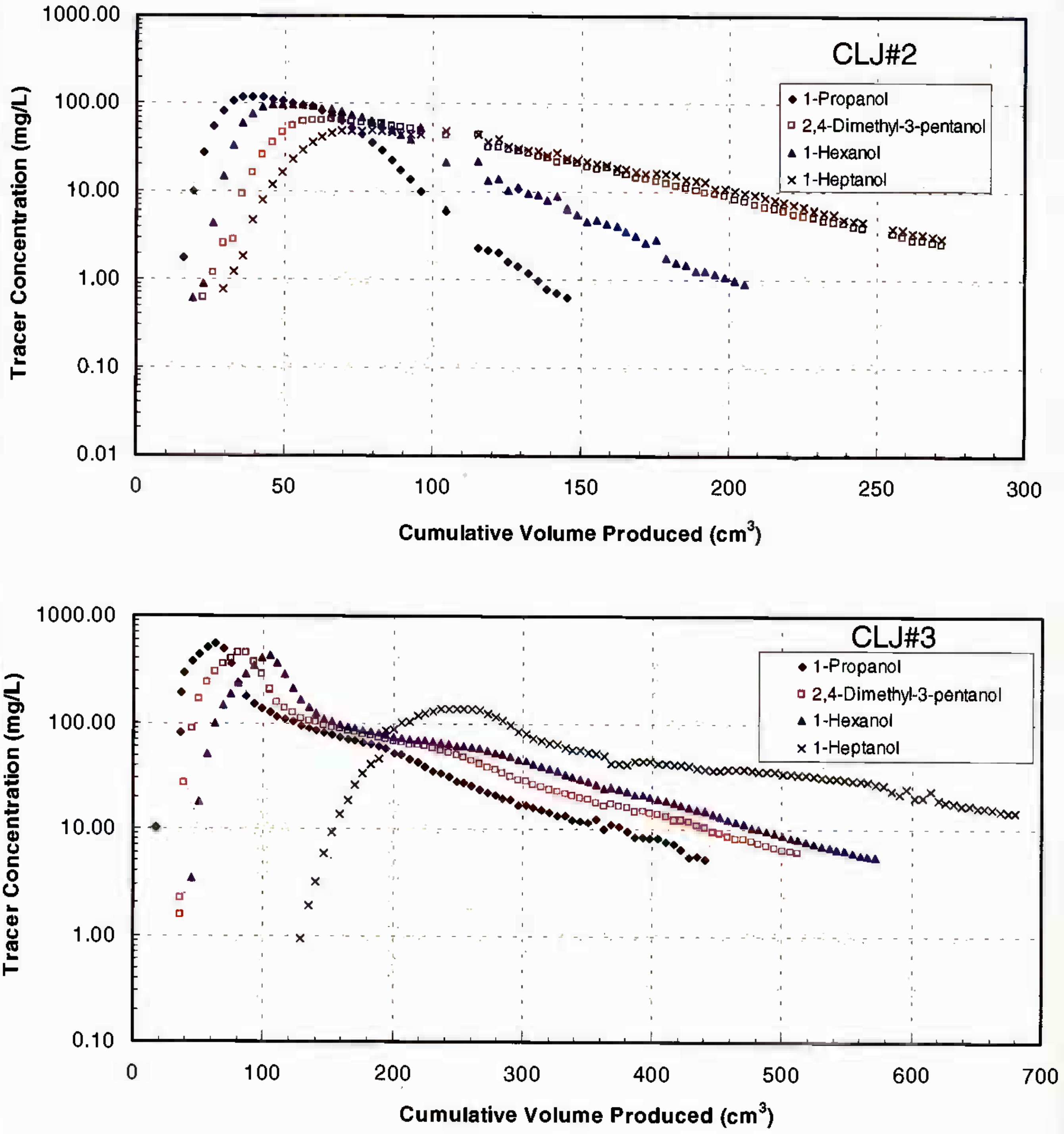
Table 7.3 DNAPL Saturation Estimated by Partitioning Tracers, Column CLJ#2

Tracer Combination	DNAPL Saturation (%)
1-Propanol, 1-Hexanol	4.64±0.55
1-Propanol, 2,4-Dimethyl-3-Pentanol	4.24±0.46
1-Propanol, 1-Heptanol	4.40±0.48
Average DNAPL Saturation (Tracers)	4.42±0.50
Standard Deviation of Partitioning Tracer Estimates	4.2%
DNAPL Saturation by Mass Balance	5.06±0.50

Table 7.4 DNAPL Saturation Estimated by Partitioning Tracers, Column CLJ#3

Tracer Combination	DNAPL Saturation (%)
1-Propanol, 1-Hexanol	7.02±0.85
1-Propanol, 2,4-Dimethyl-3-Pentanol	7.17±0.79
1-Propanol, 1-Heptanol	7.45±0.78
Average DNAPL Saturation (Tracers)	7.21±0.80
Standard Deviation of Partitioning Tracer Estimates	3.0%
DNAPL Saturation by Mass Balance	6.35±0.50

These results also indicate that the residence times for the tracers during both these experiments are sufficient. The residence times for each tracer in the partitioning tracer experiments in columns CLJ#2 and CLJ#3 are shown in Table 7.5. The residence



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Partitioning Tracer Response in DNAPL Contaminated Soil
Experiment CLJ#2 and CLJ#3

MCB Camp Lejeune, NC

Figure 7.2

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times varied between 8 hours for the conservative 1-propanol to 26.7 hours for 1-heptanol. However a residence time of 9.5 hours was sufficient for 1-hexanol to accurately determine the DNAPL saturation in column CLJ#2. This suggests that a residence time of approximately 10 hours in the subsurface is adequate for equilibrium partitioning of the tracers.

Table 7.5 Residence Times for Tracers during Partitioning Tracer Experiments

Alcohol	Column	Residence Time (hours)
1-Propanol	CLJ#2	6.8
1-Hexanol	CLJ#2	9.5
2,4-Dimethyl-3-Pentanol	CLJ#2	15.3
1-Heptanol	CLJ#2	17.7
1-Propanol	CLJ#3	7.4
4-Methyl-2-Pentanol	CLJ#3	9.7
1-Hexanol	CLJ#3	11.8
1-Heptanol	CLJ#3	26.7

7.4 Tracers Selected for Further PITT Design

Based on the experimental results, and considerations such as cost and availability of the various compounds, the following tracers were selected for further PITT design: 1-propanol, 4-methyl-2-pentanol, 1-hexanol and 1-heptanol. More discussion of the tracer properties and quantities applied to the PITT design simulations is provided in Section 8.0.

7.5 Summary and Conclusions

From the results of the partitioning tracer column studies discussed above, it can be seen that retardation of the heavier alcohol tracers such as 1-heptanol in uncontaminated alluvium is greater than the average experimental error of 0.035 in the retardation factor (Dwarakanath, 1997). This is due to sorption of partitioning tracers to sedimentary organic carbon, which occurs primarily as peat particles in the Site 88 sediments. The presence of peat leads to a sedimentary organic content that is significantly greater than the f_{oc} typically found in aquifer sediments. The resulting sorption of partitioning tracers to the organic matter results in an apparent DNAPL saturation of between 0.3% and 0.5% in uncontaminated sediments. However, in contaminated sediments with relatively high DNAPL saturations, i.e., about 5% saturation, this effect was suppressed and no measurable errors were observed in the partitioning tracer estimate of the DNAPL saturation.

Based upon the soil column experiments conducted in this study, it can be inferred that the presence of DNAPL, at relatively high saturations, masks the effect of sorption by the organic material and hence can be neglected during the analysis of the partitioning tracer data. A number of wells in the test zone at Site 88, particularly those near the building, showed the presence free phase DNAPL. In these areas it can be assumed that the retardation of the partitioning tracers is dominated by the presence of high DNAPL saturations and is very weakly affected by the natural organic material. Hence the effect of retardation by the natural organic material in such areas can be neglected during the analysis of the field PITT data.

However, in other areas of the test zone, such as away from the building where DNAPL has not been observed, the natural organic matter may produce some degree of tracer sorption that will show an apparent presence of DNAPL at relatively low DNAPL saturations of about 0.4%. It is not known at this time what level of actual DNAPL contamination, i.e., average DNAPL saturation, is needed to dominate the tracer partitioning response in the presence of the sedimentary organic carbon at Site 88. Soil column testing at lower-level DNAPL saturations, i.e., <3%, is problematic with respect to obtaining an accurate weight (i.e. mass balance) for DNAPL added to a column, and is therefore prone to significant error at low DNAPL saturations.

The partitioning tracers evaluated in both DNAPL-contaminated column tests accurately predicted the residual DNAPL saturation. This can be concluded from the close agreement of residual DNAPL saturations based on mass balance and partitioning tracers. The standard deviation in the tracer estimates of residual DNAPL saturation was less than 5% in both the partitioning tracer column experiments indicating a high level of accuracy of the partitioning tracer method. The excellent agreement between mass balance and partitioning tracer estimates of residual DNAPL saturation also validate the accuracy of the static partition coefficient measurements. Finally, for this geosystem of alluvium and DNAPL, it can be concluded from the laboratory partitioning tracer experiments that a residence time of 10 hours is sufficient to allow for equilibrium partitioning of the tracers.

8.0 PITT DESIGN SIMULATIONS

Successful implementation of a PITT requires the development of an engineering design based on careful and systematic simulations. A good design should minimize the risk of failure, optimize the information collected, and save time and money. Simulation modeling before field test implementation can provide valuable insight into pertinent design parameters that affect the outcome of the tracer test. These design parameters include: the duration of the tracer test; the amount of tracer mass needed for injection; the number and configuration of injection, extraction, and hydraulic control wells; and injection and extraction flow rates for each well. To accomplish this, we used UTCHEM, which is a multi-component, multi-phase, three-dimensional chemical flood reservoir simulator developed at the University of Texas at Austin. It was originally developed to simulate the surfactant/polymer enhanced oil recovery process (Pope and Nelson, 1978; Datta-Gupta et al., 1986; Saad et al., 1990). In the past seven years, enhancements have been made to adapt UTCHEM to simulate both PITT and SEAR processes (Delshad et. al., 1996). UTCHEM represents the current state of the art for PITT and SEAR design, and has been successfully used by DE&S (formerly INTERA) in the past several years to design numerous PITT, surfactant, and surfactant/foam flood field demonstrations (e.g., INTERA, 1997b; Jin et al., 1997a, b; RICE et al, 1997).

8.1 PITT Design Strategy and Modeling Approach

The first step in designing a tracer test with a numerical simulator is to set up a three-dimensional model of the test zone using an appropriate geometry and grid. Input parameters to the model should include the best available estimates of the site geosystem components, such as the permeability field, porosity, multi-phase fluid densities and viscosities, dispersivity and other site-specific properties based upon data from site investigations or from similar geosystems by analogy. After the model has been developed, a number of sensitivity analysis simulations are conducted to simulate the performance of the test to provide an optimum design for the PITT. The sensitivity analysis includes varying the injection and extraction rates, permeability field characteristics, and the amount and distribution of NAPL, etc. The results from these sensitivity studies are then used to determine the duration of the tracer test, the mass of each tracer needed, the injection and extraction rates, the extraction well effluent tracer concentrations over time and the cumulative amount of tracer recoverable at the end of the tracer test. A preliminary design for the PITT operation is then chosen based upon the results of these sensitivity studies. The validity of the preliminary design is then tested in the field, before the PITT, by conducting a conservative interwell tracer test (CITT) which uses one or more non-partitioning tracers. The CITT is a relatively short-term test that is used to fine-tune the final PITT design to ensure that a successful PITT will be conducted.

The main objectives of the CITT are to:

- Determine the percent recoveries of the tracer at each well
- Determine the actual residence times of the tracers in the subsurface
- Determine the actual swept pore volume to finalize the PITT design
- Determine the effective permeability of the aquifer
- Obtain insights into the relative heterogeneity of the aquifer and a better understanding of the subsurface flow system
- Act as a shakedown for the ensuing PITT in terms of equipment setup, sample collection, well monitoring, etc.

Based on the objectives of the CITT, it is evident that the model predictions for the CITT do not need to be precise. The information gained from the CITT is of great value in making final decisions on the PITT design. CITT results are used to update and calibrate the geosystem model. Then, a number of numerical simulations, for sensitivity analysis, are conducted to study the behavior of different partitioning tracers in order to formulate an optimum final design for the PITT. The results of these post-CITT sensitivity analyses are then used to:

- Finalize the selection of the tracers
- Determine the duration of the PITT
- Determine the mass of each tracer needed
- Determine the injection and extraction rates
- Determine sampling frequency at monitor and extraction wells
- Predict the swept volume
- Predict the extraction well effluent tracer concentrations
- Predict the amount of tracer recovered by the end of the tracer test

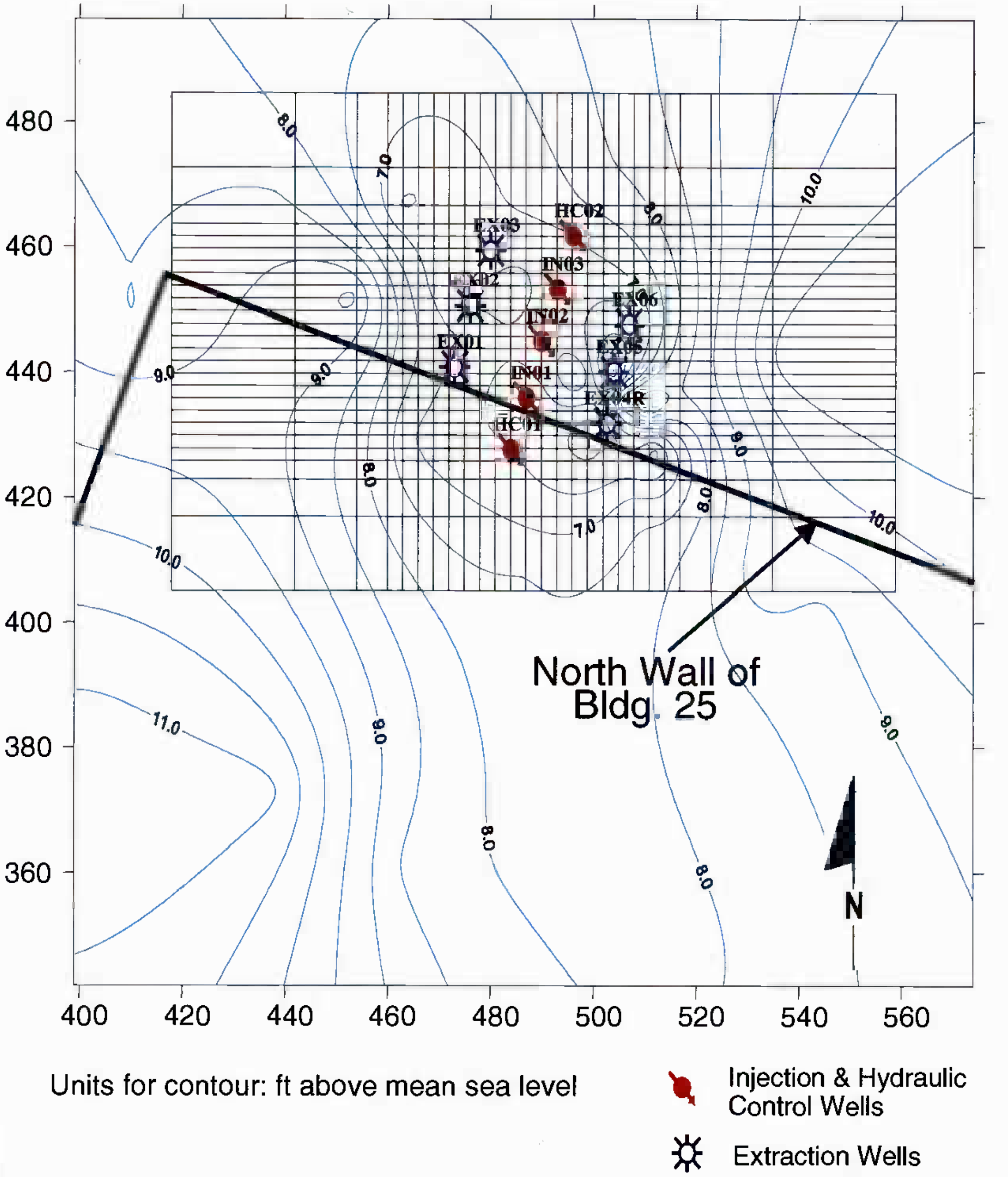
8.2 Simulation Model Development

8.2.1 Well-Field Configuration

Preliminary UTCHEM simulations based on site hydrogeological data, indicated that the PITT well field would be most efficiently configured with a divergent line-drive geometry, i.e., a line of injection wells flanked on both sides by lines of extraction wells. In order to maintain hydraulic control and to ensure that an adequate portion of the well field will be swept, each injection or extraction well is spaced 10 ft from its nearest neighbor within a line of injection or extraction wells. The interwell distance between any pair of injection and extraction wells is 15 ft. This corresponds to a well-field size of 20 ft by 30 ft. The well-field configuration is shown schematically in Figure 4.1. As the figure shows, the well field consists of 11 wells. There are six extractors and three injectors. In addition, a hydraulic control well is located outside the well field on each end of the line of injection wells. These two wells are used only as hydraulic control wells (i.e., only water will be injected into these wells during flooding operations) to provide hydraulic containment of the tracer flowpaths between injection and extraction wells. Tracer injection at the center of the well-field panel, with simultaneous extraction on both sides of the well-field array, drives the tracer injectate divergently outward towards the extraction wells where tracer recovery occurs.

8.2.2 Simulation Domain

The plan view of the three-dimensional UTCHEM model grid is illustrated in Figure 8.1. The figure also shows the locations of the injection wells, the extraction wells, and the elevation contours defining the top of the clay aquitard. The aquifer volume in the test zone was simulated using a three-dimensional 25 X 25 X 16 mesh consisting of a total of 10,000 grid blocks. The horizontal extent of the model was 141 ft long, and 99 ft wide. The vertical extent of the model was 13 ft thick to represent the saturated thickness of the test zone, and corresponds to a bottom elevation of about 5 ft amsl, and a top elevation of 18 ft amsl. This overall vertical thickness of 13 ft was divided into 16 layers with a uniform thickness of 0.5 ft per layer for the bottom 12 layers. The clay elevation contour of the aquitard was incorporated into the model by mapping all grid cells with centroid locations below the surface of the aquitard (as defined by the kriged elevations shown in Figure 8.1 as clay blocks), effectively making them no-flow boundaries. The simulation dimensions and the number of gridblocks were chosen to minimize boundary effects. No-flow boundary conditions were assumed for the top of the simulation domain. The pressures at two outer boundaries were kept constant to establish a regional hydraulic gradient of 0.015.



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Plan View of the Simulation Grid and Aquitard Elevation Contours

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Figure 8.1

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8.2.3 Physical Properties of Porous Media and Fluids

The porous media and fluid physical properties used in our model were based upon data from the site investigations or from similar geosystems by analogy. The values for some of the properties are provided below.

porosity	0.34
average permeability	0.4 darcies
density of water	1 g/cm^3
density of NAPL	1.63 g/cm^3
water-NAPL interfacial tension	45 dynes/cm
NAPL viscosity	0.89 cp
water viscosity	1.0 cp

Values for relative permeability and capillary functions were taken from the literature based on data from similar sites. It should be noted, however, relative permeability and capillary functions are not very important parameters for the PITT since the process is essentially single-phase flow with the second phase as residual NAPL. The capillary pressure equals zero in this case. The initial NAPL saturation distribution was based on the soil sampling analytical data. A NAPL saturation of 10% for the bottom two feet of the aquifer was used for the simulations. Observations of soil cores also indicated that the permeability at the bottom portion of the shallow aquifer is significantly lower than the main portion of the aquifer, as discussed in Section 5.0. This vertical heterogeneity was addressed in the model by assigning a permeability contrast of 2 between the upper intervals versus the bottom portion of the model.

The tracers used for the simulations are based on the laboratory column experiments. The tracers and their measured partition coefficients are listed in Table 8.1.

Table 8.1 Tracers and their Partition Coefficients

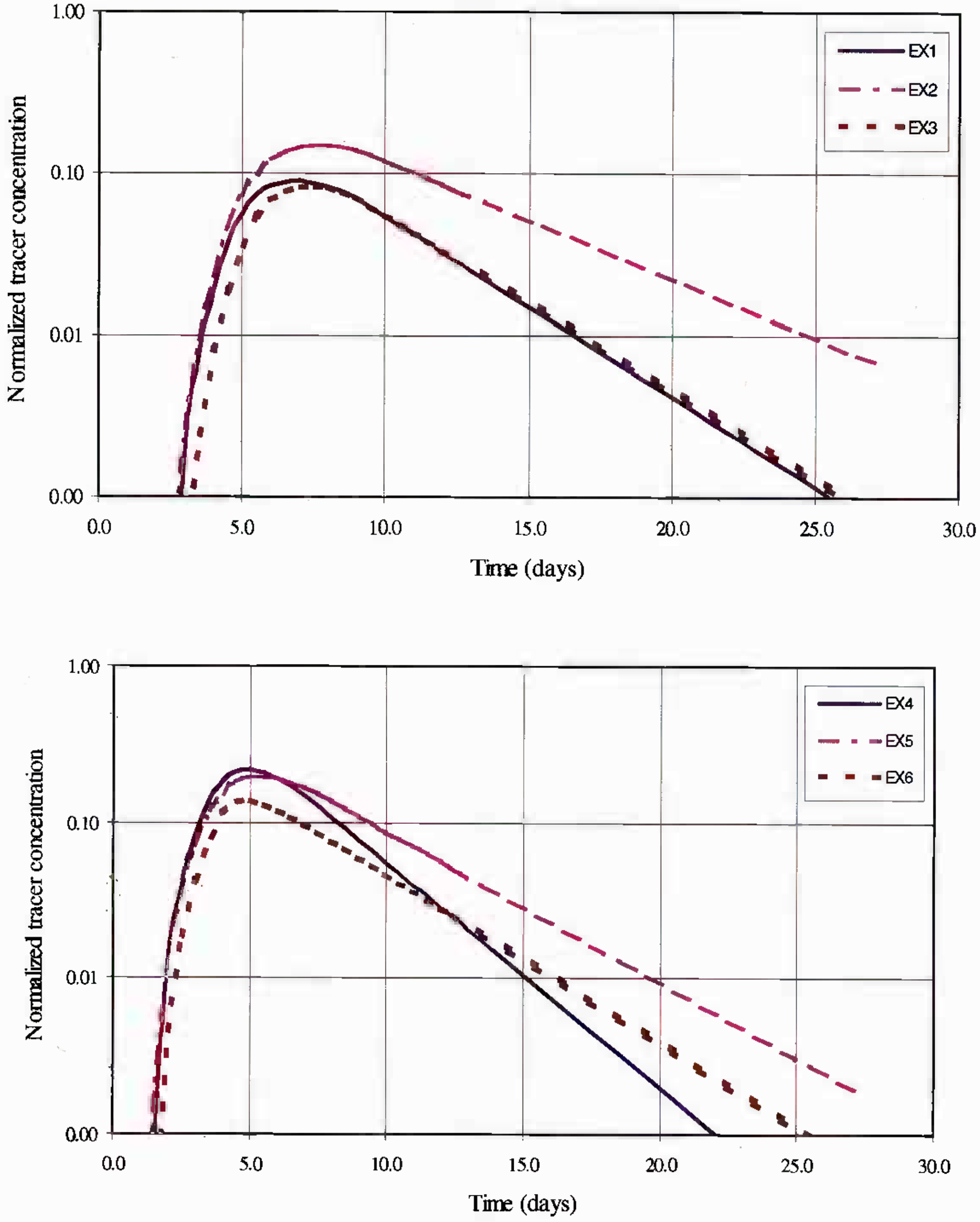
Tracer Name	Partition Coefficient
1-Propanol	0
4-Methyl-2-Pentanol	4
1-Hexanol	8
1-Heptanol	35

8.3 CITT Design

As discussed in Section 8.1, a number of sensitivity analyses were run to simulate the performance of the tracer test in order to provide an optimum design for the PITT. The sensitivity analyses included varying the injection and extraction rates and permeability distribution, etc. The results generated from these simulations were used to design the CITT. Tables 8.2 and 8.5 summarize the pertinent CITT design variables. The predicted tracer response curve for a conservative tracer at each of the extraction wells is shown in Figure 8.2. The simulation predictions, in terms of swept pore volume, the percentage of tracer recovered, and the tracer residence times for each extraction well, are given in Table 8.6. The predicted tracer recovery was approximately 90%. The predicted swept aquifer pore volume was approximately 4,920 gallons after 14 days of tracer operation. The actual results, including the predicted tracer response curves at each well, may vary somewhat for a variety of reasons such as the uncertainty in the aquifer permeability field, i.e., heterogeneity. However, the CITT can be successful over a wide range of uncertainties since the purpose of the CITT is to obtain an understanding of how an induced-flow system behaves in the test zone site. The CITT data was used to calibrate the numerical model for the final PITT design simulations.

Table 8.2 Design Summary of CITT Flow Rates

Well Type	Well Name	Flow Rate (gpm)	Total (gpm)
Extraction	EX1	0.25	1.5
	EX2	0.25	
	EX3	0.25	
	EX4R	0.25	
	EX5	0.25	
	EX6	0.25	
Injection	IN1	0.2	1.2
	IN2	0.2	
	IN3	0.2	
Hydraulic Control	HC1	0.3	
	HC2	0.3	



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Prediction of CITT Tracer Response

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Figure 8.2

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Table 8.3 Design Summary of CITT Phases

Injectate		Duration (Days)	Cumulative Time (Days)
IN1, IN2, IN3	*HC1,HC2*		
Water	Water	1	1
Tracer + Water	Water	2.5	3.5
Water	Water	11.5	15

Table 8.4 Summary of Tracer Injection Operation

Tracer	Slug Size (gals)	Total Mass (kg)	Injectate Concentration (mg/L)
Potassium Bromide	2,160	12	1,000 (as bromide)

Table 8.5 Sampling Schedule for the CITT

Sample Type	Day (since water injection began)	Day (since tracer injection began)	Sampling frequency (hours per sample)	Number of samples per well or sample point	Total number of samples
Extraction Well	1	0	0	0	0
	2-4	1-3	12	6	36
	5-8	4-7	6	16	96
	9-13	8-12	12	10	60
	14-15	13-14	24	2	12
Sub-total					**204**
Injectate	1	0	0	0	0
	2-4	1-3	6	12	12
	5-15	4-14	0	0	0
Sub-total					**12**
Total					**216**
Total (after adding additional 5% of samples for duplicates and QA/QC)					**227**

Table 8.6 Summary of CITT Simulation Predictions

Well Name	Tracer Recovery (%)	Swept Volume (gals)	Mean Tracer Residence Time (days)
EX1	10	570	7.0
EX2	19	1,230	7.7
EX3	7	460	7.4
EX4	20	920	5.3
EX5	23	1,170	6.0
EX6	11	570	5.7
Total	90	4,920	

8.4 PITT Design

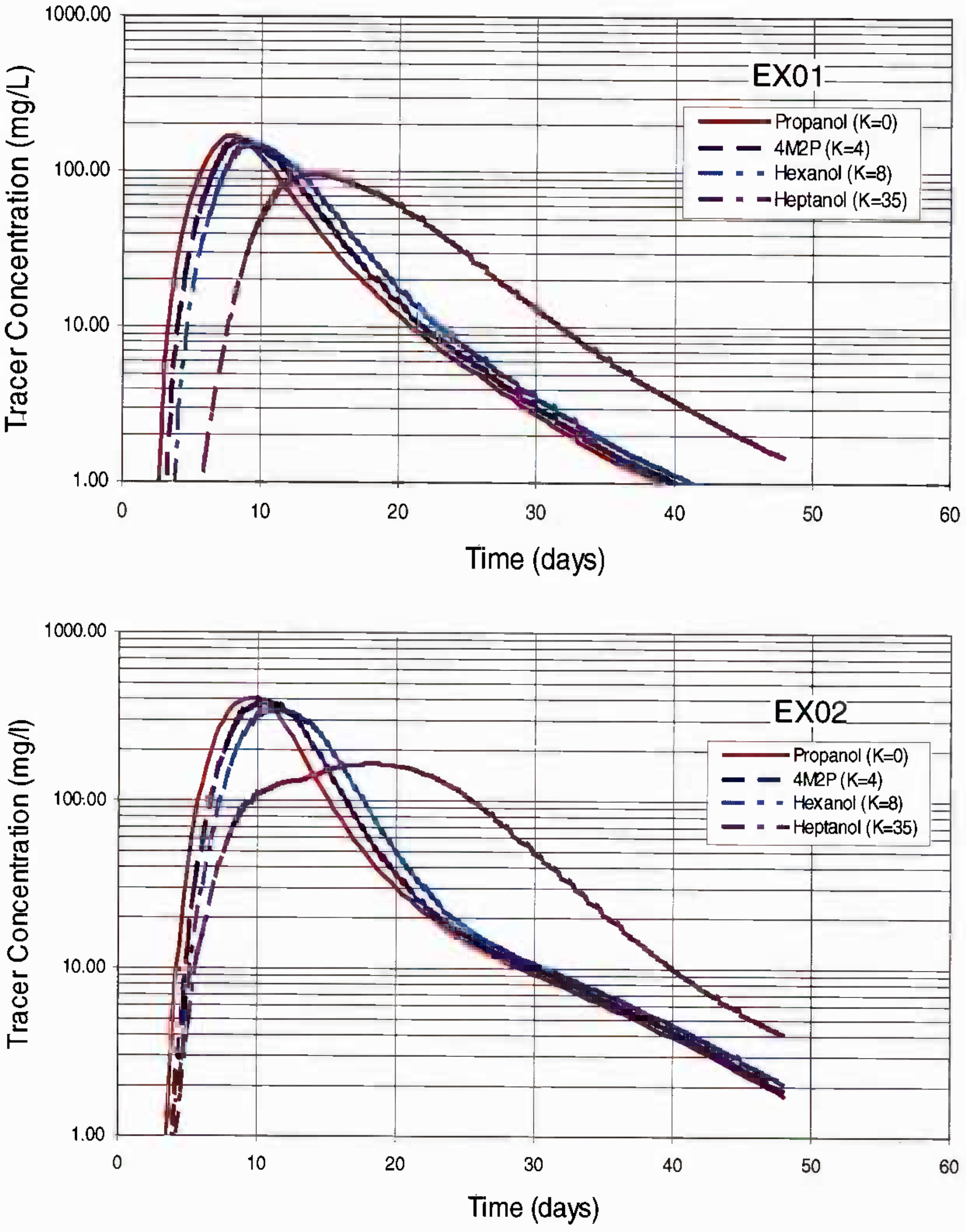
As might be anticipated, the actual CITT response curves differed from the model prediction. The detailed CITT results are presented in Section 11.3. A comparison of Table 8.6 and Table 11.1 indicates that the model prediction and the actual results were in good agreement; therefore, the geosystem model was a reasonable representation of the actual aquifer. Nonetheless, the geosystem model was updated with the results of the CITT to further refine the model for the PITT design simulations. The most important adjustment made to the geosystem model for the PITT design was to focus the tracer flowpaths along the bottom portion of the aquifer where the DNAPL resides through the use of a dual injection system. The dual injection design provides vertical hydraulic control of tracer flowpaths, and is described as follows. At each of the three injection wells, clean, tracer-free water was injected into the upper screen only (above an inflatable packer), along with the simultaneous injection of tracers below the packer into the lower screen (see Figures 4.2 and 4.4 for injection well configuration). The dual injection system also prevented tracer flowpaths from moving upwards through the LNAPL (Varsol™) smear zone which coincides with the fluctuating water table (Figure 4.4). If tracer flowpaths were allowed to travel through the LNAPL zone, there would be interference with partitioning of tracers occurring in both the LNAPL and DNAPL zones. This interference between the LNAPL and DNAPL zones would therefore increase the difficulty of analyzing the PITT data in order to obtain meaningful information with respect to the DNAPL zone. Before considering the dual injection scheme, PITT flow rates were designed for overproduction during the PITT, i.e., greater total extraction rates than total injection rates. Overproduction has the potential undesirable effect of declining flow rates over time at the extraction wells (i.e., due to dewatering the test zone). However, the addition of upper-level water injection improved the balance of flow between total injection rates and total extraction rates, and minimized the potential for dewatering at extraction wells during the PITT operation.

As in the design of the CITT, sensitivity simulations were conducted to provide an optimum design for the PITT. Tables 8.7 through 8.10 summarize the pertinent design variables for the PITT, based upon the calibrated geosystem model and the sensitivity studies. The predicted tracer response curves for all of the extraction wells are shown in Figures 8.3 through 8.5. The simulation predictions are summarized in Table 8.11 for swept pore volume, percentage of tracer recovered, and the interwell residence times (i.e., tracer travel time between an injection and extraction well pair).

Based on the results of multiple sensitivity simulations, the predicted tracer recovery at the end of the PITT was expected to be approximately 93% to 96%. The predicted swept aquifer pore volume, based on the simulated tracer response analysis, was approximately 6,450 gallons. The actual PITT results varied for a number of reasons, including the uncertainties in the degree of aquifer heterogeneity and the distribution of DNAPL in the swept pore volume. This is discussed in further detail in Section 11.4.

Table 8.7 Design Summary of PITT Flow Rate

Well Type	Well Name	Flow Rate (gpm)	Total (gpm)
Extraction	EX1	0.25	1.55
	EX2	0.25	
	EX3	0.30	
	EX4	0.25	
	EX5	0.25	
	EX6	0.25	
Injection	IN1-lower	0.2	1.44
	IN2-lower	0.2	
	IN3-lower	0.2	
	IN1-upper	0.08	
	IN2-upper	0.08	
	IN3-upper	0.08	
Hydraulic Control	HC1	0.3	
	HC2	0.3	



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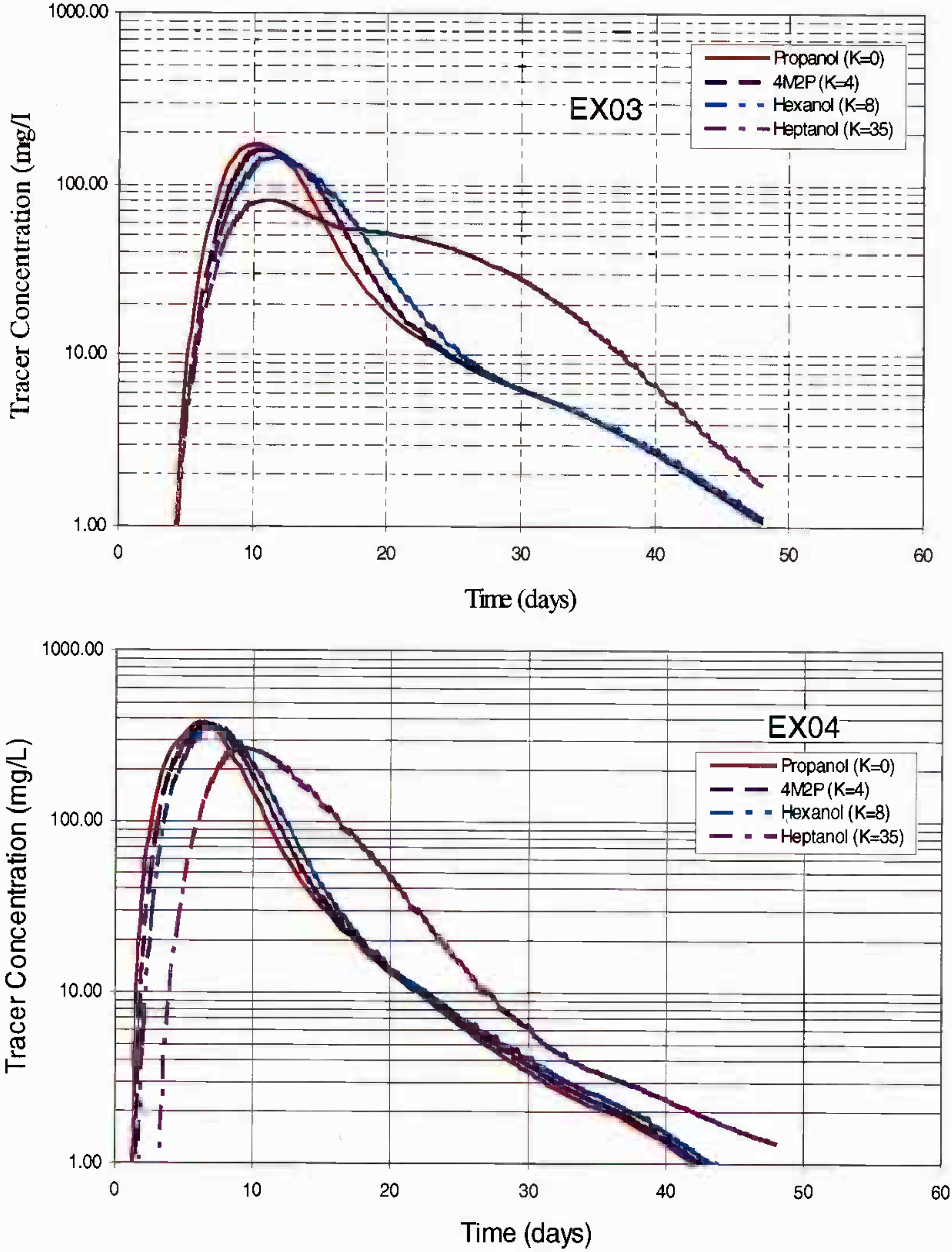

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Prediction of Extraction Wells EX03 and EX04 Tracer Response

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Figure 8.4

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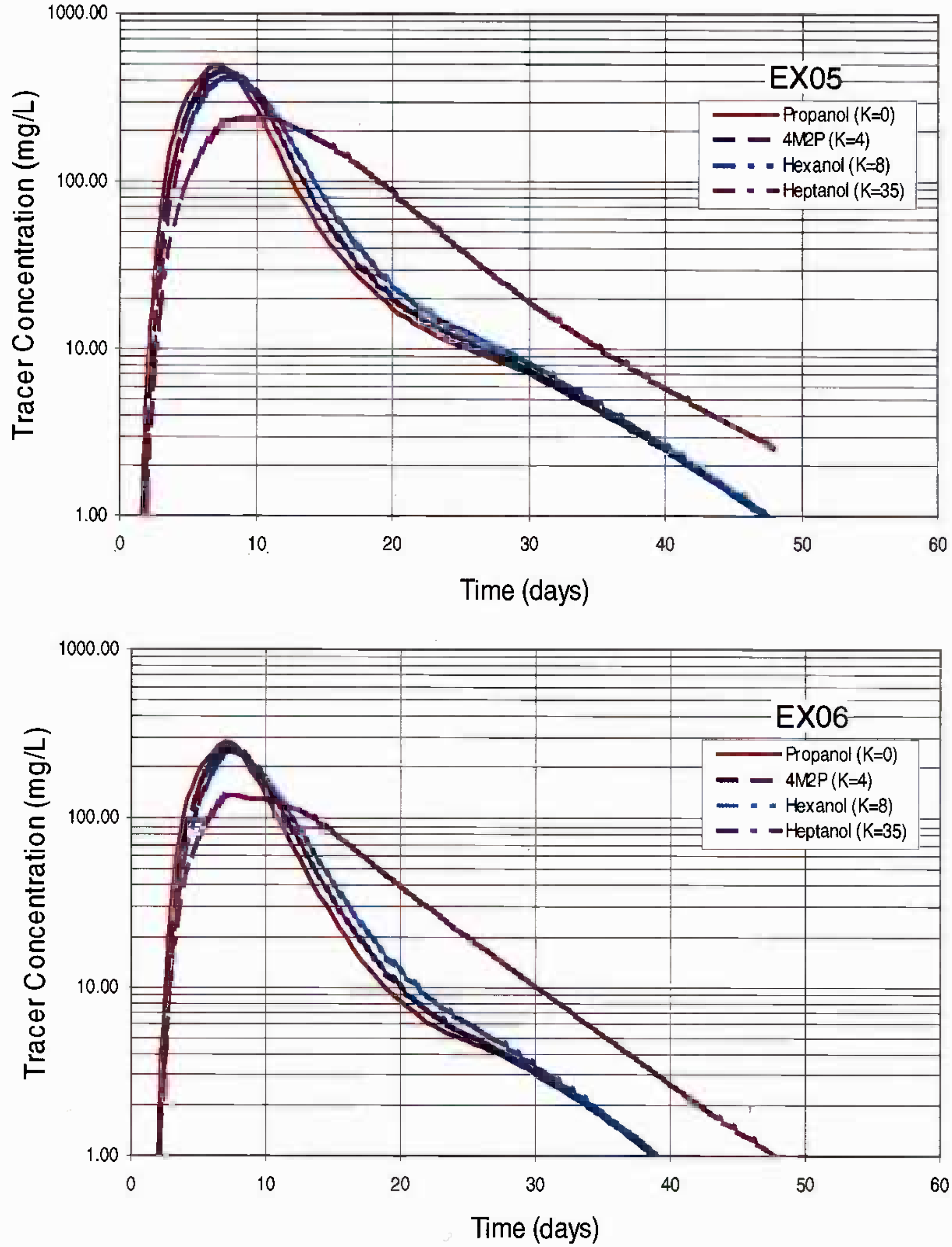

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Prediction of Extraction Wells EX05 and EX06 Tracer Response

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Figure 8.5

Table 8.8 Design Summary of PITT Operation Phases

Injectate		Duration (Days)	Cumulative Time (Days)
IN1, IN2, IN3	*HC1,HC2, IN1-upper, IN2-upper, IN3-upper*		
Water	Water	1	1
Tracer + Water	Water	5.8	6.8
Water	Water	34.2	41

Table 8.9 Summary of Tracer Injection Operation

Tracer Name	Partition Coefficient	Total Mass (kg)	Injectate Concentration (mg/L)
1-Propanol	0	19	1,000
Methanol	0	19	1,000
4-Methyl-2-Pentanol	4	19	1,000
1-Hexanol	8	19	1,000
1-Heptanol	35	13	700

Table 8.10 Sampling Schedule for the PITT

Sample Type	Day (since water injection began)	Day (since tracer injection began)	Sampling Frequency (hour per sample)	Number of Samples per Well or Sample Point	Total Number of Samples
Extraction Well	1	0	0	0	0
	2-7	1-6	6	24	144
	8-13	7-12	12	12	72
	14-41	13-40	24	28	168
Multilevel Sampler (only three out of nine sample ports were functioning during the PITT)	1	0	0	0	0
	2-7	1-6	8	18	54
	8-13	7-12	12	12	36
	14-41	13-40	24	28	84
Total Extraction Well and Multilevel Sampler Samples					558
Injectate	1	0	0	0	0
	2-7	1-6	6	24	24
	8-41	7-40	0	0	0
Total Injectate Samples					24
Sub-Total					582
Total (after adding additional 20% of samples for duplicates and QA/QC)					700

Table 8.11 Summary of PITT Simulation Predictions

Well Name	Tracer Recovery (%)	Swept Volume (gals)	Mean Residence Time (days)
EX1	9	660	8
EX2	22	1,800	9
EX3	10	940	10
EX4R	18	920	6
EX5	24	1,400	7
EX6	13	730	6
Total	96	6,450	

9.0 CONSERVATIVE INTERWELL TRACER TEST (CITT)

This section provides the operational details and test results for the conservative interwell tracer test (CITT) performed during April 15–28, 1998, using design flow rates obtained from preliminary UTCHEM modeling. The objectives of this test were to determine the average subsurface tracer residence times, tracer swept pore volumes for each of the interwell pairs, and as otherwise discussed in Section 8.1 (PITT Design Strategy and Modeling Approach). These results were then used to update the UTCHEM model for the final PITT design simulations. A general layout of the test system is shown in Figure 9.1. Tracer and water-flood solutions were mixed in the storage tanks and then injected into the aquifer via the autocollector/control trailer. Packers were installed in the injection and hydraulic control wells for the purpose of separating the upper and lower screens. The tracer injection line was run through the packer to direct flow through the lower screen into the lower zone of the shallow aquifer. Injectate flowing to the extraction wells was then pumped from the wells to the waste tanker via the autocollector/control trailer.

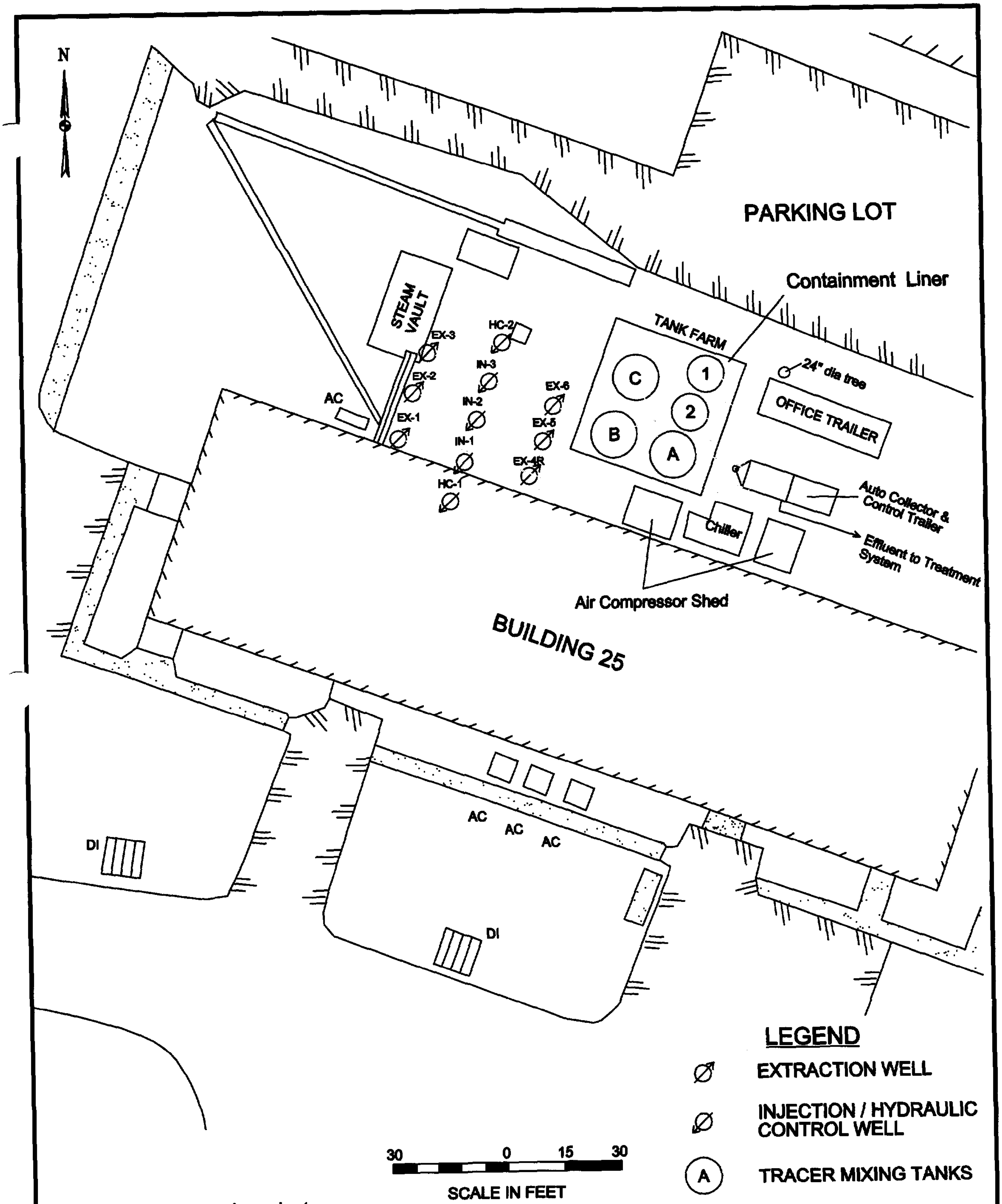
The purpose of autocollector trailer and the data acquisition system (DAS) was to collect samples, control and log injection flow rates and monitor water levels. Flow rate and water level data was electronically recorded once every 20 minutes.

Injection flow rates were manually measured daily using a stopwatch and graduated cylinder. Each manual measurement was compared to the DAS-recorded flow rate. If the flow rate varied by more than 10%, the appropriate electronic flow meter was recalibrated. Extraction well flow rates were not monitored with conventional flow meters because the pneumatic pumps provide a pulsed flow. The flow rates in the extraction wells, therefore, were determined by monitoring flow totalizers and elapsed time.

Water levels in the extraction wells and lower zones of the injection wells were electronically measured and recorded by the DAS. Manual measurements taken with a water level meter were compared to the DAS data; if significant deviations were observed, then corrective action was taken (e.g. replacement or recalibration of transducers) to correct the discrepancies Water levels were also measured in the upper zones of the hydraulic control wells and injection wells and in selected monitor wells.

On April 14, 1998 a CITT was initiated and conducted in the following sequence:

1. pre-injection water flood,
2. conservative tracer injection, and
3. post-injection water flood.



NOTE: Well Locations are Approximate

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PITT Site Map

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Figure 9.1

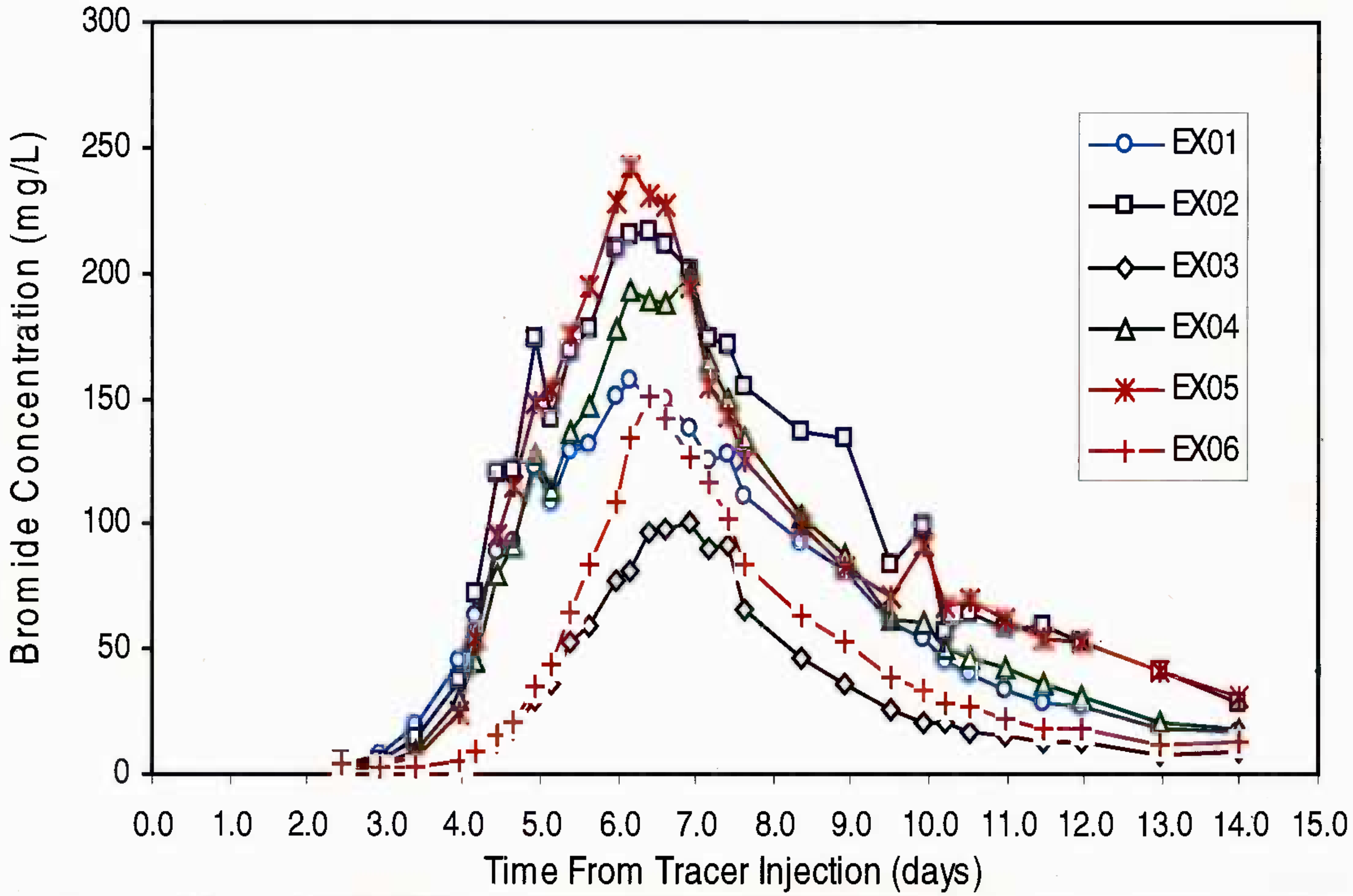
The pre-injection water flood started 24 hours before tracer injection to establish a steady-state flow regime in the well field. A tracer slug of approximately 2,100 gallons of approximately 970 mg/L of bromide ion (Br^-) was injected over a 59-hour period. Tracer injection was followed by 12 days of water flooding to transport the tracer through the zone of interest. These phases were conducted using the design extraction and injection flow rates summarized in Table 8.1. The total CITT duration was about two weeks.

All water injected during the test contained $CaCl_2$ at a concentration of approximately 1,000 mg/L. This was done to decrease the probability of clay particle mobilization due to ion exchange in the aquifer sediments. Mobilization of these fine clay particles could have resulted in significant pore-plugging, thereby reducing the hydraulic conductivity and thus the sustainable flow rates at the injection and extraction wells. Injectate batches were checked with a conductivity probe before injection to ensure that the $CaCl_2$ concentration was within acceptable limits.

Effluent samples were collected manually from each extraction well according to the sampling schedule in Table 8.5, and analyzed for Br^- concentration. Concentrations were measured using an Orion Model 9435BN bromide selective electrode and model 900200 double junction reference electrode connected to an Orion Model 250A pH meter. The analysis was carried out using the DE&S standard operating procedure outlined in Appendix L.

The Br^- tracer concentration histories are plotted in Figure 9.2 to show the tracer response at the six extraction wells. The Br^- tracer response data was then normalized (to the Br^- injectate concentration) for the CITT data analysis. The normalized tracer response data and their corresponding fitted curves, (based on Equation 11.2-2 in Section 11.3) are shown in Figures 9.3a to 9.3c for the six extraction wells. The tracer curves were analyzed using the method of temporal moments (which is discussed in Section 11.1; PITT Data Analysis). The resulting estimates of the tracer recovery, swept volume, and mean residence time for each well are summarized in Table 11.1. The total aquifer pore volume swept by the tracers was approximately 4,810 gallons as determined by adding up the swept volumes calculated for each well.

Based upon the results from the CITT, the geosystem model used was then calibrated to reflect more closely the actual test domain and was used to design the PITT as described in Section 8.4.



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CITT Bromide Break-Through Curves

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Figure 9.2

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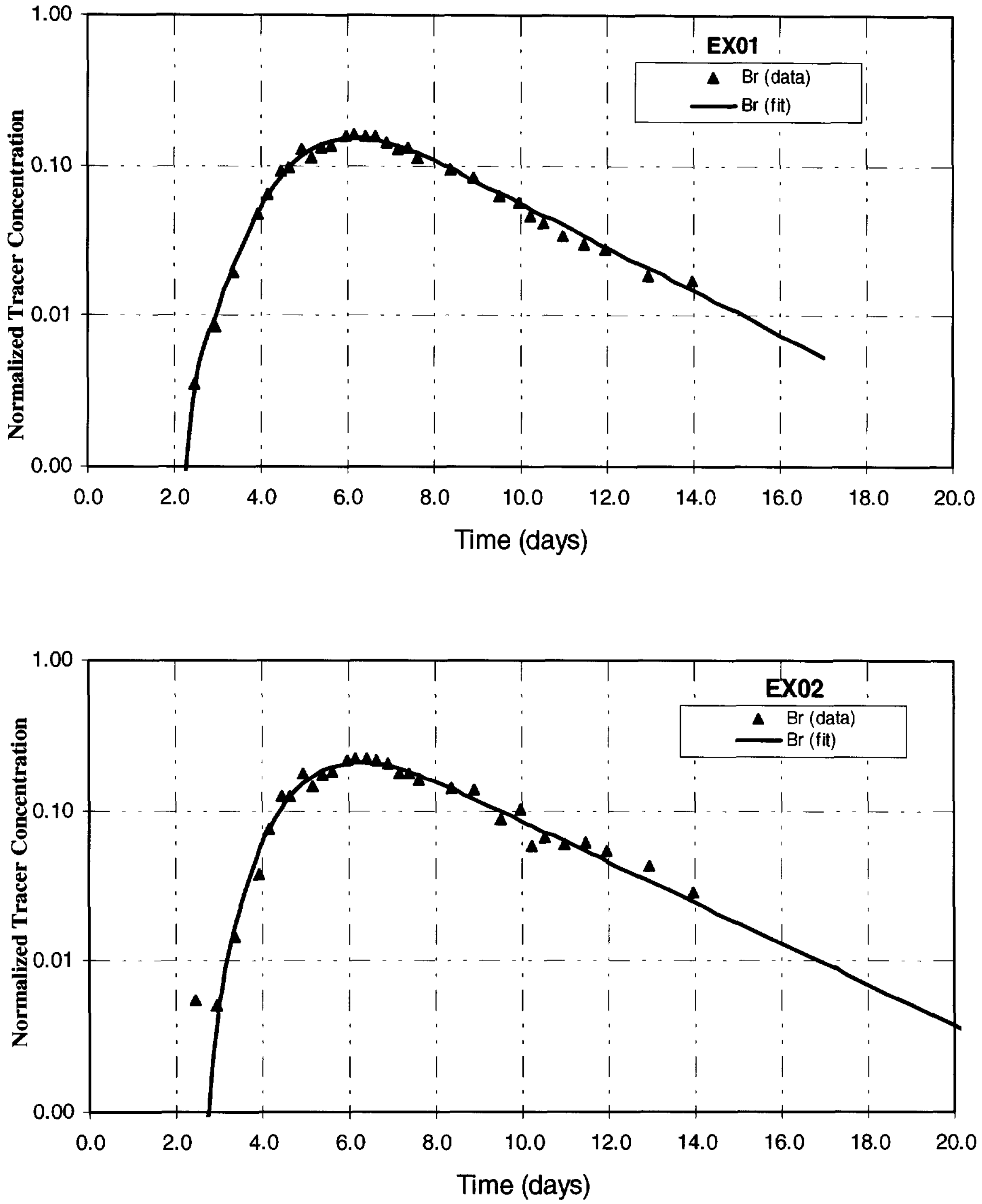

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CITT Tracer Response at Extraction Wells EX01 and EX02

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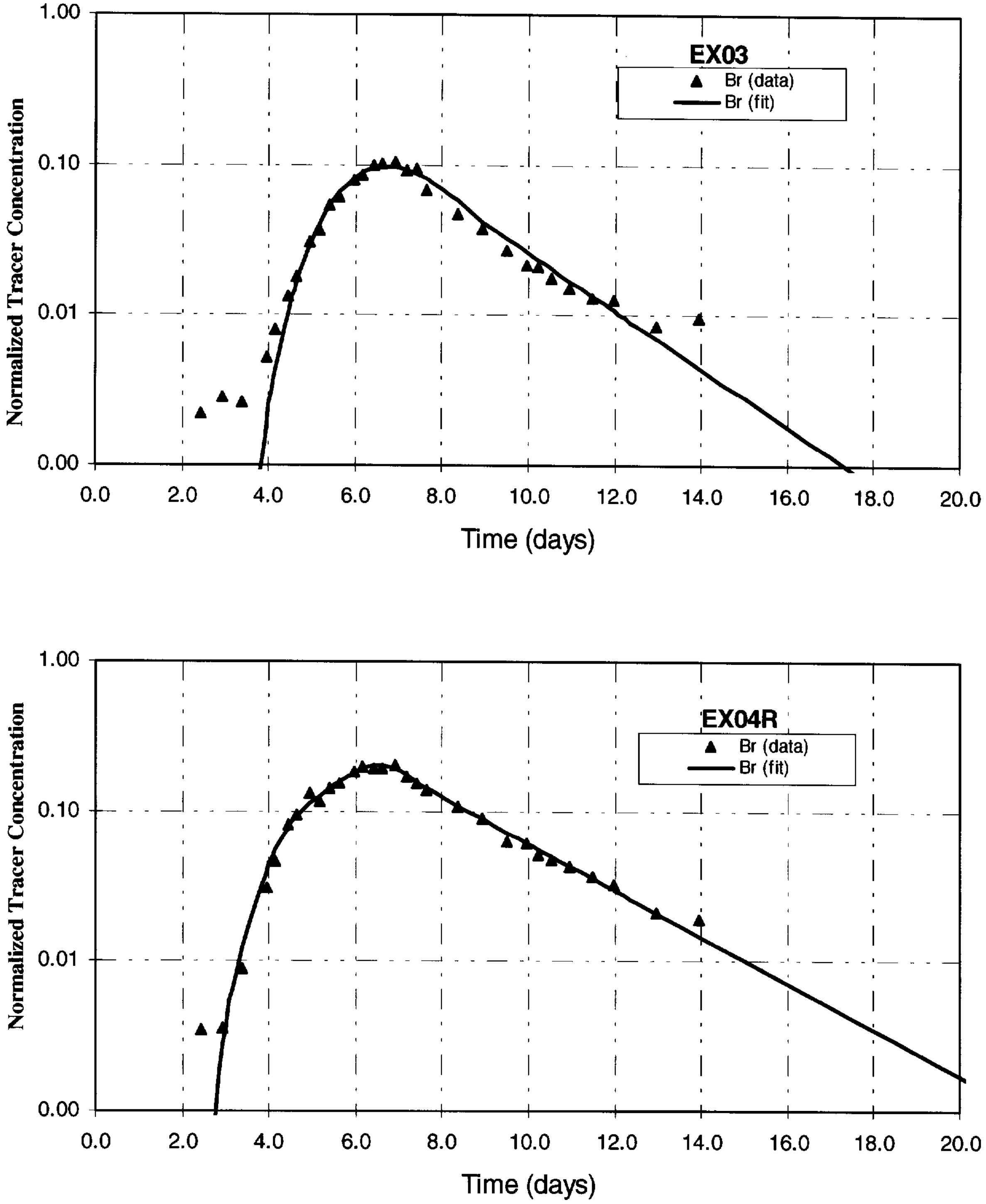
Figure 9.3a



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CITT Tracer Response at Extraction Wells EX03 and EX04R

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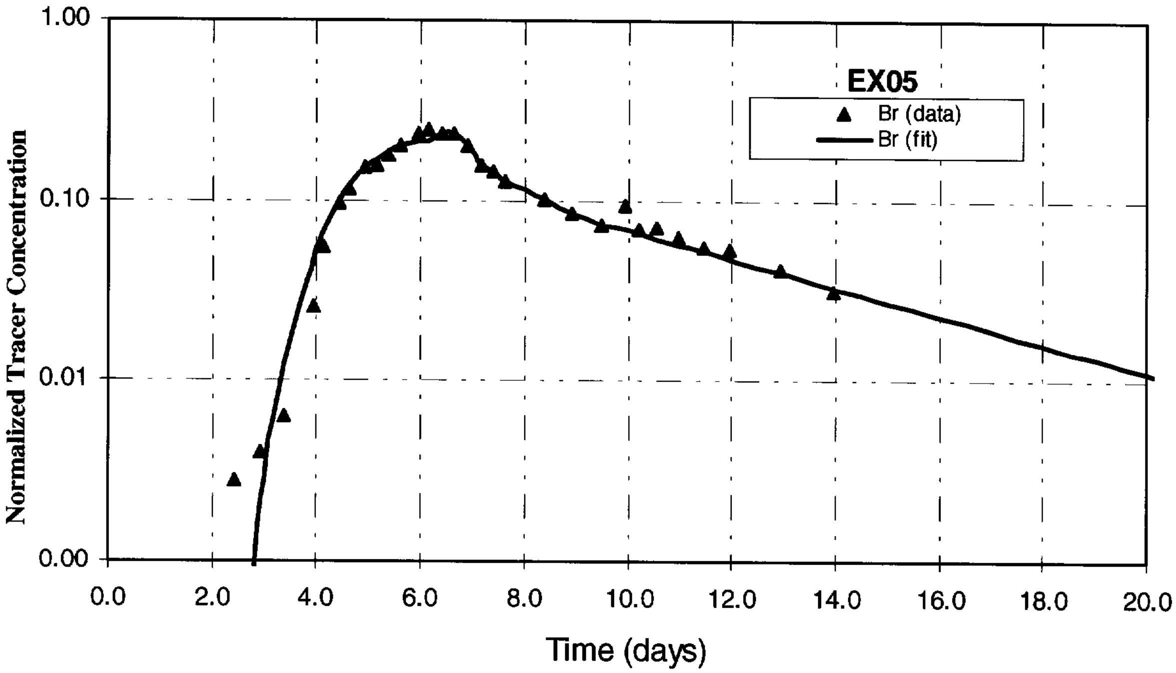
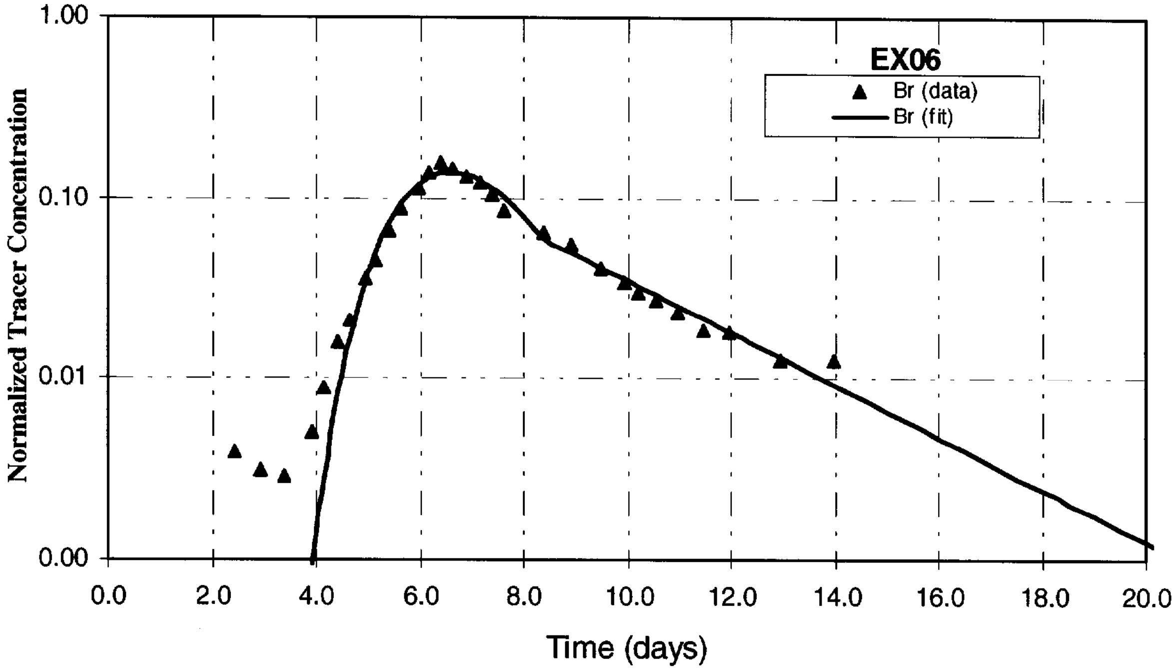
Figure 9.3b





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CITT Tracer Response at Extraction Wells EX05 and EX06

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Figure 9.3c

Table 9.1 Summary of CITT Results

Well Name	Tracer Recovery (%)	Swept Volume (gallons)	Mean Residence Time (days)
EX1	14.5	800	6.4
EX2	20.8	1,230	6.8
EX3	6.7	390	6.6
EX4R	16	910	6.5
EX5	16	1,000	7.3
EX6	8.	480	6.9
Total	82.0	4,810	

To minimize the movement of tracers vertically upward towards the water table and the associated LNAPL smear zone, a dual injection system was recommended and implemented for the PITT. In addition, the extraction rates were also slightly adjusted to balance the uneven tracer mass recovery observed in the CITT. The PITT results, as presented in Section 11.0, support the conclusion that the information gained from the CITT was of great value in making final decisions on the PITT design.

10.0 PITT FIELD IMPLEMENTATION

This section provides an overview of the actual field implementation of the PITT. Included in the discussion is a chronological description of the main events involved in the conduct of the test and the main sampling events. A more detailed description of the actual field activities and sampling events can be found in the Work Plan and the Sampling and Analysis Plan (DE&S 1998a; DE&S 1998b).

The test system was shut down after completion of the CITT to perform general maintenance, install system upgrades, and make modifications to accommodate the recommendations for the final PITT design. The final PITT design required that three additional injection lines be added to facilitate upper hydraulic-control injection into the upper screen intervals of the three IN wells. Injection of tracer-free water into the upper zone was intended to keep the tracers from flowing through the Varsol™ NAPL zone by maintaining hydraulic control of the upper section of the aquifer.

10.1 PITT Operations

The tracer solution, which contained both non-partitioning and partitioning tracers, was prepared by filling 3,000 gallon tanks with 2,500 gallons of potable water and then adding the tracers in four liter increments. Two tracer batches were mixed in separate tanks resulting in a tracer slug of about 5,000 gallons. Table 10.1 provides a list of the tracers mixed in the batch, the volume added per tank and the approximate final concentrations. The heavier or longer-chained alcohols, such as heptanol, have low aqueous solubilities and therefore, do not readily mix with water. After adding the alcohols to the tank, an alcohol phase was clearly seen floating on top of the water. The alcohols were completely mixed into solution by recirculating the water in the tanks until there was no visible evidence of an undissolved alcohol phase. Mixing was considered complete after approximately two days of recirculation.

Table 10.1 Tracer Volumes and Approximate Concentrations per Tank

Tracer	Volume added/Tank	Concentration (mg/L)
1-Propanol	12 liters	1,000
Methanol	3 gallons	950
4-methyl-2-Pentanol	12 liters	1,000
1-Hexanol	12 liters	1,000
1-Heptanol	8 liters	700

To avoid tracer concentration fluctuations in the injectate it is important that the tracer batch be completely homogenous. To achieve this, the tanks were cross-mixed after the alcohols had been dissolved into solution. Cross mixing was accomplished by inserting the "Tank A" recirculation line into "Tank B" and placing the "Tank B" recirculation line into "Tank A". The tanks were mixed in this manner for approximately 24 hours.

During the interim period between the completion of the CITT and the start of the PITT, the upper zone injection system was installed and maintenance tasks were completed on the test system. Upon completion of these interim activities, in preparation for the PITT, the test system was brought back on line. A water flood was started using the design flow rates as outlined in Table 8.7 to establish a steady-state flow field before initiating tracer injection. On May 13, 1998 following 24 hours of water flooding, tracer injection was begun. Tracer injection continued for a period of approximately five days, which was then immediately followed by 35 days of water flooding. The total duration of the PITT was 40 days; the test was terminated on June, 22 1998.

During the test, flow rates and water levels were controlled, monitored and logged as described in Section 9.0 regarding CITT operations. In addition, during the PITT the upper injection zone system was also electronically controlled by the DAS. Plots of flow rates, cumulative volume and water levels are given in Appendix M. These figures show that flow rates and water levels remained stable throughout the duration of the test.

10.2 PITT Tracer Sampling

As part of the PITT procedure, samples of the injectate, extraction-well effluent and from the multilevel samplers (MLS) were collected and analyzed for tracer concentrations. Injectate and extraction-well samples were collected in 22-mL glass jars capped with Teflon-lined caps. MLS samples were collected in 5-mL vials, also with Teflon-lined caps. All samples were stored in a refrigerator at 4°C.

Injectate samples were taken at various times during tracer injection to verify homogeneity of the tracer slug. An injectate sample was taken 15 minutes before and 15 minutes after tracer injection had begun. The injectate was then sampled at a rate of one sample per day until injection ended. Finally, samples were collected five minutes before injection terminated, and also five and 20 minutes after injection terminated. Samples were taken from a sampling port that had been installed in the injection line.

Effluent samples were collected by the autocollector following the sample schedule outlined in Table 8.10. Manual samples were also taken as backup samples at one half the automated sampling rate. Duplicates and equipment blanks were taken at a rate of one for every 20 samples collected.

Obtaining sufficient flow from the multilevel sampling points proved to be problematic. After repeated sampling attempts, flow could only be established in three of the nine sampling ports - specifically, MLS-2 at 17.0 ft and 18.5 ft bgs, and MLS-3 at 17.5 ft bgs. Samples were collected at these points following the schedule outlined in Table 8.10.

Samples to be analyzed for tracer concentrations were packed in coolers with ice and shipped to Mantech Environmental of Ada, Oklahoma. A trip blank prepared with diagnostic-grade water was placed in each cooler.

10.3 PITT Tracer Analysis

The PITT samples were analyzed for tracers by a gas chromatography (GC) method which initially involved direct injection onto a capillary column. *The Standard Operating Procedure (SOP) for GC Analysis of Alcohol Compounds in Water Samples*, by Mantech is in Appendix O. However, this very quickly created severe fouling of the capillary column, which is most likely attributed to the calcium content of the samples from $CaCl_2$ injection with the tracers. After several attempts to salvage this method by regenerating the capillary column and even by replacing it, the method was abandoned. Several options were explored, including a full evaporation GC technique that would not involve direct injection and also a high pressure liquid chromatography (HPLC) method. Finally it was decided to switch to direct injection onto a packed column. This method was successful, and was used on all samples analyzed after May 28, 1998, which approximately corresponds to PITT samples collected after May 17, 1998 (four days after the PITT was initiated). No more fouling difficulties were encountered with the use of the packed column; however, the new method raised the tracer detection limits from 1 ppm to 5 ppm for all tracers except for 1-heptanol, which could only be quantified accurately to 10 ppm with the packed column. The time spent exploring alternative analytical methods and developing the packed column method also created a backlog of samples to be analyzed (see Section 11.1.1 for more details). Full details of the analytical methods used for tracer analyses are provided in Appendix Q.

10.4 Water Quality Monitoring

In addition to the samples collected for tracer analysis, various water quality parameters were also monitored as part of the PITT operations. Also, temperature, pH and conductivity were measured at many locations in the well field for input requirements to the SEAR design process.

A small amount of arsenic (≅ 3mg/kg) contamination was present in the dry, granulated calcium chloride used to make the water-flood solutions. Since $CaCl_2$ was injected at

0.1 wt%, arsenic concentrations in the injected solution did not exceed 3 µg/L. Perimeter monitor wells were sampled and analyzed to detect potential increases in arsenic levels that occurred during the PITT. Monitor wells were also sampled for tracer concentrations to verify that hydraulic control was maintained throughout the test and that tracers did not migrate beyond the confines of the test zone.

Samples were collected from wells IW01, RW01, RW02, RW04 and the six extraction wells for field measurement of pH, conductivity, and temperature. The data was used in the design of the surfactant flood and wastewater treatment system. The six extraction wells were sampled two to three times per week and the remaining monitor wells were sampled weekly. The pH was measured with an Orion Model 250A pH meter, and the conductivity and temperature was measured with a conductivity probe. The data for these field-measured parameters are presented in Appendix N.

Extraction well samples were collected from sampling tees in the autocollector trailer. Sample lines were purged before sample collection to prevent cross contamination. Monitor well samples were collected using a peristaltic pump. Samples were taken near the bottom of the well bore and at various depths to determine if any concentration gradients existed in the wells. The data is presented in Appendix N.

Monitor wells MW02 and MW02IW were sampled on a weekly basis and analyzed for the presence of tracers to determine if injectate was escaping from the test zone. In addition, samples were collected from MW02, MW03 and MW05 before, during and after test completion to monitor arsenic levels in the aquifer. The resulting data can be found in Appendix O.

All monitor well samples were collected with a peristaltic pump following the monitor well sampling procedure outlined in Appendix L.

11.0 PITT RESULTS AND DATA ANALYSIS

The field measurements and tracer breakthrough curves collected from the PITT and the significance of these results are discussed in this section. The method of analysis applied to the interpretation of the tracer data is also briefly discussed.

11.1 Laboratory Analytical Results

11.1.1 PITT Samples

As discussed in Section 10.3, all PITT samples were analyzed for tracers by direct injection on a GC. Initially, tracer analysis included methanol, but due to analytical problems, including those discussed below, it was decided to discontinue analyzing for methanol. Since methanol was injected as a backup conservative (i.e., non-partitioning) tracer to 1-propanol, and no difficulties were encountered with analysis of 1-propanol, this has not affected the PITT results. PCE concentrations were also obtained for some PITT samples. The complete PITT data set is included in Appendix O.

Several difficulties were encountered during the analysis of the PITT samples. Already mentioned was fouling of the capillary GC column, which created the need to switch to a packed column to analyze PITT samples collected after day four of the PITT. The SOP for the GC analytical method shown in Appendix O indicates the capillary column had a quantitation limit of approximately 1 ppm whereas the tracers analyzed by packed column had a quantitation limit of approximately 5 ppm. Fouling of the GC column had not been detected during GC method development efforts conducted prior to the PITT. During method development activities, tracer solutions were made up with site ground water and $CaCl_2$, but column fouling was not observed to occur until numerous column injections were made for analysis of the PITT samples. Fouling of the capillary column is most likely attributed to the dissolved $CaCl_2$ that was included in the PITT injectate solution to prevent the mobilization of soil fines in the aquifer. The GC fouling problems created a backlog of samples and resulted in the 7-day sample holding time to be exceeded for as many as 70% of the samples collected during the first 15 days of the PITT. The conventional holding time for VOC samples is seven days without sample preservation and 14 days with sample preservation. When fouling problems came to a head, sample preservation was adopted in the field, on Day 16 of the PITT (May 29, 1998), by adding 1% HCl to all PITT samples to extend the sample holding time to 14 days. Fortunately, the missed sample holding times did not significantly affect the accuracy of the analytical results. Follow-up laboratory studies to evaluate the effect of missed holding time showed that there was no statistically significant difference in the tracer concentrations obtained between samples analyzed within their holding time and up to two weeks beyond their holding time. A summary of the holding-time study is provided in Appendix P.

A related analytical issue involved quantifying peak tracer concentrations, which sometimes exceeded the maximum tracer detection limit of approximately 200 ppm, and therefore required dilution and reanalysis. Due to the backlog of PITT samples, the reanalysis of such samples was performed three weeks after the initial analysis. In some of these samples, the final analytical result after dilution and reanalysis was ≤ 200 ppm. This decrease in the analytical result for tracer concentrations, between the original sample analysis and the later reanalysis, is suspected to have resulted in an underestimate to some degree of the actual tracer concentrations. The effects of this possible analytical issue on the PITT results are discussed in Section 11.4.3.

Finally, the increase in the quantitation limit to 5-10 ppm, caused by the modification of the analytical method (from a capillary column to a packed column), truncated the useful data set to some degree for all tracers in the tail region of the tracer curve. The effect of this is discussed in Section 11.2.

11.1.2 Monitor Well Samples

Several perimeter monitor wells were sampled for tracers and also for arsenic, during and on completion of the PITT. Wells MW02 and MW02I were sampled for tracer analysis, and wells MW02, MW03, and MW05 were sampled for arsenic analysis. The analytical results for these perimeter monitor points are included at the end of the PITT analytical results in Appendix O.

Most of the tracer analyses in these perimeter monitor wells were below detection limits. In a few of the samples (4 out of 46), tracer was detected at ppm levels, which can be attributed to carryover in the GC column (i.e., carryover from the previous sample analysis) since carryover was also observed in a similar percentage of method blank analyses.

The analytical results for arsenic were below detection limits (<5 ppb) for all of the arsenic monitoring samples.

11.2 Tracer Data Analysis Approach

The first step in the PITT data analysis process was a Quality Assurance/Quality Control (QA/QC) evaluation of the PITT dataset. The QA/QC process is necessary to validate the PITT data for interpretation of the PITT. The PITT data QA/QC report is presented in Appendix O, along with the PITT dataset.

To ensure the quality of the data used for DNAPL volume estimation, tracer data that did not meet QA/QC criteria were eliminated from the data base. The tracer data

QA/QC process also excludes the tracer data in which the measured concentrations are below the detection limits of the GC method of analysis. The reported GC detection limits were about 5 mg/L for all the tracers except 1-heptanol, which was about 10 mg/L. Figure 11.1 provides a visual comparison of the complete tracer dataset (upper plot) versus the tracer data that was used for analysis of the PITT (lower plot). The tracer data for 1-propanol that lie along the detection limit line (upper plot) were not used in the PITT analysis since the concentrations at that point were at the quantitation limit, and we could not have confidence in the accuracy of the data. Therefore, the curve fit for 1-propanol is based upon an extrapolation of the data below the quantitation limit, as shown in the lower plot in Figure 11.1.

The second step of the data analysis process is to evaluate the available field data and select a pair of non-partitioning and partitioning tracers to use for DNAPL volume and saturation estimation. Theoretically, each pair of non-partitioning and partitioning tracer data can give an independent estimate of DNAPL volume and saturation. From a practical standpoint, however, the retardation factor should be greater than 1.2 in order to increase the estimation accuracy (Jin,1995). The conservative tracer used for the PITT data analysis was 1-propanol. As shown in Figure 11.2, the tracer separation between 1-propanol and 4-methyl-2-pentanol (4M2P) is too small to provide an accurate estimate of DNAPL saturation. In general, the retardation factor of 4M2P from this tracer test was smaller compared with 1-hexanol and 1-heptanol. Therefore, the tracer data of 4M2P was not used for the data analysis.

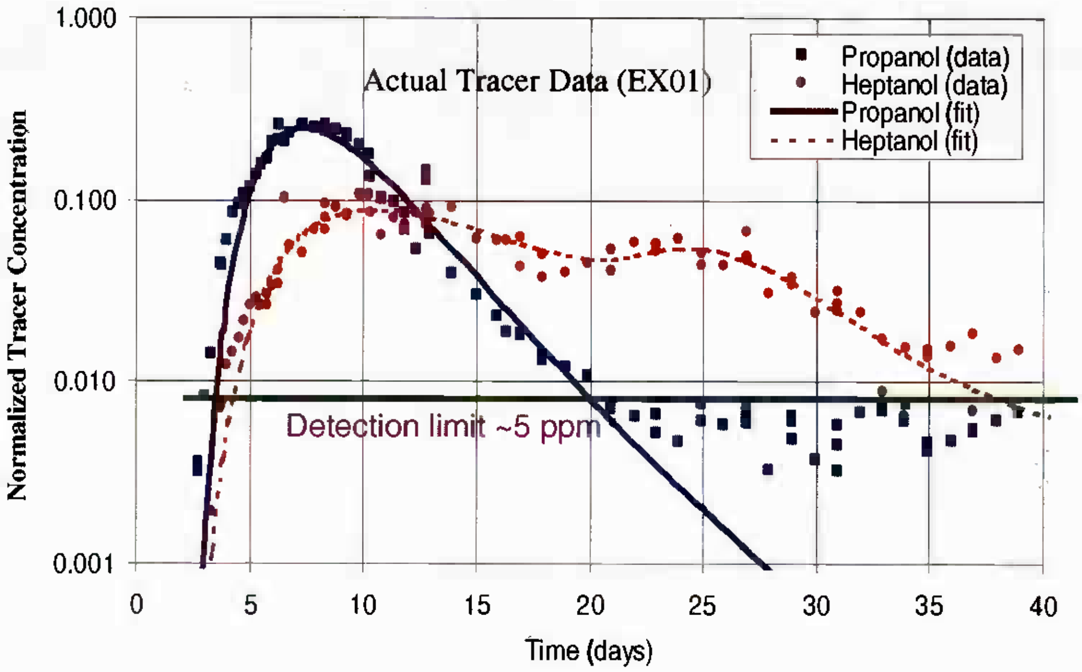
The third step is to fit the tracer response data with smooth curves and estimate the DNAPL volume and saturation as a function of tracer cutoff time. The estimated DNAPL volume and saturation should approach a plateau (not shown, see Jin et al., 1997b, Figure 9) as the tracer test approaches completion. For this tracer test, the analysis was done by fitting the tracer response data using the following exponential decline equation,

$$C(t)=\sum_{i=1}^{n} Exp(a_i+\frac{b_i}{t}+c_i \ln(t)) \qquad (11.2\text{-}1)$$

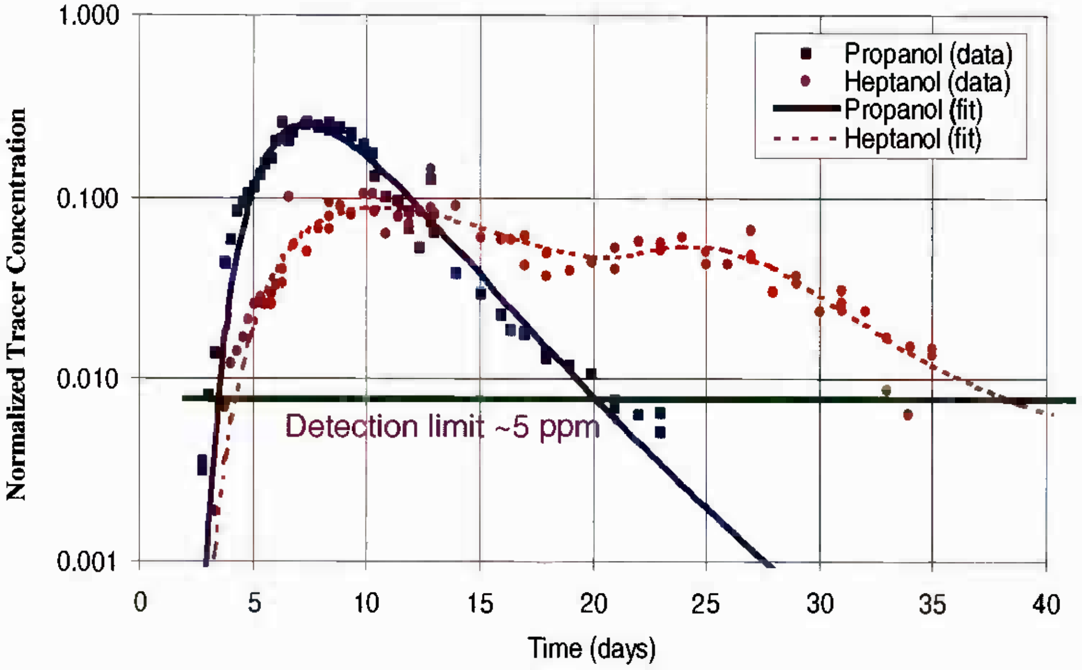
where n is the number of peaks observed in each individual tracer response curve and a_i, b_i, and c_i are the corresponding fitting parameters. In most cases, there is only one peak in a tracer response curve and the correlation equation (1) can be simplified to

$$C(t)=Exp(a+b/t+c\ln(t)) \qquad (11.2\text{-}2)$$

The fitting of the tracer data to the above equation also provides a unique way of estimating the uncertainty of the estimated DNAPL saturation from a given set of GC measured tracer data. The standard error of DNAPL saturation estimation from a PITT



Tracer Data Used for PCE Estimation (EX01)



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Example of QA/QC of Tracer Data

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Figure 11.1

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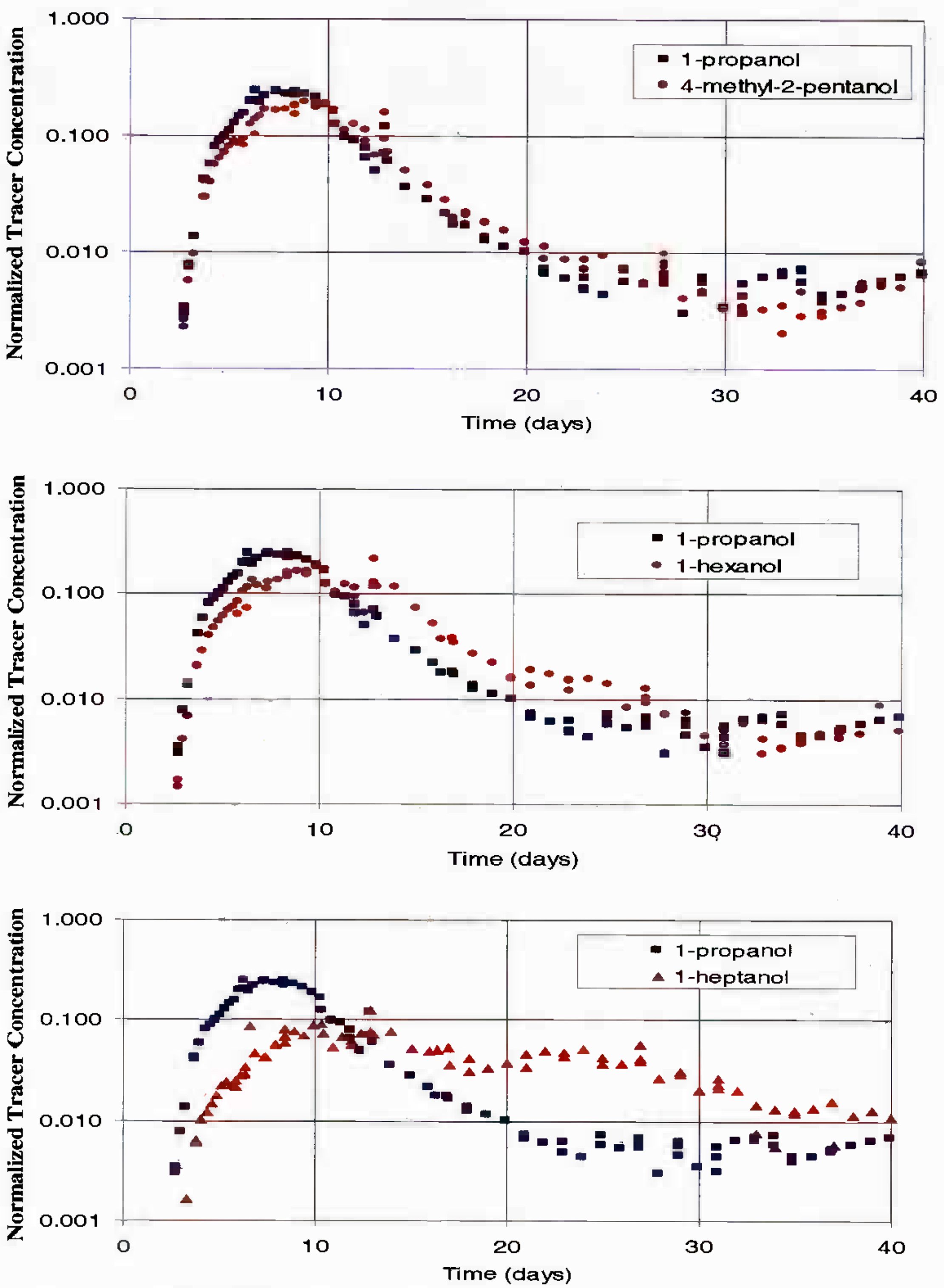

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Comparison of Degree of Separation of Tracer Response at EX01

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Figure 11.2

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can be estimated based on the standard errors of the fitting parameters, and the DNAPL saturation estimation accuracy can be increased by increasing the accuracy of the curve fitting parameters. Figure 11.3 shows an example of the fitting parameters and the corresponding standard errors of the 1-propanol response curve for extraction well EX1.

Because the tracer concentration and the flow rate data were not recorded at the same time, a separate program was used to convert the tracer response data (which are recorded as a function of time) into a function of total volume of water extracted. The program first reads in the actual cumulative volume of fluid injected/extracted for each well as a function of time based on the information obtained from the injection/extraction logs. These data are then used as a lookup table. When the sample time/tracer concentration is read in as the input, the program interprets the corresponding volumes of water injected/extracted from the lookup table.

11.3 Method of First Temporal Moment Analysis

The theoretical foundation for the method of first temporal moment analysis of partitioning tracer tests can be found in Jin et al. (1995) and Jin (1995). This method can be used to estimate the tracer swept volume (the volume of the aquifer through which the tracer solution has flowed), the average DNAPL saturation in the tracer swept volume, and the total DNAPL volume. For a partitioning tracer test with multiple extraction wells, the following equations are applied to each individual extraction/injection well pair.

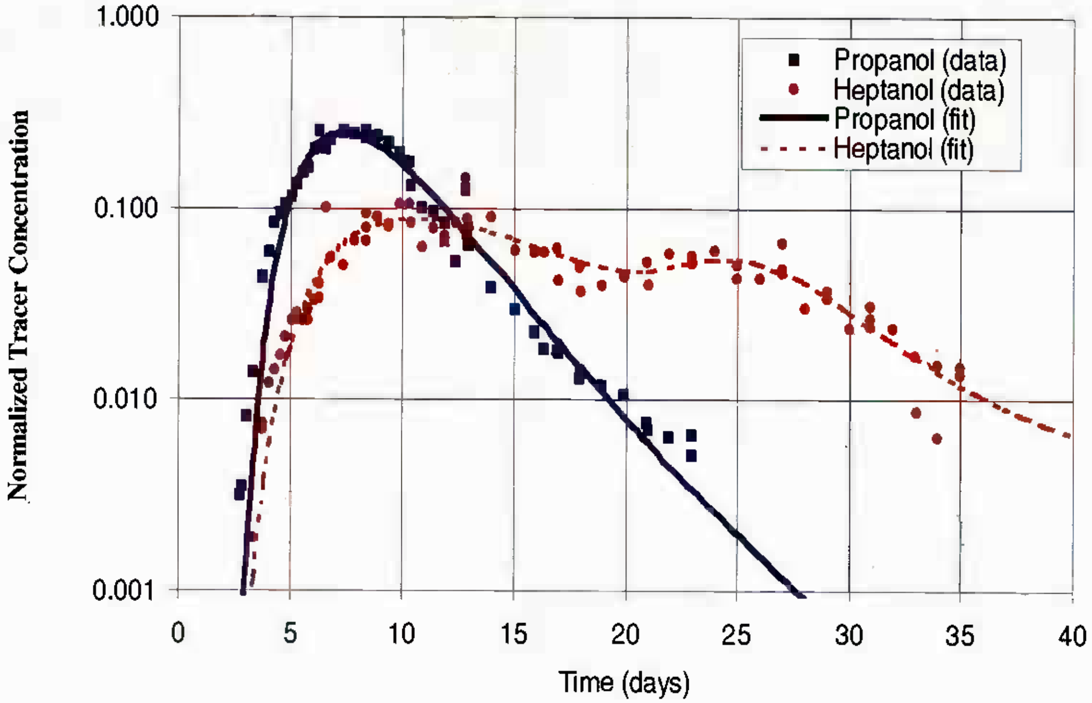
The average DNAPL saturation in the tracer swept volume (S_n) is calculated using the equation below:

$$S_n = \frac{R_f - 1}{R_f + K_P - 1} \qquad (11.1\text{-}1)$$

where K_P is the partition coefficient of the partitioning tracer, and R_f is the retardation factor defined as

$$R_f = \frac{\bar{t}_p}{\bar{t}_n} \qquad (11.1\text{-}2)$$

where $\bar{t}_p$ and $\bar{t}_n$ are the first temporal moments of the partitioning tracer and nonpartitioning tracer, respectively, and calculated using the following equations



Propanol Nonlinear Regression Fitting Equation

$a = 33.6 \pm 1.5$

$b = -69.6 \pm 3.7$

$c = -9.4 \pm 0.5$

C(t)=Exp(33.6-69.6/t-9.4*ln(t))

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Figure 11.3

$$\bar{t}_p = \frac{\int_0^{t_f} tC_p(t)dt}{\int_0^{t_f} C_p(t)dt} - \frac{t_s}{2}, \qquad (11.1\text{-}3)$$

and

$$\bar{t}_n = \frac{\int_0^{t_f} tC_n(t)dt}{\int_0^{t_f} C_n(t)dt} - \frac{t_s}{2}, \qquad (11.1\text{-}4)$$

where t_s is the slug size, i.e., the time period in which the tracer mass was injected during tracer test, t_f is the tracer test cutoff time, and $C_p(t)$ and $C_n(t)$ represent the partitioning and nonpartitioning tracer concentration as a function of time, respectively.

The average DNAPL saturation was estimated by calculating the first moments of the partitioning and nonpartitioning tracers using equations (11.1-3) and (11.1-4), by numerically integrating the corresponding tracer response curves. Next, equation (11.1-2) was used to calculate the retardation factor and then equation (11.1-1) was used to estimate the average DNAPL saturation in the swept volume.

With S_n and $\bar{t}_n$ known, the tracer swept pore volume of one particular extraction well (V_p) is now calculated as,

$$V_p = \frac{m}{M}\frac{Q\bar{t}_n}{1-S_n} \qquad (11.1\text{-}5)$$

where M is the total mass of tracer injected, and m is the total mass of tracer produced from the particular extraction well. Q is the total injection rate.

For the conservative tracer test, the tracer only sweeps the pore volume occupied by water. The tracer swept pore volume of the one particular extraction well in this case can be calculated as,

$$V_p = \frac{mQ\bar{t}_n}{M} \qquad (11.1\text{-}6)$$

11.4 PITT Data Analysis

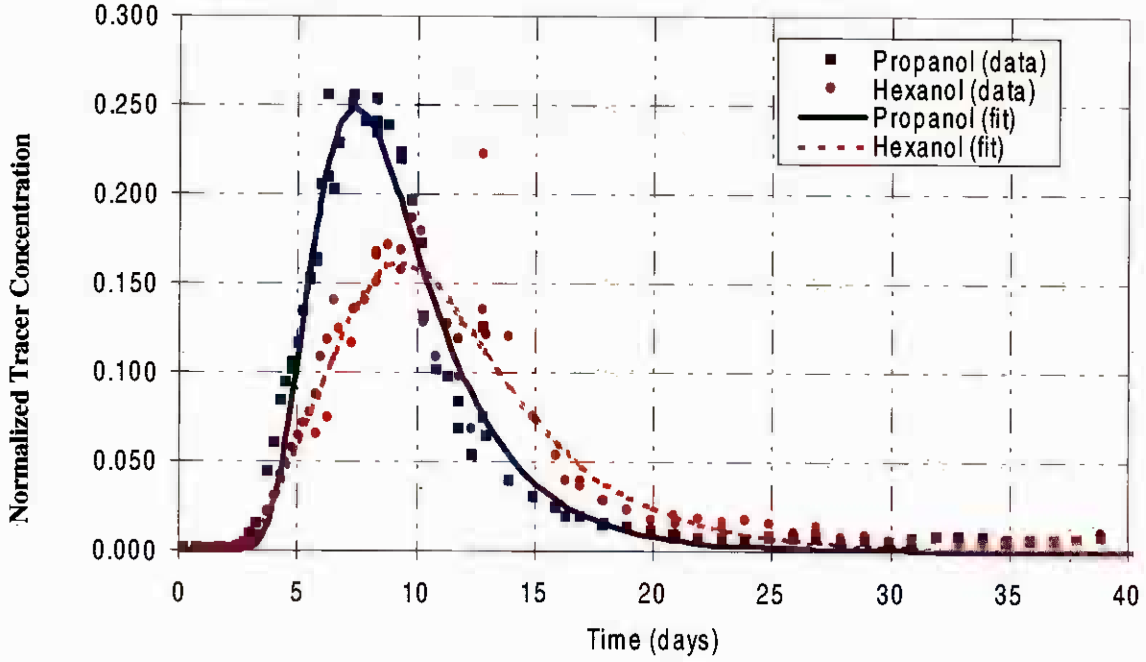
11.4.1 Extraction Well Tracer Data Analysis

Tracer concentrations for PITT samples were normalized to tracer injectate concentrations. Normalized concentrations, which are dimensionless, are calculated by dividing each measured sample concentration by the averaged tracer injectate concentration (also measured by GC analysis). The normalized tracer concentration histories and the corresponding fitted curves for the six extraction wells are shown in Figures 11.4a through 11.9. In each of the figures presented, the top graph shows the tracer concentration in a linear scale and the bottom in a semi-log scale. The linear scale graphs show the separation of tracer peak concentrations better while the semi-log scales give more information on the tailing of tracer response curves.

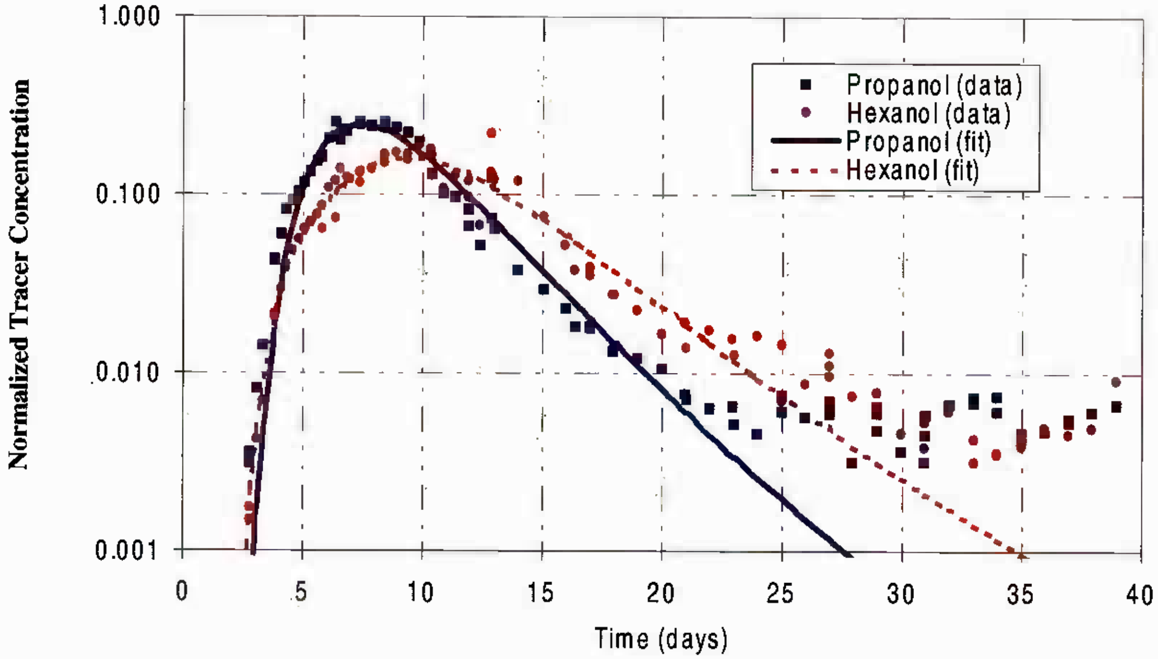
The data for only one conservative tracer (1-propanol) and two partitioning tracers (1-hexanol and 1-heptanol) data are presented in these figures. This is because the partition coefficient of 4M2P is very small, and negligible chromatographic separation was observed in this PITT between 4M2P and the conservative tracer. The separation of the tracer response between 1-propanol and 1-heptanol in all six extraction wells clearly indicates the presence of DNAPL in the pore space swept by the partitioning tracers. Since the degree of separation is different for each well, it can be inferred that the DNAPL is not uniformly distributed in the pore space swept by the partitioning tracers. Since the degree of tracer separation decreases for the wells farther away from the building, this also implies that most of the DNAPL in the test zone is near the building.

The tracer curves were analyzed using the method of first temporal moment as presented in Section 11.1 of this report. The resulting estimates of the DNAPL volume within each interwell swept pore volume are summarized in Table 11.1. The pore volume (shown as swept volume) of the aquifer swept by the tracers, for each interwell pair, as determined by the moment analyses is also shown in this table. The total aquifer pore volume swept by the tracers was 4,780 gallons as determined by summing the swept volumes calculated for each interwell pair. Moment analysis of the tracer response curves gives an estimated volume of 87 gallons of DNAPL in this swept pore volume, corresponding to an average DNAPL saturation of 1.8% throughout the test zone. The cumulative tracer recovery for 1-propanol is 85%. The cumulative tracer recovery for 1-propanol is 85%. The recoveries of the other tracers used are approximately the same, in the range of 85% ± 3%.

Linear Scale



Semi-log Scale



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Extraction Well EX01 Hexanol Tracer Response

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Figure 11.4a

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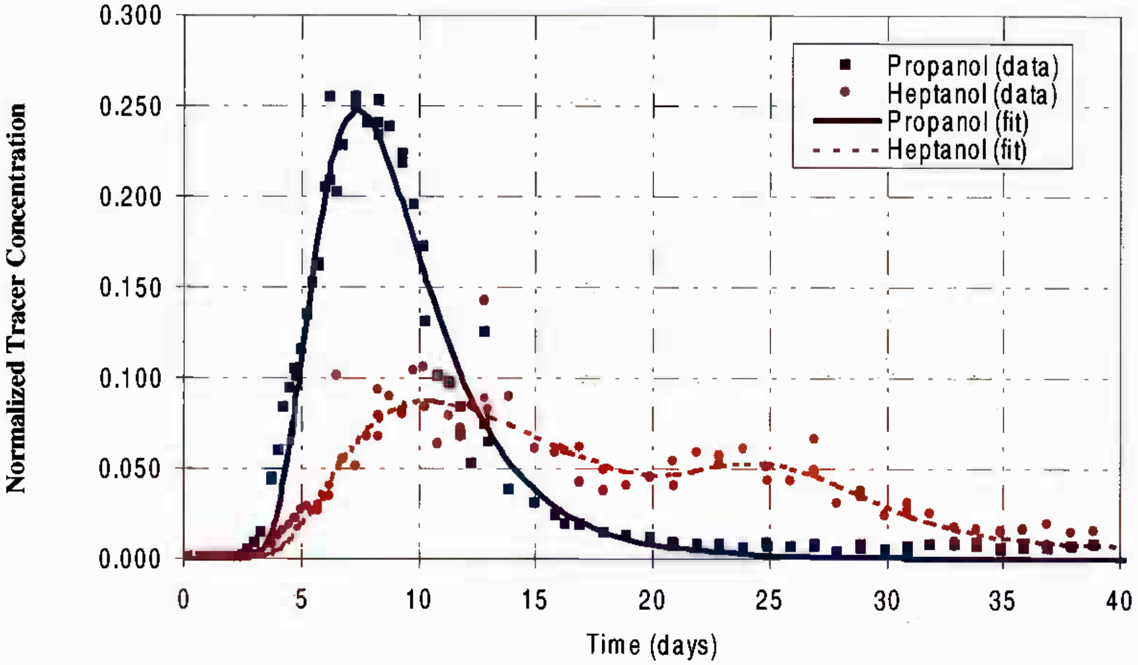
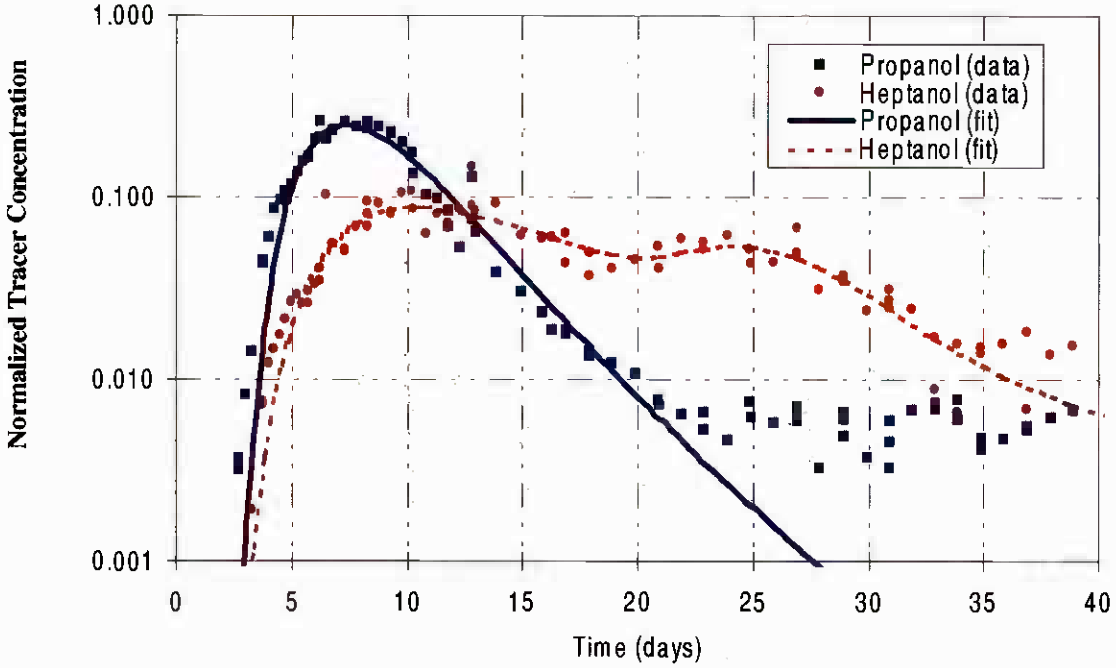
Linear Scale



Semi-log Scale



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Extraction well EX01 Heptanol Tracer Response

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Figure 11.4b

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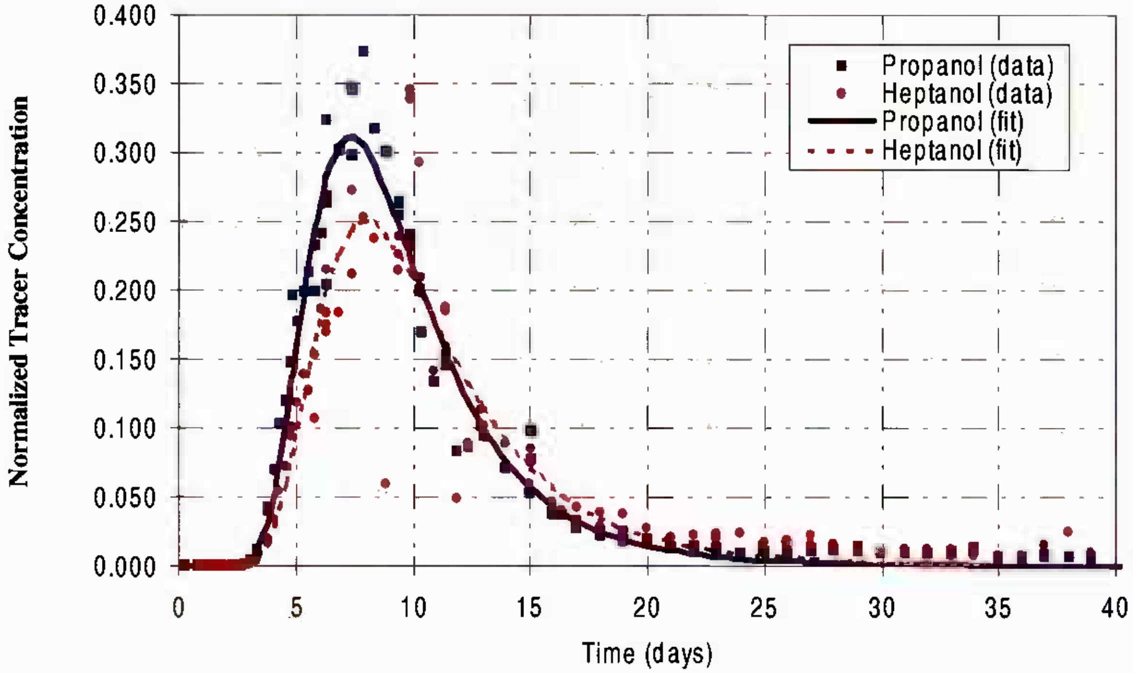
Linear Scale



Semi-log Scale

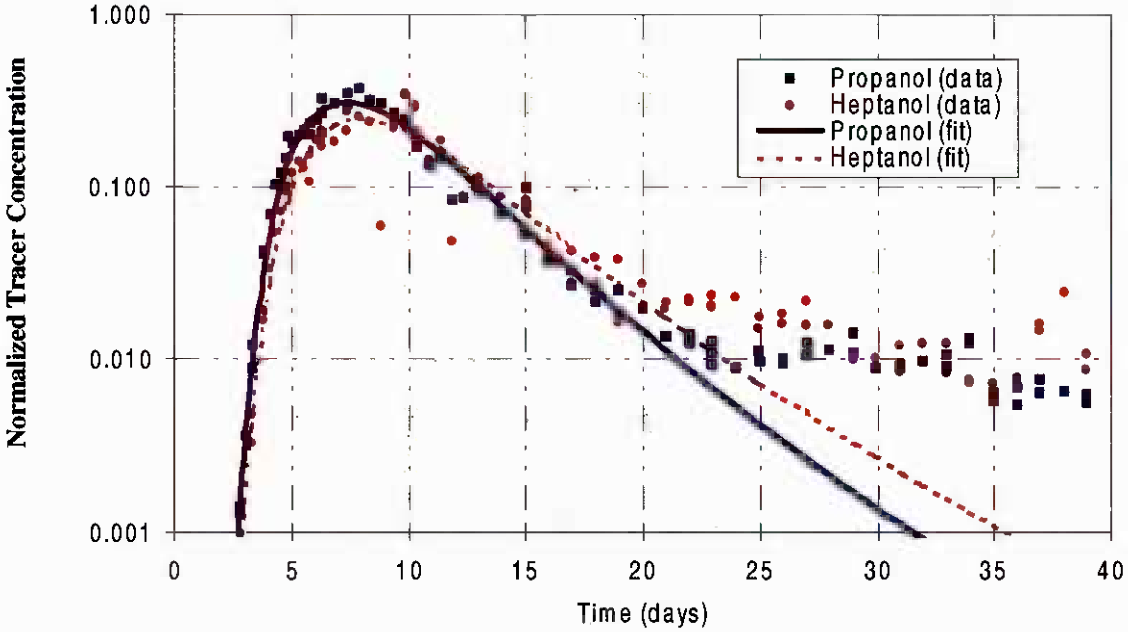


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	Figure 11.5

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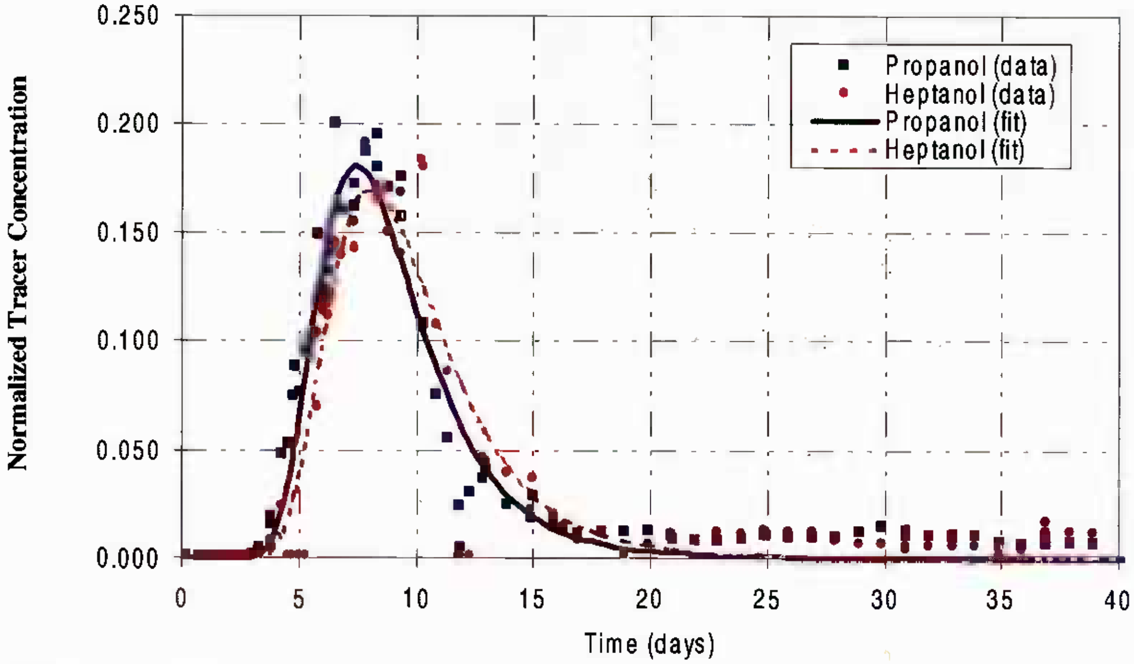
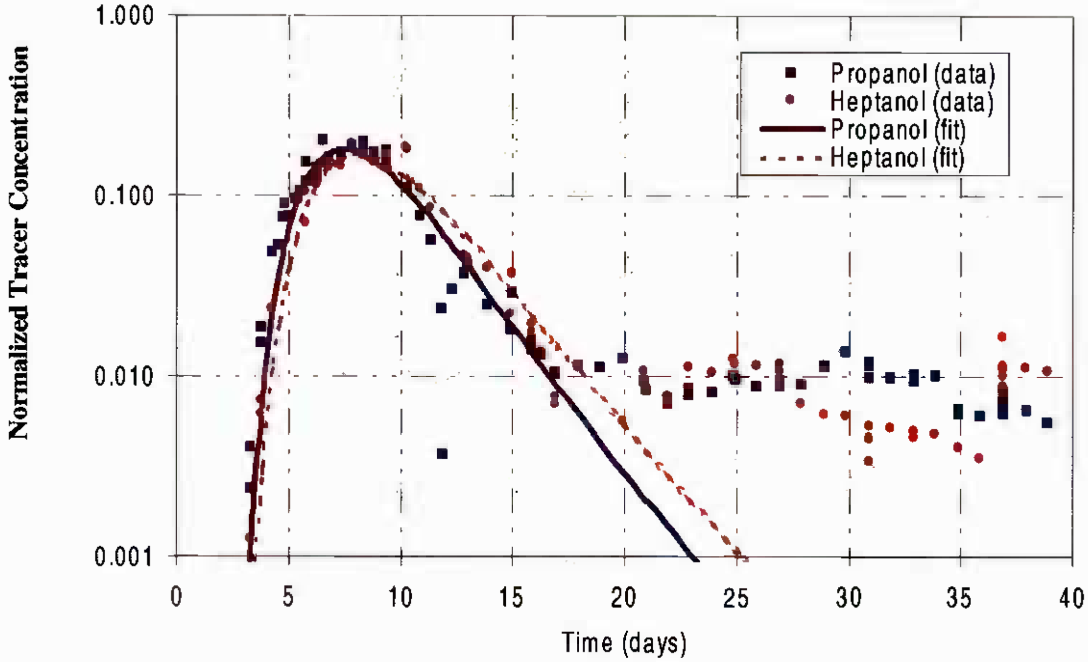
Linear Scale



Semi-log Scale



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Extraction Well EX03 Heptanol Tracer Response

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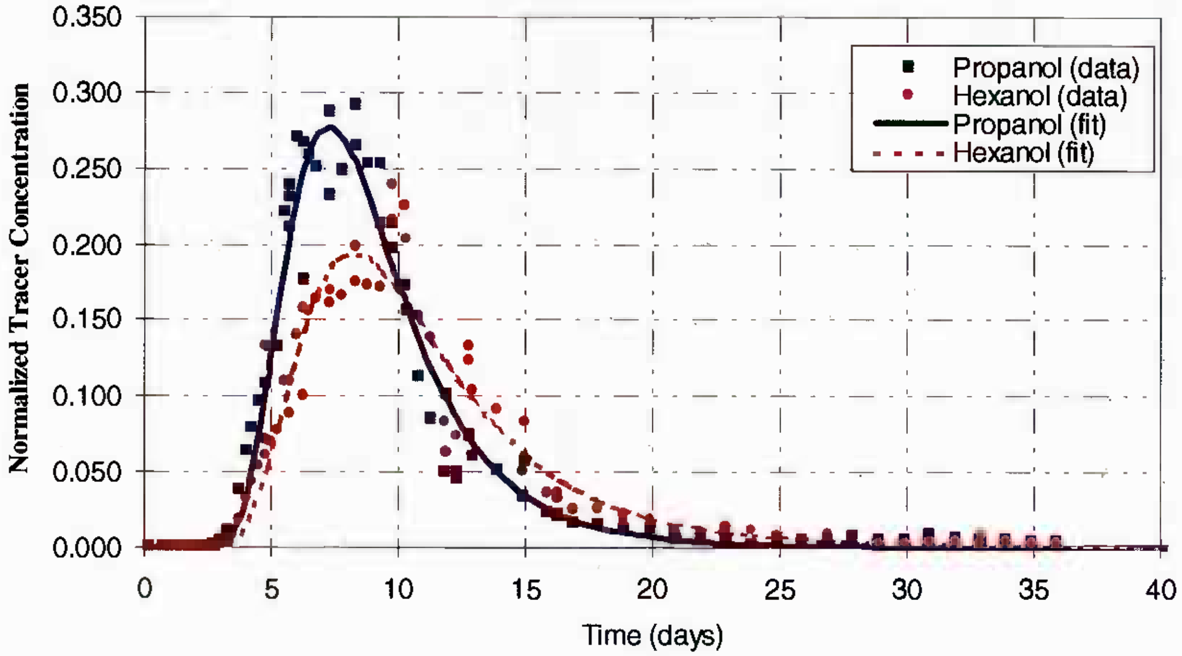
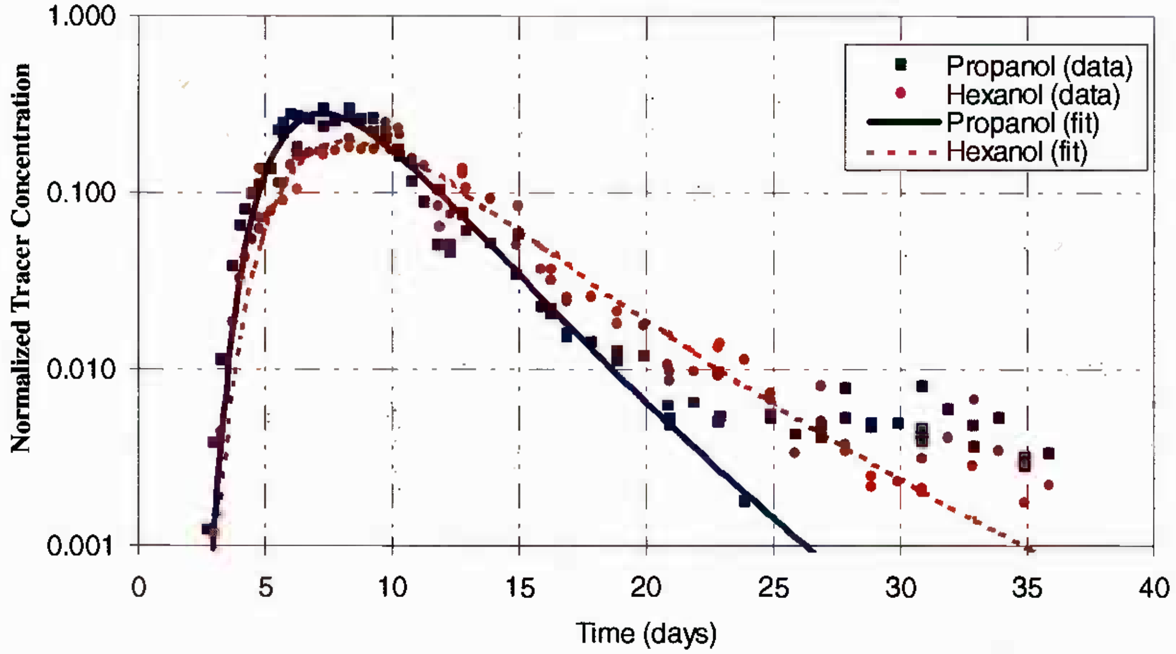
Figure 11.6

02324E25Y

Linear Scale



Semi-log Scale



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Extraction Well EX04R Hexanol Tracer Response

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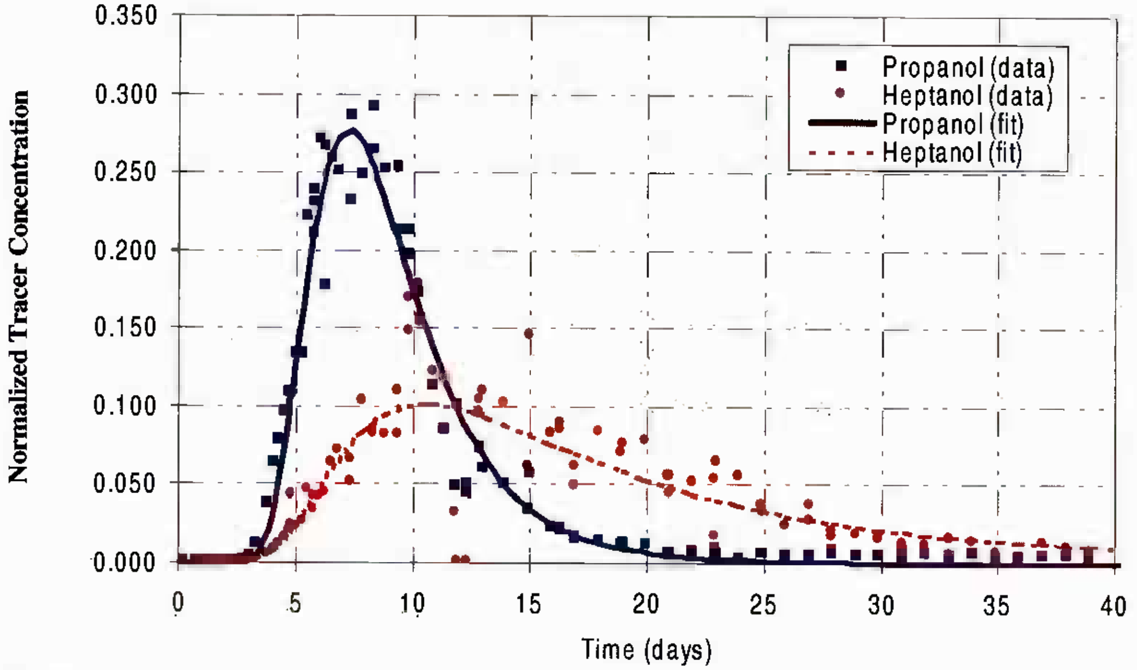
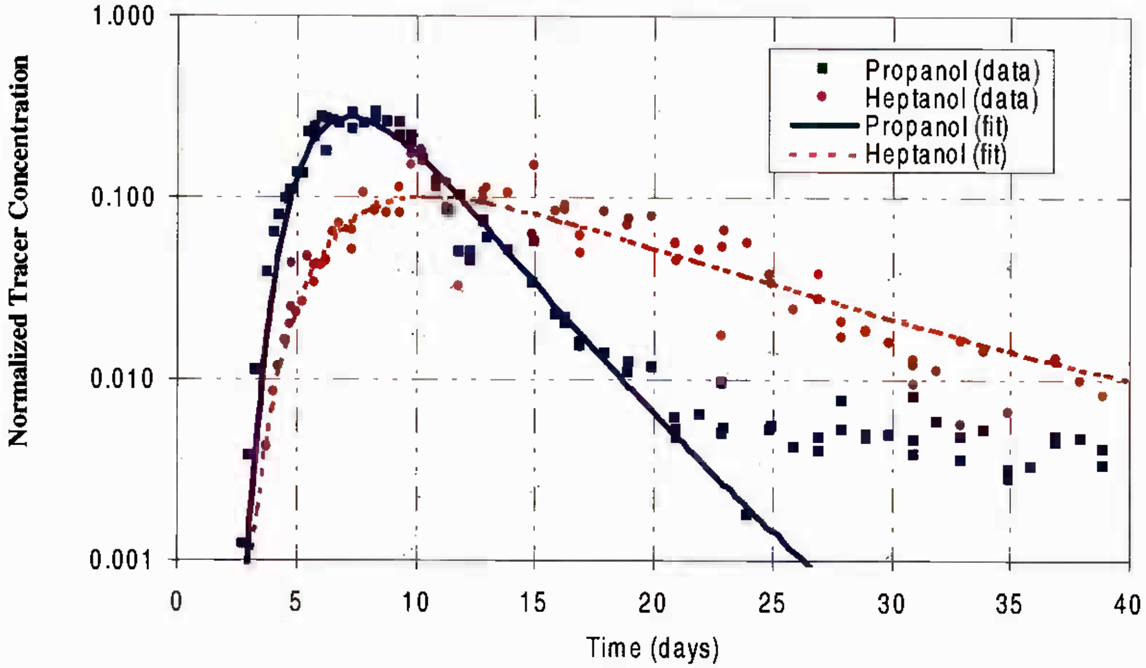
Figure 11.7a

Linear Scale



Semi-log Scale



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Extraction Well EX04R Heptanol Tracer Response

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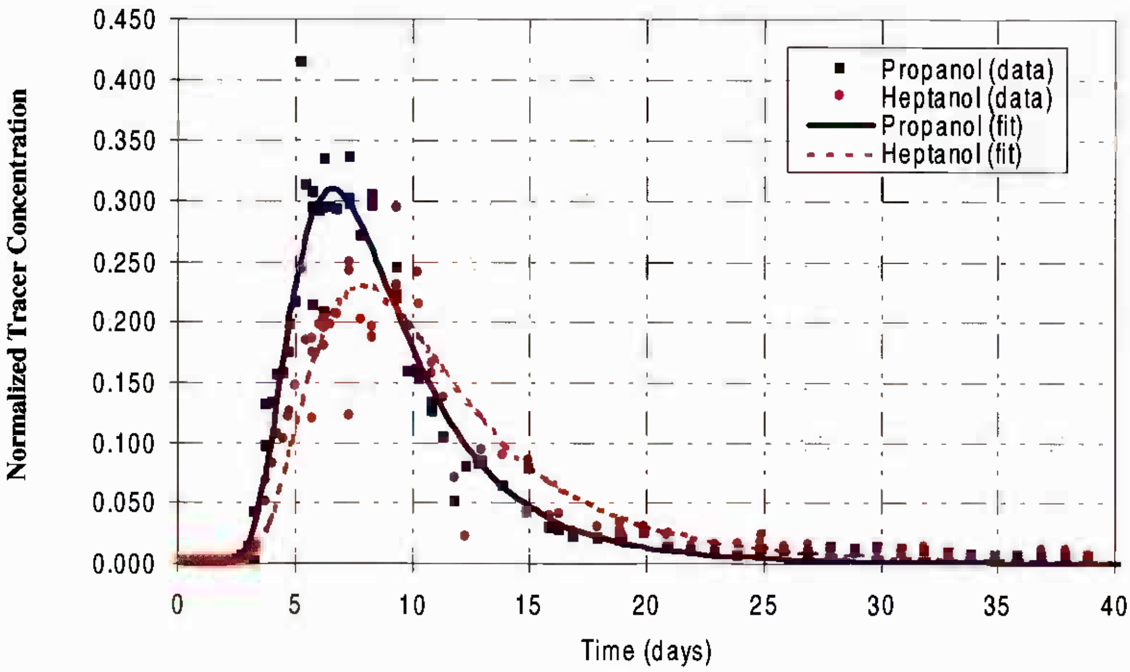
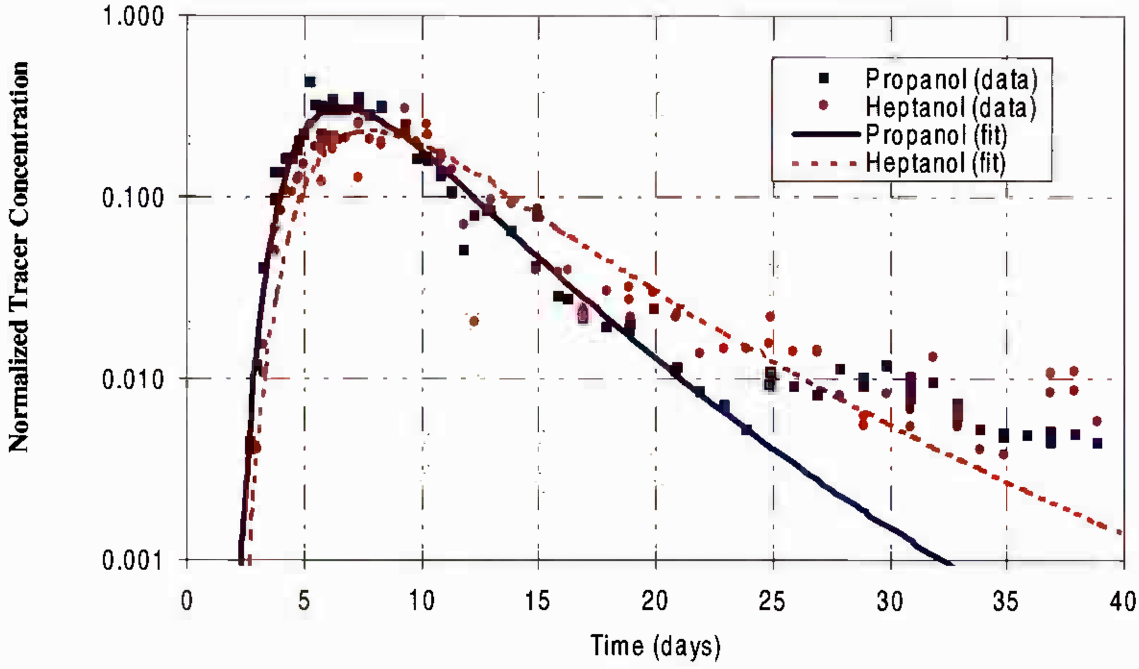
Figure 11.7b

02324E27Y

Linear Scale



Semi-log Scale



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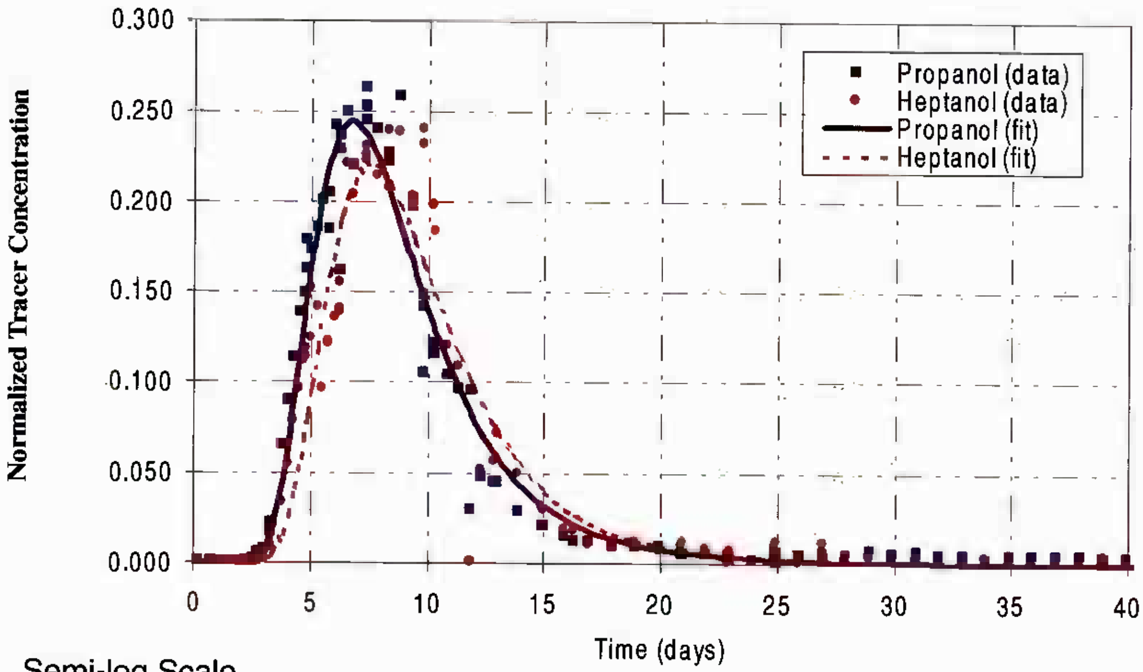
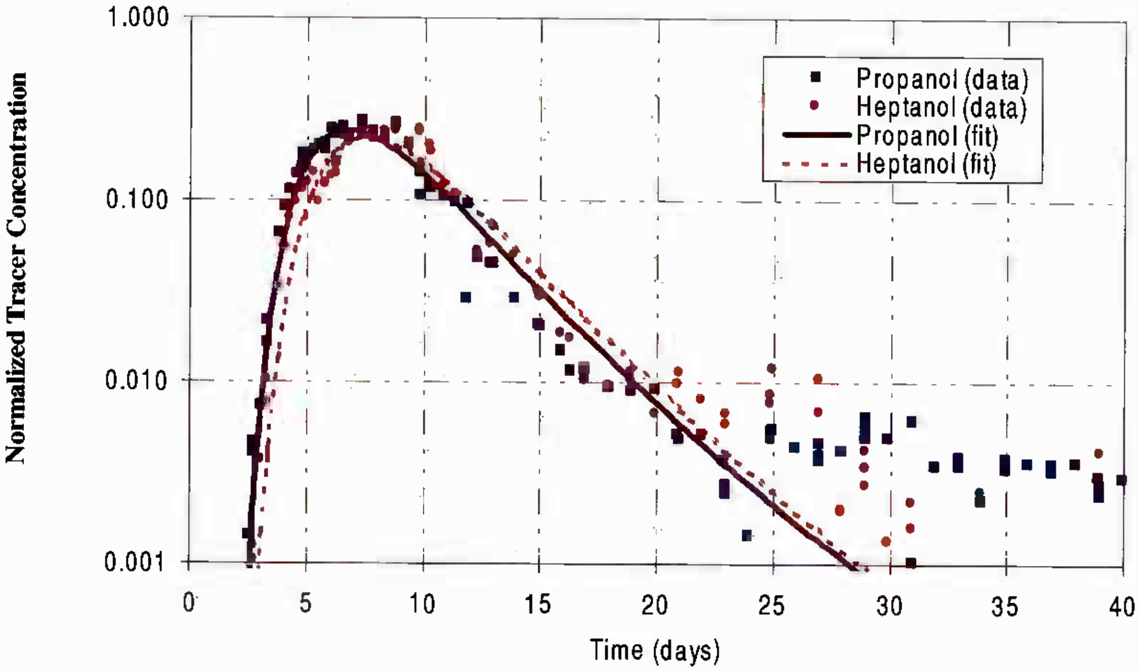
Linear Scale



Semi-log Scale



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Extraction Well EX06 Heptanol Tracer Response

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Figure 11.9

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Table 11.1 Summary of Extraction Well PITT results

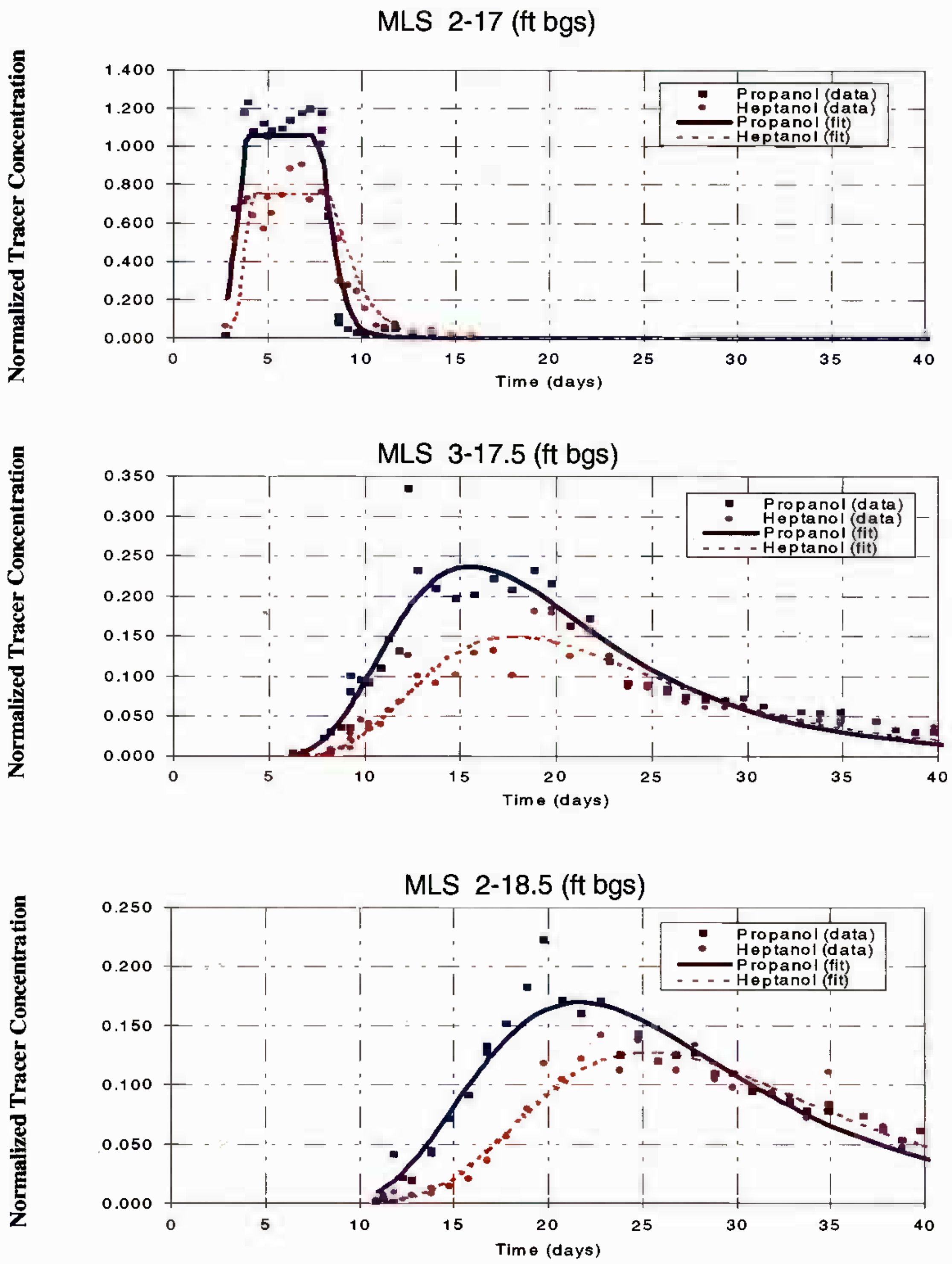
Well	Recovery (%)	Swept Volume (gals)		Saturation (%)		PCE Volume (gals)	
		1-Hexanol	*1-Heptanol*	*1-Hexanol*	*1-Heptanol*	*1-Hexanol*	*1-Heptanol*
EX01	13	790	790	4.1	3.9	33	31
EX02	17		1030		0.5		5
EX03	10		540		0.4		2
EX04R	14	790	790	3.7	4.5	29	36
EX05	17		890		1.0		10
EX06	14		740		0.4		3
Total	85		4780		1.8		87

11.4.2 Multilevel Sampler Tracer Data Analysis

Tracer concentration histories for three multilevel sampling points MLS 2-17, MLS 3-17.5, and MLS 2-18.5 (ft bgs) are shown in Figure 11.10. Tracer data from the six other multilevel sampling points was not available because these sampling points were incapable of yielding a sufficient flow to collect a viable sample, as discussed in Section 10.2.

The chromatographic separation of the partitioning tracer response at the three viable MLS sampling points confirms the existence of DNAPL at these depth locations. Based on the observation and analysis of the partitioning tracer data, several conclusions were drawn. First, the degree of tracer separation in monitor points MLS 2-17, MLS 3-17.5, and MLS 2-18.5 is observed to increase with depth, as shown in Figure 11.10. Based on this observation, it is concluded that DNAPL saturation tends to increase with depth near the base of the shallow aquifer, which implies that the majority of the DNAPL is localized in the silty layer immediately above the clay aquitard. This coincides with soil sampling observations during the initial DNAPL zone investigations. Second, the MLS data shows the non-partitioning tracer breakthrough and peak times are significantly later in the basal silt layer compared to the overlying fine sands. From this it can be inferred that the hydraulic conductivity of the silty layer at the base of the shallow aquifer is lower by a factor of approximately 4 when compared to the overlying fine sands. This has important implications for the SEAR design, as discussed in Section 12.

The MLS tracer data was analyzed by the same method as used for the extraction well tracer data, except that the MLS data analysis was limited to calculating DNAPL saturation but not DNAPL volume. This is because the MLS sampling points are monitor points along the tracer flow path between the injection and extraction wells, and



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Multilevel Sampler Sample Point Tracer Responses

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Figure 11.10

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there is no flow rate associated with the MLS sample points. The flow rate (Q) at an extraction well is required to calculate the swept pore volume, as shown in equation 11.1.5, which is then used to calculate DNAPL volume in the swept pore volume between a given pair of injection and extraction wells. It should also be noted that the estimated value of DNAPL saturation at each MLS point does not represent the DNAPL saturation at the monitor point, but rather, it is the average DNAPL saturation in the steamtube (tracer flowpath) from the injection well to the MLS monitor point. Based on moment analysis of MLS tracer data for MLS-2 and MLS-3, it is estimated that the average DNAPL saturation is approximately 0.5% in the higher permeability layer (overlying fine sand), and about 3.6% in the lower permeability (basal silt) layer. It is likely that the DNAPL saturations are higher than this at locations closer to the building, however MLS-1 (located between IN01 and EX01; see Figure 4.1) was not functional for sampling, therefore there is no tracer data at this near-building MLS location.

The effective permeability contrast at the different MLS depths is represented by the ratio of the first moments for the non-partitioning tracer response curves at the different MLS monitor points. The results indicate that the effective permeability of the basal silt layer is about four times lower than that of the overlying fine sands, and permeability may be even lower near the basal contact of the shallow aquifer at the aquitard. However, no PITT samples were successfully collected from the lowest MLS sampling points, i.e., just above the aquitard, to confirm this possibility.

A summary of the DNAPL saturation estimates based on the MLS tracer data is summarized in Table 11.2. The results for effective permeability contrast estimation are shown in Table 11.3.

Table 11.2 Summary of Multilevel Sampler (MLS) Tracer Data Analysis Results

MLS	Saturation (%)
2-17.0	0.7*
3-17.5	0.5
2-18.5	3.6

* High uncertainty due to the quality of the data.

Table 11.3 Estimated Effective Permeability Contrast

MLS Pair	k Ratio
2-17.0 / 3-17.5	2
2-17.0 / 2-18.5	4
3-17.5 / 2-18.5	2

11.4.3 Comparison of PITT results to Simulation Predictions

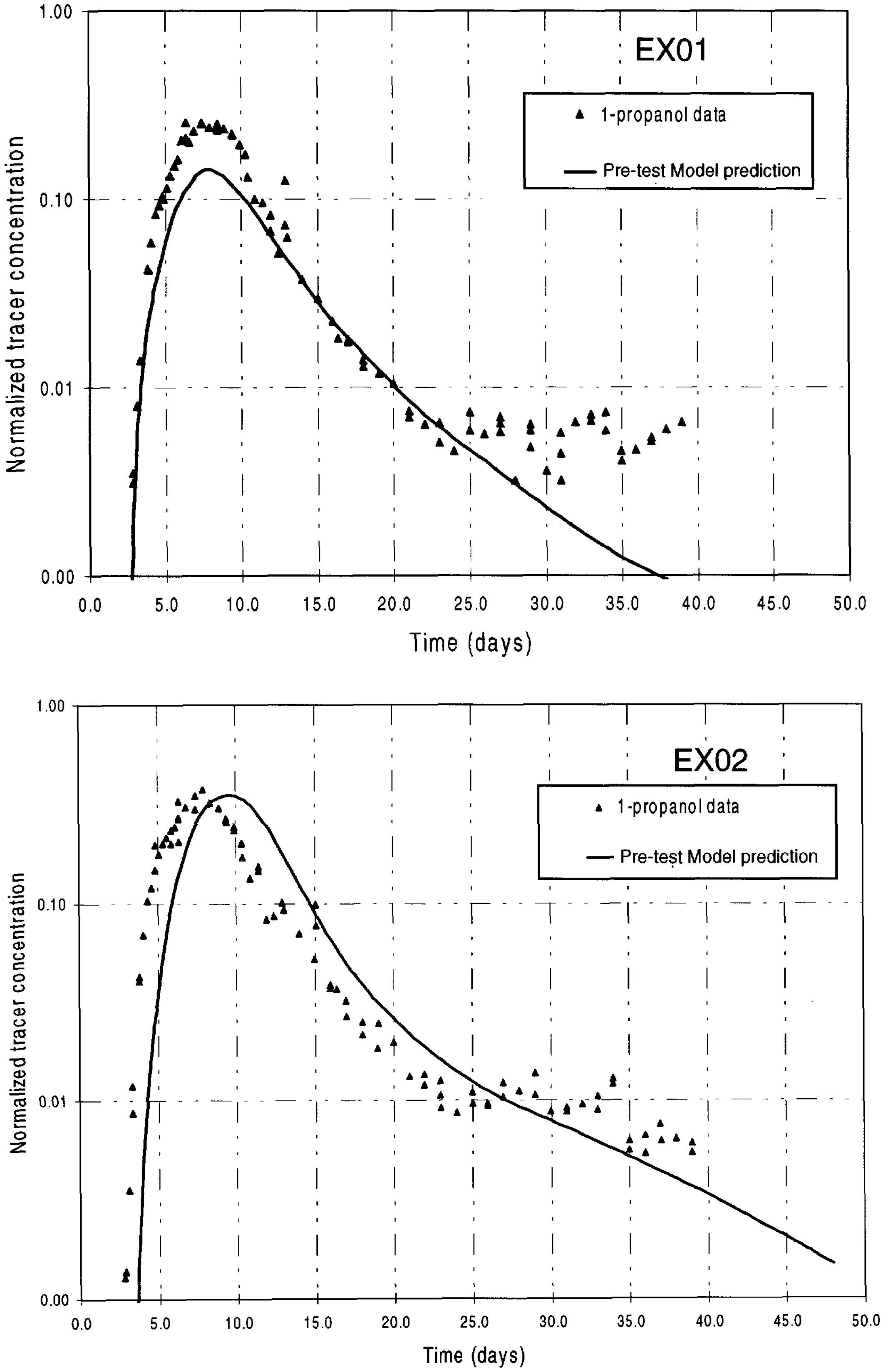
The PITT data for the non-partitioning tracer, 1-propanol, is plotted against the UTCHEM simulation predictions for a non-partitioning tracer in Figures 11.11 to 11.13. These figures show excellent agreement between predicted and actual tracer response. However, tracer recoveries obtained during the PITT (85% ± 3%) were lower than the original simulation prediction of 93% to 96%. As mentioned earlier, the water level and pumping rate data recorded continuously during the PITT show that hydraulic control was maintained throughout the PITT. A water level contour map produced using this data, provided as Figure 11.14, further supports this conclusion. As such, the lower than expected tracer recovery should not be due to loss of tracer out of the demonstration area. The most likely explanation for the lower tracer recovery is that the analyzed/reported tracer concentrations are lower than actual sample concentrations. The laboratory that analyzed the PITT samples experienced analytical problems as discussed in Sections 10.3 and 11.1, which may have contributed a low-level systematic underestimation of tracer concentrations for the PITT samples.

In addition to analytical difficulties, biodegradation of the tracers in the subsurface may have contributed to tracer loss to a minor degree. Biodegradation of the tracers may have been favored by the relatively high ground water temperature (due to the adjacent steam vault) and noted organic content of the aquifer. While the impact of analytical errors and biodegradation is not easily quantified, they provide reasonable explanations for the deviation of actual tracer recoveries from the originally estimated value. Lessons learned from the GC analysis of PITT samples from this initial PITT at Site 88 will be used to fine-tune the GC method for more accurate and reliable operations for the final (post-SEAR) PITT.

11.5 Error Analysis

There are two main sources of errors associated with the analysis of partitioning tracer data, which may contribute to uncertainty in the estimates of average DNAPL saturation. The first source of error, ΔR_f, is an uncertainty in the estimation of the retardation factor based on the actual tracer data for a pair of tracers (i.e., as a function of scatter in the non-partitioning and partitioning tracer datasets). The second source of error, ΔK, is due to the uncertainty in the partition coefficient measurement. Based on the theory of error propagation (Taylor, 1997; pg. 79), the error for DNAPL saturation, ΔS_N, which accounts for the cumulative error from ΔR_f and ΔK, can be derived from equation 11.1-1, as:

$$\Delta S_N = \sqrt{\left(\frac{K}{(R_f + K - 1)^2}\Delta R_f\right)^2 + \left(\frac{R_f - 1}{(R_f + K - 1)^2}\Delta K\right)^2} \qquad (11.5\text{-}1)$$



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Comparison of Non-partitioning Tracer Curves: UTCHEM Pre-Test Prediction vs Actual PITT Data at Extraction Wells EX01 and EX02

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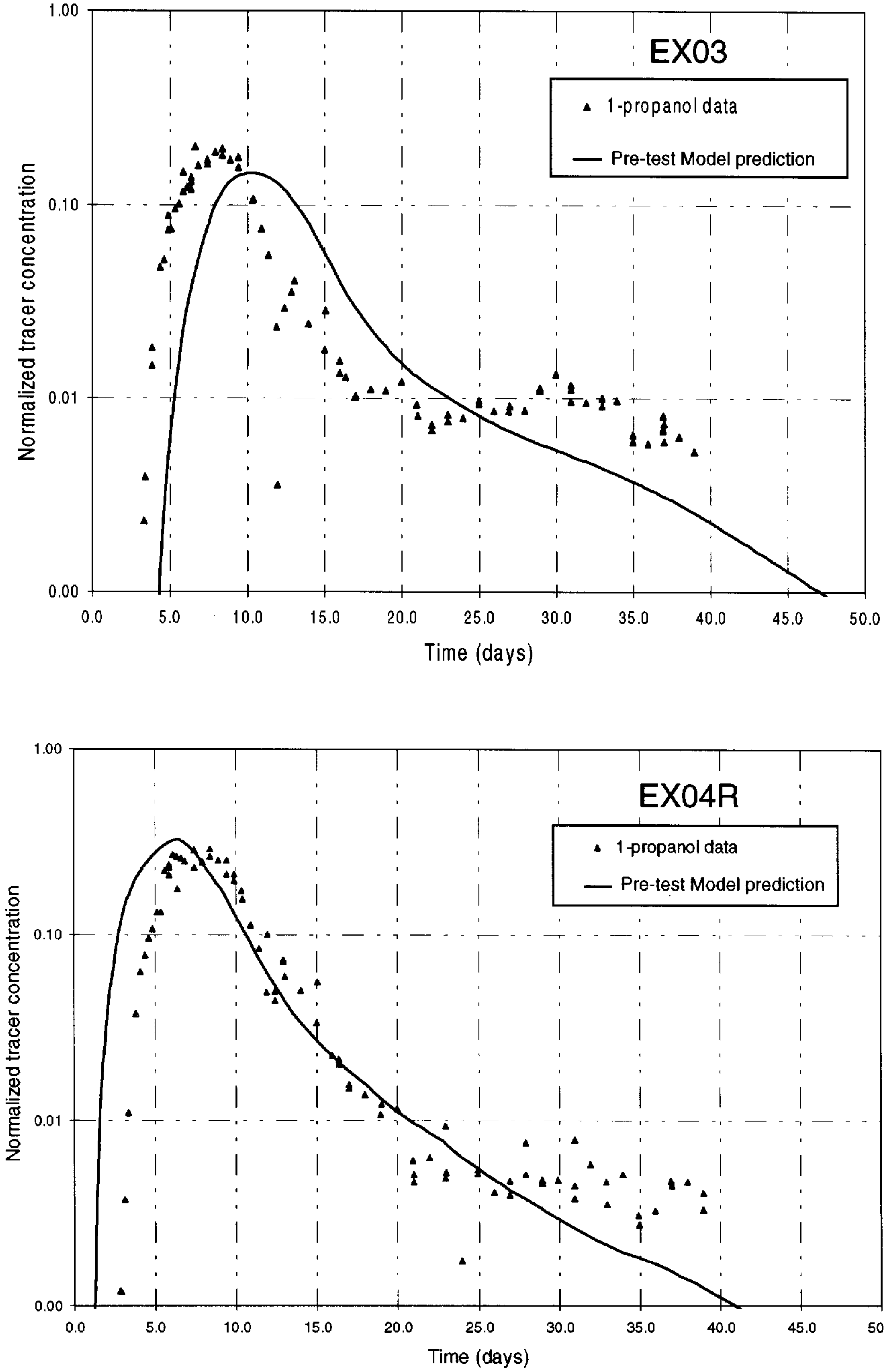
Figure 11.11



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Comparison of Non-partitioning Tracer Curves: UTCHEM Pre-Test Prediction vs Actual PITT Data at Extraction Wells EX03 and EX04R

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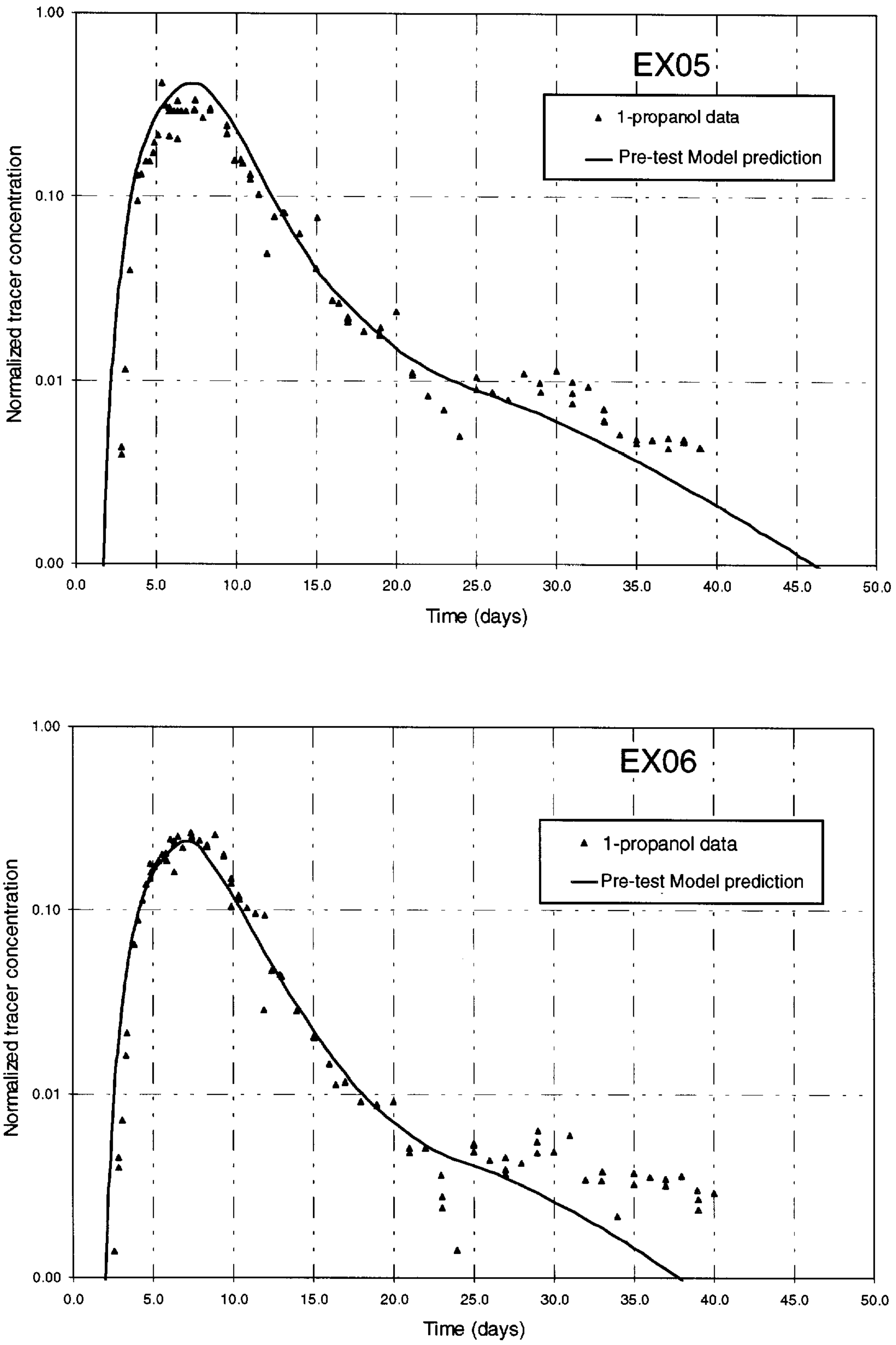
Figure 11.12



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Comparison of Non-partitioning Tracer Curves: UTCHEM Pre-Test Prediction vs Actual PITT Data at Extraction Wells EX05 and EX06

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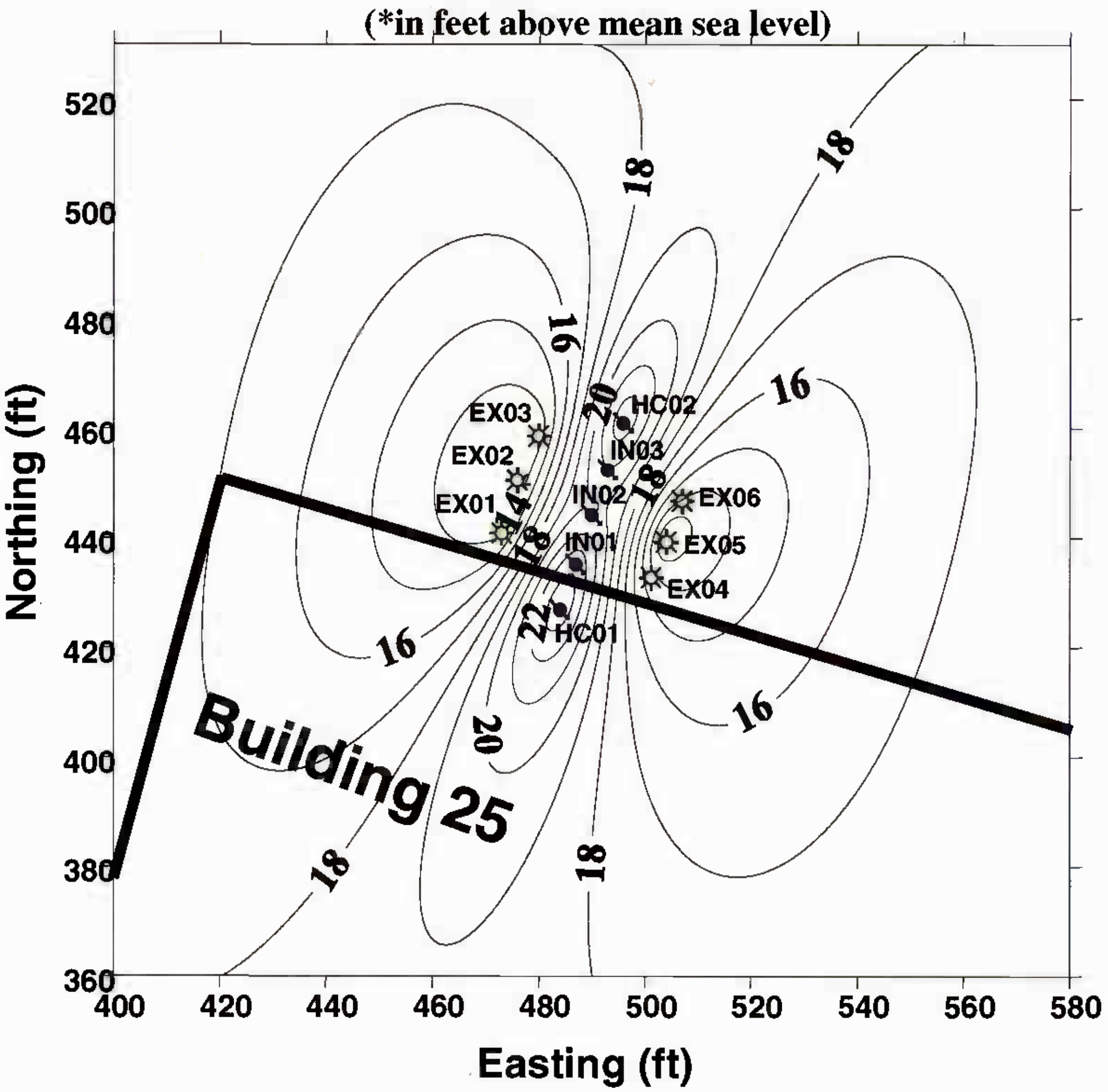
Figure 11.13



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Water Level Elevations During the Pitt

MCB Camp Lejeune, NC

Figure 11.14

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The first source of error, ΔR_f, can be estimated based on the standard error of the fitting parameters, as discussed in Section 11.2 of this report. A detailed discussion on estimating the standard error of the retardation factor from standard errors of the fitting parameters can be found in a recent paper by Jin and Pope (1998). Table 11.4 summarizes the retardation factor estimated error of the retardation factor ($R_f \pm \Delta R_f$) and the percent error of the retardation factor ($\Delta R_f/R_f$) for 1-heptanol at each extraction well.

The second source of error can be estimated based on error analyses of numerous laboratory measurements of the tracer partition coefficient. It was found that the average relative error in the partition coefficient measurement, ΔK, is expected to be about 10% (G.A. Pope, University of Texas at Austin, personal communication, 1998). The laboratory measured partition coefficient of 1-heptanol is 35. This means that the uncertainty of the partition coefficient of 1-heptanol is 35 ± 3.5, which is a conservative estimate for ΔK given the % uncertainty in the lab measurements of K reported in Table 7.1.

Based upon these two sources of error, the uncertainty of saturation estimates using equation 11.5-1 is summarized in Table 11.5.

Table 11.4 Uncertainty of DNAPL Saturation Estimates (1-propanol vs. 1-heptanol)

Well	$R_f \pm \Delta R_f$	$\Delta R_f/R_f$ (%)	$S_N \pm \Delta S_N$	$\Delta S_N/S_N$ (%)
EX01	2.45 ± 0.08	3.30	3.90 ± 0.44	11.2
EX02	1.16 ± 0.01	0.34	0.45 ± 0.05	11.5
EX03	1.13 ± 0.01	0.48	0.36 ± 0.04	10.7
EX04R	2.65 ± 0.37	14.0	4.50 ± 1.06	23.5
EX05	1.38 ± 0.02	1.10	1.07 ± 0.11	10.7
EX06	1.12 ± 0.01	0.88	0.35 ± 0.05	12.9

Note: $K \pm \Delta K = 35 \pm 3.5$ for 1-heptanol; and $\Delta K/K$ (%) = 10

As Table 11.4 indicates, the relative error of the retardation factor ($\Delta R_f/R_f$) is generally small (<~3%) compared to the relative error of the tracer partition coefficient estimation, i.e., 10%. The only exception in this case is EX04R where the relative error of the retardation factor is somewhat higher due to the scattering of the GC tracer data.

In general, the uncertainty of DNAPL saturation estimation is inversely proportional to the tracer partition coefficient as shown in equation 11.5-1. Tracers with higher partition coefficients will lead to larger retardation factors and improved accuracy in DNAPL volume estimation. This has also been illustrated on a theoretical basis by Jin (1995). In practice, the retardation factor has to be at least 1.2 in order to have a reliable DNAPL volume and saturation estimate. If the tracers with large partition coefficients, such as 1-heptanol, still yield retardation factors in the range of 1.0 to 1.1, it means that there is little, if any, DNAPL present in the subsurface being tested.

The above analysis of potential DNAPL saturation estimation error does not account for errors which may be due to uneven distribution of Varsol™ across the site (i.e., Varsol that is dissolved in the PCE DNAPL). Recently collected (free-phase) DNAPL samples indicate that at extraction wells EX01 and EX04, Varsol™ concentrations may be as high as 4-14 wt% of the DNAPL. Previously, Varsol™ concentrations had not been observed to exceed 2 wt%. Based on the Equivalent Alkane Carbon Number (EACN) approach (Dwarakanath and Pope, 1998), it is possible to estimate the influence of Varsol™ on the estimated DNAPL saturation. Using this approach, with 4-14 wt% Varsol™ present in the DNAPL, the underestimate in DNAPL saturations by PITT data analysis would be between 2-5% (see Appendix Q), which is relatively negligible.

A final source of estimation error is from the extrapolation of experimental data. Extrapolation of experimental data is required when the tails of the tracer concentration histories are not fully characterized due to limitations in the GC detection limits. This can cause under prediction of the average DNAPL saturation and hence cause estimation errors. These errors would be large or small depending on the quality of the tracer data. The data extrapolation technique is very simple and sound in its principle. However if there is significant scattering in the tracer concentration tail due to the effect of analysis errors and low tracer concentrations (on the order of the detection limit), a great deal of engineering judgment and subjectivity may be required to pick the correct exponential decline of the tracer tail. The average DNAPL saturations are highly sensitive to the changes in the slope of the exponential decline curve and this can cause a relatively large uncertainty in the average DNAPL saturation estimates. On the other hand, if the tracer data is of good quality and a linear decline in tracer concentrations on a semi-log plot is observed, the extrapolation errors will be minimal. If extrapolation errors are minimal, the result will be a significant increase in the overall estimation accuracy of the average DNAPL saturations. The tracer data shows reasonably linear declines in tracer concentrations on the semi-log plots for data above the detection limit (Figures 11.4a to11.9), and it is our professional judgement that any error associated with extrapolation of the data is not significant with respect to the resulting estimates for DNAPL saturation.

The above error discussion is based on the assumption that all observed tracer retardation is due to tracer partitioning to DNAPL. However, the column test experiments, discussed in Section 7, have shown that the elevated sedimentary organic content, as a result of peat particles in the sediments, can lead to tracer sorption to the natural organic matter which gives an apparent response for the presence of DNAPL in uncontaminated sediments. Pre-PITT soil sampling indicated that little or no DNAPL is likely present in the zone between EX03 and EX06 (see Figure 3.3). The tracer response at EX03 and EX06, which lead to a combined estimate of approximately 5 gallons of DNAPL for these two interwell locations, may actually be due to tracer interference with the sedimentary organic carbon, i.e., peat, in the sediments. Furthermore, it is likely that of the DNAPL measured by the PITT at EX02 and EX05 (0.5% and 1.0% saturations, respectively), a significant portion of the tracer retardation was due to tracer sorption to the peat. It is not, however, believed that the peat played any significant role in the tracer response at wells EX01 and EX04R, where DNAPL saturations were measured to be 3.9 and 4.5%, respectively.

11.6 Summary and Conclusions of PITT Results

Moment analysis of the PITT data estimated a DNAPL volume of 87 gallons in the swept volume of about 4,800 gallons. The DNAPL is non-uniformly distributed in the geosystem and the majority of the DNAPL is localized in the basal silt layer overlying the aquitard. There is a tendency for the DNAPL saturation to increase with depth and decrease laterally away from the building. The measured average DNAPL saturation for the well pairs near the building is about 4.5%, and 0.4% for the well pairs away from the building.

However, it should be noted that although the results from the PITT are reliable, the DNAPL volume estimation of 87 gallons is not exact. There are several factors that could contribute to an overestimate or underestimate of DNAPL in the test zone. The presence of peat particles in DNAPL-zone sediments, which elevates the sedimentary organic carbon content in the sediments, has been shown in column tests to interfere with tracer retardation such that DNAPL appears to be present in uncontaminated sediments at low-level DNAPL saturations of approximately 0.3% to 0.5%. Unless this is accounted for, it may lead to overestimation of the volume of DNAPL in the test zone. It is believed that this interference is responsible for an apparent volume of approximately 13 gallons of DNAPL in the swept pore zones represented by samples collected from extraction wells EX02, EX03, EX05, and EX06. Therefore, the corrected estimate for the total volume of DNAPL measured by the PITT is 74 gallons. This correction is based upon the results of soil column tests which showed an apparent DNAPL saturation of 0.3 to 0.5% in uncontaminated soil. It is possible that the actual volume of DNAPL is even somewhat lower than 74 gallons since the degree of tracer sorption to natural organic matter is a function of the degree of the f_{oc} present in uncontaminated and/or in low-level DNAPL-contaminated portions of the test zone. The column experiments were conducted with fine sand sediments with f_{oc} values that ranged from 1200 to 2100 mg/kg (Section 7.4.1). However, f_{oc} analyses conducted on three soil samples collected from the basal, fining downward sediments in the DNAPL zone (grading from fine sand to clayey silt just above the aquitard contact) resulted in f_{oc} values that range from 1500 to 6400 mg/kg (Table 3.2).

Conversely, factors that may have contributed to an underestimate of DNAPL include: (1) the presence and production of free-phase DNAPL during the PITT; (2) slightly lower tracer recovery by chemical analysis after the holding time had expired; and (3) the higher than anticipated Varsol concentrations in the DNAPL. These factors have not been quantified in the error analysis, as presented in the above section. Taking these factors into account, it is estimated that an additional 14 gallons of DNAPL may be present in the test zone for a total of about 88 gallons.

12.0 SUMMARY AND CONCLUSIONS

Duke Engineering & Services completed characterization of a PCE DNAPL zone at Site 88, US Marine Corps Base, Camp Lejeune, NC, in cooperation with Baker Environmental during 1997 and the first half of 1998. The Site 88 DNAPL zone was located at 17 to 20 ft bgs, both beneath and adjacent to Building 25, the Base dry-cleaning facility. In addition to the DNAPL zone, a zone of LNAPL has also been identified at a depth of approximately 7 to 10 ft bgs. This LNAPL zone is contaminated with Varsol™, a petroleum distillate that was used as the dry-cleaning solvent before it was replaced by PCE in the 1970s.

The shallow aquifer containing the PCE DNAPL zone is composed of fine sand and silt with an average hydraulic conductivity of approximately 5 x 10^{-4} cm/s (~1.4 ft/day). The sediments grade finer at the base of the aquifer to a clayey silt immediately above the clay aquitard; this basal silt layer was measured to have a hydraulic conductivity of about 1 x 10^{-4} cm/s (~0.3 ft/day). The clay aquitard, at the base of the shallow aquifer, appears to provide effective protection against further downward migration of DNAPL contamination to the underlying Castle Hayne Aquifer. The equivalent pressure for entry of DNAPL into the clay aquitard was measured to be approximately 15 ft of DNAPL head. The hydraulic head drop across the aquitard from the shallow aquifer to the Upper Portion of the Castle Hayne is of the order of 7 ft.

The DNAPL zone extends laterally in the shallow sand aquifer to approximately 20 to 30 ft north of Building 25 and is bounded below by the clay aquitard. The upper surface of the clay layer forms a stratigraphic trap (i.e., depression) in which some of the DNAPL has pooled. DNAPL saturations increase with depth from 17 to 20 ft bgs, with residual DNAPL grading downward to free-phase DNAPL above the clay surface. This free-phase DNAPL is, however, contained within clayey silts and the ability to recover DNAPL from this zone via traditional pumping from recovery wells is very limited.

A well field of three injection, six extraction, and two hydraulic control wells was installed for use in a partitioning interwell tracer test, or PITT, to measure the volume and spatial distribution of PCE DNAPL in the test zone. During the PITT, the tracers swept a pore volume of approximately 4,800 gallons of the shallow aquifer, in the depth interval between about 15 to 20 ft bgs. A UTCHEM-based geosystem model of the well field was developed for preliminary design of the PITT. The geosystem model was updated and calibrated based on the results of a conservative interwell tracer test (using bromide as a tracer). The updated/calibrated model was then used for further simulations to finalize the PITT design.

It was determined by partitioning tracer testing over a period of forty days in May-June 1998 that the DNAPL zone contained approximately 74-88 gallons of PCE DNAPL. Additional DNAPL is known to be present directly beneath Building 25, but that area was not included in this DNAPL investigation because of potential operational conflicts with ongoing dry-cleaning activities. The average DNAPL saturations measured by the PITT ranged from approximately 4.5% adjacent to Building 25 and decreasing to 0.4% at a distance of 20 ft away from Building 25. It appears likely, however, that the low-level DNAPL contamination detected by the PITT in the test zone area away from the building (i.e., 0.4% DNAPL saturation) is actually the result of tracer sorption to natural organic matter (i.e. peat) in the sediments rather than partitioning to DNAPL. This conclusion is supported by column test results that were obtained prior to the PITT. Therefore, the area approximately 20 ft north of the building appears likely to be DNAPL free. The results of the SEAR demonstration will provide clarification for the presence or absence of DNAPL in this area of the test zone. Finally, the PITT data revealed an approximately four-fold decrease in effective permeability between the fine sands and basal silt zones in the test zone portion of shallow aquifer.

These results have several implications for the SEAR demonstration. Firstly, it shows that the geosystem model developed thus far is a reasonable representation of the contaminated DNAPL zone in the test area; corrections to accommodate potential biodegradation of injected chemicals as well as varying Varsol™ concentrations across the test zone will improve the model. Secondly, it illustrates that most of the PCE DNAPL is in the lower permeability (basal) zone of the aquifer, and that the remediation challenge will be to design the surfactant flood to effectively remove the DNAPL contamination from this zone. Finally, it indicates that there is some utility to including a non-alcohol based conservative tracer (e.g. bromide) in the tracer suite to examine the potential biodegradation of alcohol tracers during the final post-SEAR PITT.

Analytical difficulties were encountered during this PITT that point to the need to address GC fouling by calcium chloride in order to obtain an accurate analysis of the SEAR and post-SEAR PITT samples.

Finally, the pre-SEAR PITT has provided valuable data for evaluating the baseline conditions within the test zone for SEAR test design. The data on the averaged DNAPL saturations, the DNAPL volume in the test zone, and the approximate DNAPL distribution will refine the existing site geosystem model for optimum SEAR design.

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APPENDICES

APPENDIX A

Procedure for Soil Sampling with Methanol Preservation

CORE SAMPLING FOR RESIDUAL NAPL SATURATION
Collection, Preservation, and Analysis Procedures

SOP-CORSAMP-1
March 1, 1998
Revision 4

PURPOSE: Measure total concentration of organic compounds in core samples. Use data to estimate residual NAPL saturation, composition, and component phase distribution.

1.0 SAMPLE CONTAINER PREPARATION

1.1 Materials

- 1.1.1 For samples of sediments without gravel or cobbles:
  - a. 40 mL amber glass vials with teflon-septa
  - b. purge and trap grade methanol below 8°C
  - c. 25 mL graduated cylinder
  - d. balance with at least 0.1 gm accuracy and 100 gm capacity
- 1.1.2 For samples of sediments containing gravel or cobbles:
  - a. 4 oz. amber wide mouth jars with teflon-lined caps
  - b. purge and trap grade methanol below 8°C
  - c. 50 mL graduated cylinder
  - d. balance with at least 0.1 gm accuracy and 400 gm capacity

1.2 Procedure

- 1.2.1 For samples of sediments without gravel or cobbles (may be done in the lab):
  - a. Add 15.0 mL methanol to each vial. Seal vial with cap.
  - b. Mark each vial with a unique number. CAUTION: some kinds of ink can be dissolved by methanol!
  - c. Weigh each vial and record.
  - d. Prepare extra vials for QA samples, spillage, and uncertainty of core depths to sample.
- 1.2.2 For samples of sediments containing gravel or cobbles (may be done in the lab):
  - a. Add 50.0 mL methanol to each jar. Seal jar with cap.
  - b. Mark each jar with a unique number. CAUTION: some kinds of ink can be dissolved by methanol!
  - c. Weigh each jar and record.
  - d. Prepare extra jars for QA samples, spillage, and uncertainty of core depths to sample.

2.0 SAMPLE COLLECTION

2.1 Materials

- 2.1.1 For all samples
  - a. soap (e.g., Alconox)
  - b. wipes (e.g., Kimwipes)
  - c. vial or jar labels
  - d. field book
  - e. ball-point pens
  - f. chain-of-custody forms
  - g. transparent packing tape (to cover vial labels and wrap packages)
  - h. lab address, phone number, and contact person
  - I. cooler and packing material
  - j. plastic bags for samples and COCs

k. FedEx package forms and sleeves
l. custody seals
m. box of protective gloves
n. vials or jars prepared in step 1
o. balance listed in step 1

2.1.2 For samples of sediments without gravel or cobbles:
a. modified 10 cc plastic syringes (VWR Cat No. BD305462) for use as subcorers (tips cut off at 0 cc mark (by knife) and rubber tip removed from plungers)
b. bottle brush for pre-cleaning subcorers

2.1.3 For samples of sediments containing gravel or cobbles:
a. stainless steel scoops or spoons

2.2 Procedure

2.2.1 For all samples:
a. Clean subcorers, scoops, or spoons with soap and water and dry.
b. Immediately after the split spoon core sampler or sample core liner is opened, use a subcorer, scoop, or spoon to collect about 8 mL (for 40 mL vials) or 25 mL (for 4 oz. jars) of undisturbed core and deliver it to the vial or jar. Do not add sample at a methanol:soil sample volume ratio greater than 1 to ensure that all DNAPL will be extracted into the methanol. Take care not to remove any of the methanol in the vial or jar by splashing or contacting the methanol with the subcorer, scoop, or spoon. Wipe cap threads with Kimwipe to remove grit. Cap.
c. Wipe dry the outside of the vials.
d. Weigh vials to determine sample masses delivered.
e. Complete labels or add labels to vials or jars. Cover with transparent tape to protect labels from methanol.
f. Reweigh and record. The lab will be asked to reweigh to check for sample loss.
g. Seal each sample container in a separate Zip-lock bag and store cold (below 8 °C).

3.0 EXTRACTION ANALYSIS

3.1 Analyze contaminant concentrations in methanol extract by GC.
a. For volatile chlorinated hydrocarbons use SW-846 GC-PID/ELCD Method 8021B (formerly 8010B) or GC-MS Method 8260B (Star Analytical, 1-800-887-4179, will do the GC-MS method for $78/sample). Request analysis for the target analytes only, or if necessary, request all halogenated compounds listed in EPA 8010B. Request reporting limits of no lower than 1.0 mg/L.
b. For volatile components of coal tar or petroleum products use SW-846 GC-PID/ELCD Method 8021B or GC-MS Method 8260B.
c. For semi-volatile components of coal tar or petroleum products use SW-846 GC-MS Method 8270C.
d. For PCBs use SW-846 GC Method 8082 or, with PAHs, GC-MS Method 8275A.

3.2 Request that the lab weigh the sample jar and contents to check for sample loss.
3.3 Request that clods be broken up and samples agitated 24 hours before analysis.
3.4 Ask the lab to report the concentrations as concentrations in methanol (mg/L).
3.5 Request that field-collected QC blanks be analyzed at the beginning of a batch.
3.6 For water content analysis, the Karl-Fisher titration method (approx. $30/sample) is best. A cheaper method is to measure the density of the extract, but this has not worked in the past, likely because methanol vaporizes so quickly. Densities could probably be measured more precisely by taring a syringe or pycnometer and working in a cold room. This method could provide a cheap way to determine sample water content, which is valuable information for NAPLANAL calculations.

4.0 CALCULATIONS

4.1 Use the measurements and Mathcad file CORWAT0.MCD to estimate the total mass of contaminants and water in the sample.

4.2 Enter the results into NAPLANAL to calculate NAPL residual saturation, composition, and component phase distribution.

Calculating Sample Concentrations from Methanol Extract Concentrations
Core Samples from the Saturated Zone

Measurements:

Wet mass of sample: $Msamp := 226.5 \cdot gm$

Volume methanol added: $Vmeth := 96.2 \cdot mL$

Number of contaminants: $N := 2$

Estimated water content (vol. water/vol. sample): $fwat := 0.25$

TCE Conc in extract: $Ccont_1 := 1100 \cdot \frac{mg}{liter}$

PCE Conc in extract: $Cecont_2 := 200 \cdot \frac{mg}{liter}$

Constants:

Rock density: $\rho s := 2.6 \cdot \frac{kg}{liter}$

Water density (at 22-23'C): $\rho wat := 0.998 \cdot \frac{kg}{liter}$

Calculations:

Estimated sample water volume: $Vw := \frac{fwat \cdot Msamp}{(fwat \cdot \rho wat + (1 - fwat) \cdot \rho s)}$ $Vw = 25.744 \cdot mL$

Total masses of contaminants in sample:

TCE: $Mcont_1 := Cecont_1 \cdot (Vw + Vmeth)$ $Mcont_1 = 134.139 \cdot mg$

PCE: $Mcont_2 := Cecont_2 \cdot (Vw + Vmeth)$ $Mcont_2 = 24.389 \cdot mg$

Total sample concentrations:

TCE: $Ccont_1 := \frac{Mcont_1}{Msamp}$ $Ccont_1 = 592.225 \cdot \frac{mg}{kg}$

PCE: $Ccont_2 := \frac{Mcont_2}{Msamp}$ $Ccont_2 = 107.677 \cdot \frac{mg}{kg}$

APPENDIX B

Geologic Logs and Well Construction Details

Location Coordinates of Wells, soil borings, CPT borings and MLS samplers

Location	Northing	Easting	Elevation Ground	TOC
IN01	339435.8315	2496487.07	25.54	25.71
IN02	339444.8916	2496489.85	25.52	25.27
IN03	339453.1307	2496492.71	25.8	25.34
HC01	339427.527	2496483.9	26.85	26.42
HC02	339461.6546	2496495.7	26.17	25.87
EX01	339440.8058	2496472.62	25.63	25.59
EX02	339450.5296	2496475.9	25.66	25.56
EX03	339459.3573	2496479.4	25.98	25.64
EX04	339430.571	2496500.34	25.59	25.65
EX04R	339432.88	2496502.62	25.6	
EX05	339439.9732	2496504.05	25.42	25.22
EX06	339447.4862	2496506.44	25.73	25.45
RW01	339447.2038	2496475.77	25.49	25.24
RW02	339441.6861	2496489.87	25.54	25.35
RW03	339429.4074	2496466.98	26.84	26.49
RW04	339427.0241	2496511.78	26.07	25.78
RW06	339417.9552	2496507.8	26.86	26.46
IW01	339439.3594	2496496.52	25.61	25.24
MW10IW	339451.5	2496487.02	25.8*	NA
WP01AQT	339448.32	2496485	25.6*	NA
WP02AQT	339449.61	2496485.72	25.6*	NA
MLS-1	339439.23	2496477.66	25.6*	
MLS-2	339448.96	2496480.72	25.6*	
MLS-3	339457.37	2496487.02	25.8*	
CPT01	339429.1547	2496573.55	25.79	
CPT02	339442.6893	2496537.93	28.83	
CPT04	339469.7012	2496499.49	25.8	
CPT05	339496.3537	2496424.99	25	
CPT06	339467.986	2496437.42	25.54	
CPT07	339450.2707	2496410.37	25.99	
CPT08	339382.1602	2496399.19	25.73	
CPT09	339361.3396	2496464.64	26.28	
CPT10	339342.0089	2496515.72	26.33	
CPT11	339372.7974	2496436.73	26.13	
CPT12	339454.1104	2496483.59	25.69	
IS01	339435.6666	2496505.83	25.45	
IS02	339434.5729	2496511.08	25.57	
IS03	339429.3495	2496514.01	25.98	
IS04	339379.83	2496471.4		
IS05	339405.9933	2496486.14	26.87	
IS06	339390.05	2496486.31		
IS07	339454.0657	2496469.83	25.74	
IS09	339391.1085	2496486.19	26.8	
IS10	339441.94	2496486.31		
IS11	339447.94	2496484.99		
IS12	339451.8148	2496452.56	26.11	
IS13	339447.94	2496483.18		
IS14	339439.95	2496511.93		
IS15	339457.02	2496492.37		
IS16	339428.05	2496516.91		
IS17	339454.25	2496470		
IS18	339466.8791	2496462.76	25.24	
IS19	339440.57	2496502.33		
IS20	339461.2	2496484.19		
IS21	339431.59	2496501.06		
IS22	339434.43	2496491.13		
IS23	339445.37	2494993.26		
IS24	339441.66	2496499.46		
IS25	339445.43	246485.45		
IS26	339443.58	2496496.18		
IS27	339453.36	2496505.63		
IS28	339401.2763	2496543.85	26.86	
IS29	339428.27	2496476.53		
IS30	339414.46	2496498.38		
IS31	339407.2556	2496533.24	26.83	
IS32	339432.88	2496498.38		

* Estimated from nearby well elevations

Table 3.1 Well Construction Details

Well ID	Casing Diameter (in)	Elevation (ft amsl)		Well Depth (ft BGS)	Screen Intervals (ft amsl)		Bentonite Seal Interval (ft amsl)	Sand Pack Interval (ft amsl)
		Ground	TOC		Lower	Upper		
EX01	4	25.63	25.59	19.96	6.1-10.6	NA	16.8-12.8	12.8-5.6
EX02	4	25.56	25.66	21.20	4.9-9.5	NA	14.7-11.8	11.8-4.2
EX03	4	25.64	25.98	19.94	6.5-11.0	NA	15.9-12.9	12.9-6.0
EX04	4	25.65	25.59	21.09	4.9-9.5	NA	14.1-11.8	11.8-4.6
EX04R	4	25.65	25.59	19.70	6.3-10.9	NA	16.9-13.1	13.1-5.6
EX05	4	25.22	25.42	21.75	4.1-8.7	NA	13.9-11.2	11.2-4.4
EX06	4	25.45	25.73	20.41	5.7-10.3	NA	15.5-12.5	12.5-5.2
HC01	2	26.42	26.85	22.71	4.5-9.1	5.9-15	13.9-11.9	11.9-4.9
HC02	2	25.87	26.17	20.40	6.1-10.8	13.9-18.4	12.8-11.8	11.8-6.1
IN01	4	25.71	25.54	22.58	3.5-8.0	14.0-18.0	12.1-10.1	10.1-3.0
IN02	4	25.27	25.52	19.65	6.5-11.0	14.5-18.5	12.6-11.6	11.6-5.5
IN03	4	25.34	25.8	19.96	6.4-10.9	14.4-18.4	12.9-11.9	11.9-5.8
RW01	4	25.49	25.24	20.00	6.2-10.4	NA	16.2-13.2	13.2-5.2
RW02	4	25.54	25.35	20.00	6.4-10.9	NA	16.4-13.4	13.4-5.4
RW03	2	26.49	26.84	21.97	5.2-9.9	15.8-19.7	14.0-12.0	12.0-5.0
RW04	4	25.78	26.07	23.39	3.3-7.8	13.7-18.2	13.2-11.2	11.2-4.1
RW06	2	26.46	26.86	21.07	6.1-10.8	14.2-18.7	13.9-12.4	12.4-6.4
IW01	2	25.61	25.24	18.50	6.9-11.4	NA	20.7-17.7	17.7-6.2
MW10IW	¼" tube	25.8*	25.0*	39.00	-12.9 - -8.4	NA	8.2- -6.1	-6.1 - -13.34
WP01AQT	¼" tube	25.6*	NA	23.0	2.6-3.6	NA	10.6-4.0	4.0-2.2
WP02AQT	2	25.6*	NA	25.0	0.6-1.6	NA	10.6-2.6	2.6-0.2

*Estimated from nearby wells

ft amsl = feet above mean sea level

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Bldg 25: DNAPL Source Zone Borings

2. LOCATION (Coordinates or Station) Bldg 25: UST T25-2 Area

3. DRILLING AGENCY Geo Environmental

4. HOLE NO. (As shown on drawing title and file number) IR88-IS01

5. NAME OF DRILLER Rich Melton

6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ________ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE 19 ft

10. SIZE AND TYPE OF BIT Direct Push

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 1 UNDISTURBED 5

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER ~ 9 ft bgs

16. DATE HOLE STARTED 7/25/97 @ 1025 COMPLETED 7/25/97 @

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR Geologist: Fred Holzmer INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			TANK Removal Backfill: clean f. SAND, tan, moist, loose	85%		Geoprobe cont tube 1 11/16 in ID HNu 0.5' = 1.6 1.0 = 4.2 1.5 = 3.9
	2					2.0 = 3.5
					3	3.5 = 2.9
	4					4.0 = 2.6
			4.5 Contact @ native seds: f. SAND w̄ silt/clay, wet, cohesive, low plast, mottled lt/med gray	75%		4.5 = 2.1 50 = 56 Sample HS 5.2 = 796 IS01-1 5.5 = 98 strong chemical odor: smells like petrol distillates (Varsol?)
	6					Sample 01-1 @ 5.4-5.5
					7	7.0 = 196 7.5 = 511
	8			85%		8.0 = 780 Sample HS@ " = 1950 IS01-2 8.5 = 1024 Sample HS@ " = 1640 IS01-2 9.0 = 331 Strong chem odor
	10		med. gray, wet, loose		10	10 = 311 HS 10.0 = 1436 Sample IS01-4 10.5 = 96
			11.0 f. SAND, w̄ decreased silt/clay, wet, cohesive, slight plast, lt gray	100%		11 = 177 11.5 = 121
	12					12 = 34 12.5 = 25 mild chem odor
			f. SAND w̄ minor fines, wet, cohesive, no plast, lt gray		13	13 = 17 resistant probing layer ~ 14-16' Sample tube split lengthwise 14 = 44
	14		Core samples from ~ 14-19 may be borehole backfilling	60%		trace chem. odor 15 = 13 HS 15.5 = 32 HS 16.0 = 72
	16		Samples from 16-19 of unknown depth (borehole backfilling?) Flowing sands, borehole not staying open between Core runs	?	16	Core samples clogged in sampler, extruded, not represent. samples
	18		TD = 19'; descriptions to ~ 14' bgs.			
					19	

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PROJECT

HOLE NO.

Hole No.

DRILLING LOG

DIVISION

INSTALLATION: MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT: Bldg. 25 DNAPL Source Zone Borings
2. LOCATION (Coordinates or Station): N of Bldg 25: T25-1 Area
3. DRILLING AGENCY: GeoEnvironmental
4. HOLE NO. (As shown on drawing title and file number): IRBB-IS02
5. NAME OF DRILLER: Rich Melton
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 20 ft
10. SIZE AND TYPE OF BIT: Direct Push
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED: 7
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER: ~ 9 ft bgs
16. DATE HOLE: STARTED 7/25/97 @ 1430; COMPLETED 7/25/97 @ 1510
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR: Geologist: Fred Hofmer INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Tank Removal: Backfill: f. SAND, clean, moist, loose			Cont tube Samples 1 11/16 in ID
						HNu 1.5' = 3.1
						2.0 3.1
						2.5 2.6
	2			80%		3.0 2.8
						3.5 2.3
	4			4		4.5' = 120
						5 97
			4.9 Contact Native seds f. SAND w̄ ~~some~~ silt/clay, moist, cohesive, slt to low plast, minor peat, organic decay smell, med-dk gray	100%		5.5 61
						6. 33
	6					6.5 158
			6.1 f. SAND w̄ minor silt/clay, wet, cohesive, lt gray, org decay & hydrocarb smell			
			6.8 CLAY seam, w̄ some ~~sm~~ silt, wet, med plast, lt to greenish gray w̄ yellow-orange mottling	7		
		NR				
			7.5 f. SAND (w̄ intermitant silt & clay, decreasing w̄ depth) wet, cohesive, lt to med gray strong hydrocarb smell			
	8			70%		8' = 394 strong hydrocarb smell ⟨Sample IS02-1
						HS 8.3 = 1616
						8.5 1032
						HS 8.8 = 1180 ⟨Sample IS02-2, IS02-3
			9.0 f. SAND, trace silt, wet, loose, lt tannish gray, strong hydrocarb smell			9 909
						9.5 115 open to atm
	10			10		
			10.5 si-f. SAND, wet, loose, tan to lt gray			11 = 146
				90%		11.5 68
			11.9 f. SAND w̄ minor silt, lt to med gray			12 27
	12					12.5 12
				13	NS	Muck sample; will use discrete sampler
	14		14 si-f. SAND	14		Discrete sampler (2' x 1" ID)
						HNu 14.5' = 2.8
			f. SAND, minor silt			15 2.8
						15.5 2.7
	16		16 si-cl-f. SAND grading to	16		16.3 – ⟨Sample IS02-4
						16.5 = 2.0
			16.6 si-CLAY, wet, soft, med plast, olive gray	100%		17 2.0
			17.4 grading to si-cl-f. SAND, low plast.			17.5 2.3
	18			18		
			18.4 CLAY w̄ peat, med plast, olive to charcoal brn @ 20'	80%		HNu 18.5 = 1.6
						19 1.6
				20		

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PROJECT

HOLE NO.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Bldg 25 DNAPL Source Zone Borings
2. LOCATION (Coordinates or Station) N-side Bldg 25 @ former AST/PCE (5 ft west of Air Comp)
3. DRILLING AGENCY GeoEnvironmental
4. HOLE NO. (As shown on drawing title and file number) IR88-IS03
5. NAME OF DRILLER Rich Melton
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 16'
10. SIZE AND TYPE OF BIT Direct Push
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: — UNDISTURBED: 4
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~ 9 ft bgs
16. DATE HOLE — STARTED: 7-25-97 @ 1654 — COMPLETED: 7-25-97 @ 1725
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Geologist: Fred Holzmer INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Soil Zone/orig bldg constr backfill. f. SAND w̄ minor silt, color alternating lt brn to dk brn to charcoal brn (3.2-3.5)			HNu 1' = 92 ppm 1.5 66
	2			100%		2 210 mild sweet smell 2.5 400 HS 2.8 = 191 Sample IS03-1 3 309
			2.8 Native sed contact f. SAND w̄ some silt/clay, moist, cohesive, friable to slt plast, lt brn-gray			3.5 10
	4			4		4.5 = 153 mild sweet smell 5 40
			5.4 Si-CLAY, moist, firm, low plast, lt gray	100%		5.5 51 HS 5.7 26 Sample IS03-2 6 82
	6		6.0 f. SAND, minor fines, moist, friable, mottled yel-orange in tan matrix			HS 6.1 12 6.5 14
				7		7.5 = 211 mild sweet smell HS 7.6 108 Sample IS03-3 8 23
	8			70%		8.5 11 9 14
	10			10		10 = 6 10.5 2.8 11 2.4
			11.5 grading to med gray (texture as above)	100%		11.5 3.0
	12					12 2.4 12.5 2.6
				13		
	14					14 = 2.2 14.5 = 1.6 15 1.9 15.5 2.1
	16		as above to TD @ 16.0	16		
	18					

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PROJECT

HOLE NO.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Bldg 25 DNAPL Source Zone Borings
2. LOCATION (Coordinates or Station) ~6' W of TW04 (S-side Bldg 25)
3. DRILLING AGENCY GeoEnvironmental
4. HOLE NO. (As shown on drawing title and file number) IR88-IS04
5. NAME OF DRILLER Rich Melton
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 13 ft
10. SIZE AND TYPE OF BIT Direct Push
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED ______ UNDISTURBED 4
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~9.5 ft bgs
16. DATE HOLE STARTED 7-26-97 @ 0740 COMPLETED 7-26-97 @ 0815
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Geologist: Fred Holzmer INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Grass, soil zone, f. SAND w̄ silt, moist, cohesive, friable, gray brn			HNu Backgrnd= 1.5 1.0' = 1.5 ppm 1.5 1.5
	2		si-v.f. SAND	95%		2 1.7 2.5 1.7 3 1.6 3.5 1.6
	4				4	
			5.1 Sediments sat'd to ~ 7.0 ft bgs. then unsat'd (recharg° pulse from recent rains)	90%		5 = 1.5 5.5 = 1.5
	6		6.1 si-CLAY w f. sand, moist cohesive, low plast, lt brn			6 = 1.5 6.5 = 1.5
			6.5 si-v.f. SAND, moist firm, cohesive, friable, tan w̄ yel-orange mottling		7	
	8			80%		8.5 = 2.7 9 1.9 9.5 2.7
			9.1 sat'd 7-24-97 WL = 9.36 btoc @ MW02 (~20 ft from boring)			
	10				10	11 = 9.2 11.25 34 11.5 11
			11.0 grading to f. to v.f. SAND, clean, wet, stiff, cohesive, tan	80%		12 107 12-12.2 Sample IS04-1 12.5 22
	12		TD = 13			
					13	
	14					

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PROJECT

HOLE NO.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Bldg 25 DNAPL Source Zone Borings

2. LOCATION (Coordinates or Station) Inside Bldg 25, ~ 13' from S of N-wall

3. DRILLING AGENCY Geoprobe

4. HOLE NO. (As shown on drawing title and file number) IR88-IS05

5. NAME OF DRILLER Rich Melton

6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE 20 ft

10. SIZE AND TYPE OF BIT Direct Push

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 7

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER ~ 9-9.5 ft bgs

16. DATE HOLE STARTED 7·26·97 @ 0915 COMPLETED 7·26·97 @ 1026

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR Geologist: Fred Holzmer INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0-.35 Conc	.4		Cont tube samples 1 1/16 ID (43 mm HNu
			.35 construction backfill; f. SAND, moist, loose, tan to lt brn			1.0 = 240 ppm 1.5 445 strong hydrocarb smell
				70%		2 609
	2		2.1 Native soil zone contact f. SAND w minor silt/clay, lt brn w charcoal mottling, loose			2.5 861 HS 2.8 1005 Sample IS05-1 3 760
			as above, grading to buff color			
	4			4		
			4.5 cl-SILT, moist, cohesive, friable mottled lt gray-brn & yellow-orange			4.5 = 308 5 844 strong hydrocarb smell
			w ↑ f. sand fraction	95%		5.5 945 HS 5.8 1179 Sample IS05-2
	6					6 1051
			6.1 si-CLAY, moist, firm, low-med plast, lt gray/brn & yel-org grading @ 6.5 cl-SILT, slt plast			6.5 653
		NR		7		
			7.0 SILT/v.f. SAND, moist cohesive, friable, some clay clasts, buff color			7.5 = 947 strong hydrocarb smell
	8					8 887 HS 8.4 1225 8.5 945 Sample IS05-3
			increasing v.f. sand content	100%		
			v.f. SAND/SILT, clean (no clay)			
	10		darker (lt gray) w depth	10		HS 10.2 938 Sample IS05-4 10.5 = 621
						11 371
				90%		11.5 154 12 100
	12					12.5 101
				13		
			as above			13.5 = 39
	14					14 89
				90		14.5 60 15 49 15.5 36
	16			16	1" dia discrete sampler	16.5 = 73 17 = 52
				100		17.5 = 45
	18		18.2 grading to cl-SILT wet, cohesive, med-gray	18	as above	18.5 = 30
				100		19 11
			19.3 grading to si-CLAY, wet cohesive, low-med plast, med-gray TD = 20' bgs			19.5 9.3 20 9.9

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PROJECT

HOLE NO.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Bldg 25 DNAPL Source Zone Borings
2. LOCATION (Coordinates or Station) SW Corner Bldg 25 (outside ~5' S of Bldg)
3. DRILLING AGENCY GeoEnvironmental
4. HOLE NO. (As shown on drawing title and file number) IRBB-IS06
5. NAME OF DRILLER Rich Melton
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 14 ft
10. SIZE AND TYPE OF BIT Direct Push
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 5
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~ 9.5 ft bgs
16. DATE HOLE STARTED 7-26-97 @ 1412 COMPLETED 7-26-97 @
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Geologist: Fred Holzmer INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Soil horizon: v.f. SAND, moist, cohesive, friable, dk brn			Geoprobe cont tube 1 11/16" ID HNu
						1.0 = 3.6
						1.5 = 3.3
	2			100%		2 3
			2.6 grading to unweathered seds. si - v.f. SAND, moist, cohesive friable, tan to mottled yel-orange			2.5 3
						3 2.8
						3.5 2.7
	4				4	
						4.5 = 2.9
						5 2.5
				100		5.5 2.4
	6					6 2.5
						6.5 2.5
					7	
			as above			7.5 = 100
	8					8 130
				80%		8.5 5.4
			wet	Resampled; Seds dropped out of tube on 1st try		9 126 strong hydrocarbon smell
						HS 9.3 — 405
						9.5 61 Sample IS06-1
	10		as above		10	
				Sampled dropped out; moved rig ~1' & used 2'×1"d discrete sampler		10.1' = 3.6 (bkgrnd)
						10.5 "
						11 "
			11.6 grading to f. SAND, minor fines, wet, cohesive, yel-orange			11.5 "
				100%		12 "
	12				12	12.1 = 7.5
						12.5 6.6 (Bkgrnd)
			13.0 grading to f. to v.f. SAND, minor fines, wet, cohesive, med gray (to TD = 14' bgs)	100%		13 6.4
						13.5 6.5
	14				14	
						TD = 14' bgs
	16					
	18					

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PROJECT

HOLE NO.

Hole No.

DRILLING LOG	DIVISION	INSTALLATION MCB Camp Lejeune	SHEET 1 OF 1 SHEETS

1. PROJECT Bldg 25 DNAPL

2. LOCATION (Coordinates or Station) N-side Bldg 25 @ Tank T25-4

3. DRILLING AGENCY Geo Environmental

4. HOLE NO. (As shown on drawing title and file number) IR88-IS07

5. NAME OF DRILLER Rich Melton

6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE 20 ft

10. SIZE AND TYPE OF BIT Direct Push

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED 7

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER

16. DATE HOLE | STARTED 7·26·97 @ 1555 | COMPLETED 7·26·97 @

17. ELEVATION TOP OF HOLE ~ 9-9.5 ft bgs

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR Geologist: Fred Hofman INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2		0.0 Tank yank backfill f-v.f. SAND, clean, moist, loose tan.	75%		Geoprobe Cont tube 1 1/16" ID HNu 1.0' = 4.0 (bkgrd) 1.5 3.6 2 3.4 2.5 3.5 3 3.3 3.5 3.6
	4			4		
			4.7 Contact w̄ native seds: SILT w̄ clay & f. sand, moist cohesive, friable, med-gray	70%		4.5' = 3.1 5 138 HS 5.3 — 83 Sample IS07-1 5.5 20
	6		5.5 grading to cl-SILT, trace f. sand, minor peat, moist, cohesive, slt plast, organic decay odor, dk gray			6 112
		NR		7		
	8		cl-SILT / cl-f. SAND moist, cohesive, friable, slt plast, occassional plant fibers & clay clasts, med-dk gray w̄ mottled yel-orange	90%		7.5' = 4 8 29 strong hyd-carb smell 8.5 171 HS 8.8 — 477 Sample IS07-2 9 53
			9.2 f.-v.f. SAND. w̄ silt,			9.5 79
	10		9.8 si-f. SAND, wet, firm, cohesive, olive gray	10		10' = 47
				100%		10.5 37 HS 10.8 — 195 Sample IS07-3 11 44 11.5 32
	12					12 11 12.5 9 13 13
				13		13 113(?) probably backfill from above 13.5 153(?) 14 90(?)
	14			50%(?)		14.5 14 15 14 15.5 10
	16			16	1" ID Sampler	16.5' = 12 17 13 17.5 16
			17.8 grading to SILT w clay & v.f. sand, wet, firm	100%		18 77
	18			18	1" ID Sample	18 81 18.5 701 Sample IS07-4
			19 si-sa-CLAY w̄ plant matter, soft, olive-gray TD push = 20'; TD recovery ~ 19'	50% likely bottom foot dropped out		19 219

PROJECT | HOLE NO.

DRILLING LOG | DIVISION | INSTALLATION MCB Camp Lejeune | SHEET 1 OF 1 SHEETS

1. PROJECT Bldg 25 DNAPL Source Zone Borings
2. LOCATION (Coordinates or Station) N-side of Bldg 25, ~ 20' west of tank T25-4
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number) IR88-IS08
5. NAME OF DRILLER Rich Melton
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 21 ft
10. SIZE AND TYPE OF BIT Direct Push
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED 9
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~ 9-9.5 ft bgs
16. DATE HOLE | STARTED 7-27-97 @ 0728 | COMPLETED 7-27-97 @
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Geologist: Fred Hofner INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0.0 Backfill f. SAND, tan			Geoprobe cont. tube sampler 1 1/16" ID
			.8 Native soil contact si-cl-f. SAND, wet, soft, minor peat matter, dk gray-brn low plast	80%		HNu 0.5' = 54 ppm 1 33 1.5 48
	2					2 23
			2.6 grading to f. SAND w̄ fines, moist, cohesive, firm friable, lt brn			2.5 280 3 234
	4			4		Sample IS08-6 Hydrocarb Sample Sample IS08-4 4.5 604 strong hydrocarb smell 5 523
				95%		5.5 350
	6					6 516
			6.4 grading to cl-f. SAND, wet, cohesive, low plast, med gray-brn			6.5 381
			7.2 grading to f. SAND w̄ fines, moist to wet, cohesive, lt gray, soft to med firm	7 100	8-10 dropped out	7 340 Sample IS08-5 7.5 442 8 166 Sample IS08-6 Hydro carb Sample
	8	?	8-10 Sample interval uncertain	8 50%	1" ID discrete sampler (collected ~1' N of orig boring)	Looks like 7-8' interval 440 Bottom 1/2 dropped out of sample tube 340 83
	10		si-f. SAND, wet, cohesive firm, lt gray	10		10' = 56 10.5 41
			10.8 grading to f. SAND, minor fines, lt gray brn	100		11 32 11.5 28
	12		grading to med gray some clay content, slt plast			12 23 12.5 24
			f. SAND w silt, minor clay	13		13 81. 13.5 13
	14			100 14.5		14 15
			~~17.0 grading to si-cl-f. SAND~~	95%		15 52 15.5 13
	16			16.5	NS	16 12
			17.0 grading to si-cl-f. SAND	17		HS 17.5 – 829 strong solvent (sweet) smell 17.5 870 Sample IS08-1 18 534
	18		grading to si-cl-v.f. SAND slt plast			HS 18.5 – 875 Sample IS08-2 18.5 683 DNAPL(?) fluid inclusion
			19.0 grading to si-CLAY, wet, soft med plast, med gray, to TD= 21' bgs	19	HS 19.5= 925	19 871 " 254 (Bkgrd 200) (Bkgd 50) Sample IS08-3 19.5 871 (" 165) 20 230 (" 220) 20.5 174 21 156

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(148)

Hole No.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Bldg 25 DNAPL Source Zone Borings
2. LOCATION (Coordinates or Station) Inside Bldg 25: ~ 25ft S of N-wall
3. DRILLING AGENCY GeoEnvironmental
4. HOLE NO. (As shown on drawing title and file number) IRBB-IS09
5. NAME OF DRILLER Rich Melton
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 21 ft
10. SIZE AND TYPE OF BIT Direct Push
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 8
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~ 9-9.5 ft bgs
16. DATE HOLE STARTED 7-27-97@ 1040 COMPLETED 7-27-97@
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Geologist: Fred Hahmer INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0. - .4 Conc floor		Conc.	
			.4 Construction backfill f. SAND, moist, loose, tan to lt brn			HNu .5' = 134
						1 151
						1.5 174
						2 220
	2			70%		2.5 15
			2.3 Contact with native sed si-f. SAND, firm, cohesive friable, lt gray-brn			
	4			4		4.5' = 176
						5 81
				95%		5.5 206
	6					6 160
			6.4 si-v.f. SAND, moist, cohesive, mottled lt gray & yel-orange			6.5 15
				7		7' = 518 strong hydrocarbon smell
						7.5 367
	8			100%		8 370
						8.5 470
		NR				
	10		as above, lt gray, wet	10		10' = 44
						10.5 181 Sample IS09-1
						11 21
				70%		11.5 29
	12					12 36
				13		13' = 62
			13.5 as above, grading to yel-orange			13.5 33
	14			90%		14 9 Sample IS09-2
						14.5 41
						15 105 moderate solvent smell
				15	1" ID discrete Sampler	15 55
						15.5 6 after HNu malfcn & repair
	16					16' = 6
						16.5 2.5
			increasing fines, slt plast			17 10
				17	as above	17 7
			as above, grading to med gray	50%		17.5 2
	18				bottom	18
		NR				
			as above	19		19' = 3
			19.1 si-CLAY w minor v.f. sand, wet, med plast, med gray (to TD = 21' bgs)			19.5 1.3
						20 1.5
						20.5 3.4
						21 1.7

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DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Bldg 25 DNAPL Source Zone Borings

2. LOCATION (Coordinates or Station) N-side Bldg 25: ~ 10' W-SW of Tank T25-4

3. DRILLING AGENCY GeoEnvironmental

4. HOLE NO. (As shown on drawing title and file number) IR88-IS10

5. NAME OF DRILLER Rich Melton

6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE 21

10. SIZE AND TYPE OF BIT Direct Push

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED ___ UNDISTURBED 8

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER ~ 9-9.5 ft bgs

16. DATE HOLE STARTED 7-27-97 @ 1454 COMPLETED 7-27-97

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR Geologist: Fred Holzmer INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Tank yank backfill f.-v.f. SAND, clean, tan			Geoprobe cont tube sampler 1 1/16" ID HNu – DL 101 0.5 = .8 (Bkgrnd) 1 .8 1.5 1
	2			75%		2 .9 2.5 1
		NR	3-4' interval dropped out of tube upon retrieval			
	4		si-v.f. SAND, moist, cohesive soft, lt tan-gray	4		4.5' = 3.1 5 .4 5.5 1.1
				85%		6 2.3
	6		6.1 si-CLAY, moist, med plast, lt gray			6.5 .7
		NR				
			si-v.f. SAND, moist, cohesive, buff color w yel-orange	7		7' = 4.1 7.5 18
	8		8.7 as above, grading to lt gray & wet	100%		8 34 8.5 19 9 0.6 9.5 .7
	10		as above	10		10' = 4 10.5 217 11 73
		NR	11.1-13: sampled dropped out out of tube upon retrieval.	35%		
	12					
			as above, lt gray & bright yellow-orange pockets, wet 13.8 grading to med-gray	13		13' = 3.3 13.5 1.0 HNu ?! 14 1.0
	14			100		14.5 1.0 mod solvent smell 15 → 15.4 Sample IS10-1
			v.f. SAND, minor silt	15	1" ID discrete Sampler	HNu out of order
	16			90%		Sample tubes noticably Cool upon retrieval, with strong solvent smell 16.1-16.4 Sample IS10-2
			Increasing fines, w coorse plant fibers 17.7 grading to cl-SILT, low plast med gray	17	as above	Sample tube noted cool. Fluid inclusions of DNAPL(?) associated with sporadic peat (plant fibers) @ 17.2-17.4, & trapped droplets @ 17.6-17.8' 17.2 Sample IS10-3 17.75 Sample IS10-4
	18	NR	Sample dropped out upon retrieval			
			si-CLAY, decreasing silt w depth, soft, med plast, med-dk gray 20.3 organic CLAY (with fine peat layers), no solvent smell, only organic decay / H_2S smell, to TD = 21' bgs	19	as above	Strong solvent smell @ 19.0, decreasing to none @ ~19.5

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PROJECT

HOLE NO.

DRILLING LOG	**DIVISION**	**INSTALLATION** MCB Camp Lejeune	**SHEET** 1 **OF** 1 **SHEETS**

1. PROJECT Bldg 25 DNAPL Source Zone Borings

2. LOCATION (Coordinates or Station) N-side Bldg 25; ~16' W of Tank T25-4

3. DRILLING AGENCY GeoEnvironmental

4. HOLE NO. (As shown on drawing title and file number) IR88-IS11

5. NAME OF DRILLER Rich Melton

6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE 18 ft

10. SIZE AND TYPE OF BIT Direct Push

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED ______ UNDISTURBED 6

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER ~9-9.5 ft bgs

16. DATE HOLE STARTED 7-27-97@ 1728 COMPLETED 7-27-97

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR Geologist: Fred Holzmer INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2		Mixed tank yank backfill & native sediments, disturbed thru-out f. to v.f. SAND	75		HNu 0.5' = 7.7 (bkgrnd) 1 7.2 1.5 6.4 2 6.8 2.5 6.4
		NR	See below			
	4	NR	Core sample dropped out upon retrieval (Geoprobe needs to develop catcher baskets to prevent this)	4 0%		
	6					
	8		cl- f. to v.f. SAND, wet, soft, low plast, occassional gray clay clasts in dk-gray brn matrix	7 70%		7.5' = 6.4 8 8.7 8.5 70 9 27 moderate hydrocarb & organic decay smell
	10 12		Core tube stuck in barrel due to flowing sands; had to destroy tube: misc disturbed core described: f. to v.f. SAND, wet, cohesive, lt to med gray	10 30%		strong hydrocarb smell
			No sample collected	13	NS	
	14		si- f.-v.f. SAND, wet, cohesive, med gray	14 100%	1" ID discrete sampler	14' = 5 14.5 4 (bkgrnd) 15 4 15.5 4 16 4 no solvent smell
	16		16.0 grading to cl-SILT, wet soft, low plast, med gray 16.4 grading to si-CLAY, wet, soft low-med plast, med gray (to TD=18' bgs) sparse plant fibers	16 70%	As above	16.5 43 17 18 17.5 17 mild solvent smell organic decay smell
	18			18		

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

HOLE NO.

Hole No.

DRILLING LOG

DIVISION

INSTALLATION Camp Lejeune, NC

SHEET 01 OF 1 SHEETS

1. PROJECT Bldg. HP25 DNAPL Source Zone Borings
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY PARRATT-WOLFE INC
4. HOLE NO. (As shown on drawing title and file number) IR88-IS12
5. NAME OF DRILLER ARNOLD CHAPEC
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN NA
8. DEPTH DRILLED INTO ROCK NA
9. TOTAL DEPTH OF HOLE 19 feet
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL CME55 adapted for hollow stem augers
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE | STARTED 8/19/97 | COMPLETED 8/19/97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING 78 %
19. SIGNATURE OF INSPECTOR John T. Londergan INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SANDY LOAM, BROWN, dry			HNU (ppm)
	2		clay content increases			
			3			1.8
						16.0
	4					39.0 RECOVERED 3' out of a 4' push
						49.8
						77.0
						45.0
	6					
			Fine Sand, moist, lt. brown 7			1.0
						0.8
	8					4.8 RECOVERED 3' out of 4' push
						1.6
						1.0
						1.2
	10					
			VERY Fine Sand, wet lt gry/brown color 11			7.4
						3.6
						1.1
	12					0.8 RECOVERED 3' out of a 4' push
						0.7
						0.7
	14					IS12-03 PCE 15.5'
			15			6.7
						2.3 PCE
	16					2.7 IS12-01 16-16.2
			silty clay, gray, soft wet			1.2 RECOVERED 3.5' out of a 4' push
						1.3 FOG
						0.8
	18					0.7 IR88-IS12-08 16.2-16.5'
			silty clay, gray, soft wet 19			IS12-02 PCE 17-17.2'
	20					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT | HOLE NO.

Hole No.

DRILLING LOG

DIVISION

INSTALLATION Camp Lejeune, NC

SHEET 01 OF 01 SHEETS

1. PROJECT Bldg HP25 DNAPL Source Zone Borings
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY PARRATT - WOLFF INC.
4. HOLE NO. (As shown on drawing title and file number) IR88 - IS13
5. NAME OF DRILLER ARNOLD CHAPEL
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ________ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN NA
8. DEPTH DRILLED INTO ROCK NA
9. TOTAL DEPTH OF HOLE 19 Feet
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL CME 55 adapted for hollow stem auger
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE | STARTED 8/19/97 | COMPLETED 8/19/97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING 75 %
19. SIGNATURE OF INSPECTOR John T. Londergan - INTERA

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Very fine sand, lt. brown, dry			HNU (ppm)
	2					
			3	2.5' recovered out of 4' push		1.2
						0.8
	4					1.1
						1.5
						5.2
						30.0
	6					
			Hydrocarbon odor			
			7	2.5' recovered out of 4' push		6.8
	8					19.5
						93.0 ~~IS13-04 TPA 8.5~~
						71.0
						6.3 NOT SUBMITTED
	10					2.6 TO LABORATORY
			11	3.5' of recovery out of 4' push		7.9
						1.4
	12					1.5
						1.1
						1.0
						0.7
						0.7
	14					1.0
			Very fine sand, lt. gray, wet, Hydrocarbon odor 15	2.5' of recovery out of 4' push		4.8
						4.0
	16					6.6
						15.9 IS13-1 PCE 17.0
						148.0 IS13-2 PCE 17.5
						182.0 IS13-09 FOC 17.5-17.7
	18					106.0 IS13-3 PCE 18.0
						12.0 IS13-08 TPH 18.0-18.5
			Silty clay, soft, dk gray, wet 19			
	20					

DRILLING LOG	**DIVISION**	**INSTALLATION** MCB Camp Lejeune	**SHEET** 1 **OF** 1 **SHEETS**

1. PROJECT Geoprobe Soil sampling @ Bldg 25

2. LOCATION (Coordinates or Station) N-side of Bldg 25

3. DRILLING AGENCY FUGRO

4. HOLE NO. (As shown on drawing title and file number) IR88-IS14

5. NAME OF DRILLER Frank Ward

6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE 22 ft

10. SIZE AND TYPE OF BIT 1" & 1¾" ID core barrel

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED: | UNDISTURBED: 7

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER ~ 8 ft BGS

16. DATE HOLE STARTED: 11-18-97 @ 0912 | COMPLETED: 11-18-97 @ 1450

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR Fred Holmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0.0 Grass, v.f. SAND, moist, cohesive, loose, tan			Hnu
						18
			1.5 si-CLAY, tan-brn, low plast			78
			1.6 SILT w̄ v.f. sand, moist, friable, charcoal-brn grading to dk brn			74
	2					24
			2.8 SILT w̄ clay & v.f. sand, moist slt plast, gray-brn			20
				3		19
						8
	4					13
						9
			5.1 Si-CLAY, wet, low plast	80%		5
		NR				3
	6		6.0 Cl-SILT w̄ v.f. sand, slt plast, moist grading to wet @ ~ 7.0, gray	6		4
						2
						1
			7.7 SILT w̄ minor clay, wet, cohesive, tan to buff, trace v.f. sand	100		1
	8					1
			8.4 si-CLAY, wet, low plast, tan-gray 8.5 v.f. SAND, trace fines, wet, cohesive, lt gray w̄ tan & yel-org mottling			0
				9		0
						0
	10					1
			10.4 grading to cl-si-v.f. sand, wet, slt plast, med-gray cohesive	85%		2
			10.8 v.f. SAND, wet, loose, gray			1
		NR				1
	12		12.0 si-v.f SAND, wet, cohesive med-gray	12		12
						0
			13.1 thin cl-si-v.f. SAND seam, slt plast 13.2 f.-v.f. SAND, trace fines, wet cohesive	70%		1
						0
	14					0
			grading to v.f. SAND			
				15		0
						0
	16					2
						1
				50%		
		NR				
	18		18.0 CLAY, v. soft, med plast gray	18		
						3
			20.1 grading to CLAY w̄ peat, soft, med plast, gray-brn to TD @ 22'	100		0
						0
						0
						0

ENG FORM 1836 MAR 71 **PREVIOUS EDITIONS ARE OBSOLETE.** **PROJECT** 22 **HOLE NO.** 0

DRILLING LOG

DIVISION

INSTALLATION: MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT: Geoprobe soil sampling Bldg 25
2. LOCATION (Coordinates or Station): N-side of Bldg 25
3. DRILLING AGENCY: FUGRO
4. HOLE NO. (As shown on drawing title and file number): IRBB-IS15
5. NAME OF DRILLER: Frank Ward
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 22 ft
10. SIZE AND TYPE OF BIT: 1" & 1 3/4" ID core barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED: 7
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER: ~ 8 ft BGS
16. DATE HOLE: STARTED 11-18-97@1500 COMPLETED 11-18-97@1730
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR: Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0 Appears to be mixed backfill from tank removal area: clean f. sand w̄ native soil: si-f. sand w̄ clay			Core samples collected in 1-11/16" ID core tubes Hnu 0 0 2
	2			70%		1 1
				3		
	4			50%		0 0
	6			6		
			6.4 CLAY, soft, wet, med plast, yel-org & gray			2
			6.6 si-v.f. SAND, moist, cohesive buff	85		4 6
	8					IS15-01 8-9' 13
				9		
			9.5 grading to SILT w̄ v.f. sand, wet, cohesive, gray			3
	10		w̄ intermitant zones of SILT w̄ clay & v.f sand	85%		2 4 3 0
	12			12		1
				80		5 6 0
	14					
				15		
	16	NR		0		
			18.0 SILT, wet, cohesive, gray	18		8
			19.0 CLAY, wet v. soft, med plast gray	90%		IS15-02 @ 19' above clay contact — 25
			19.9 CLAY w̄ peat, low-med plast gray-brn			0 0 0 0
				22		

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe Soil sampling @ Bldg 25
2. LOCATION (Coordinates or Station) 5ft N of Bldg 25
3. DRILLING AGENCY FUGRO
4. HOLE NO. (As shown on drawing title and file number) IR88-IS16
5. NAME OF DRILLER Frank Ward
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ________ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 20 ft
10. SIZE AND TYPE OF BIT 1" & 1 3/4" ID corebarrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE STARTED 11·19·97 COMPLETED 11·19·97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
						IS16 is located 1 ft E of IS03
	2					
	4					
	6					
	8		8.0 si-v.f. SAND, wet, Cohesive, tan	8 75%		IS16-01 8-9' 4 7 8 7
	10			10		
	12					
	14					
	16		16.0 si-v.f. SAND, wet, cohesive, firm, gray to loose	16		2 3
			17.5 grading to SILT w̄ v.f. sand, wet, soft, cohesive,	100%		70
	18					320 Strong solvent smell
			18.6 grading to si-CLAY, wet, v. soft, low plast			500 IS16-02 @ 18.5' 250 260 500
	20			20		25

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

HOLE NO.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe Soil Sampling @ Bldg 25

2. LOCATION (Coordinates or Station)

3. DRILLING AGENCY FUGRO

4. HOLE NO. (As shown on drawing title and file number) IR88-IS17

5. NAME OF DRILLER Frank Ward

6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE 21 ft

10. SIZE AND TYPE OF BIT 1" & 1 3/4" ID core barrel

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED 2

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER ~ 8 ft BGS

16. DATE HOLE | STARTED 11-19-97 @ 1015 | COMPLETED 11-19-97 @ 1150

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
	8		8.0 si-v.f. SAND, wet, loose, lt. gray	8 80%		Hnu Strong hydrocarb smell 280 IS17-01 8-9' 160 70
	10			10		80
	12					
	14					
	16					Hnu
			17.0 SILT w clay & v.f. sand, firm, wet, cohesive, slt plast, gray	17		220
	18					Strong solvent odor IS17-02 @ 18.0' → 400
			18.5 grading to si-CLAY w v.f. sand & peat, wet, v. soft, low plast gray	100%		100 190
			19.8 CLAY w peat, soft to firm, low plast, peat decreasing w depth			40
	20					80

ENG FORM

PROJECT 21

HOLE NO. 20 30

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe Soil Sampling @ Bldg 25
2. LOCATION (Coordinates or Station) ~12 ft N of well TW-3
3. DRILLING AGENCY FUGRO
4. HOLE NO. (As shown on drawing title and file number) IRBB-IS18
5. NAME OF DRILLER Frank Ward
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 21 ft
10. SIZE AND TYPE OF BIT 1" & 1¾" ID core barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~8 ft BGS
16. DATE HOLE STARTED 11.19.97 @ 1400 COMPLETED 11.19.97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzner DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
						Hnu
	8		8.0 f. to v.f. SAND, wet, loose to cohesive, firm, lt gray	8		6
				100%		2
						2
	10			10		0
	12					
	14					
	16					
			17.0 si- v.f. SAND, wet, firm, cohesive, gray	17		3
	18		18.0 grading to cl-SILT w̄ f. sand & peat particles, slt plast.			IS18-02 7
				100%		@ 18.4' ---> 7
			18.8 grading to si-CLAY w̄ f sand & peat particles, wet, soft, med gray low plast			3
			19.6 grading to CLAY w̄ peat, minor silt & f. sand, soft-firm, low plast			1
	20					0
				21		0

ENG FORM 1836

PROJECT

HOLE NO.

Hole No.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe Soil Sampling @ Bldg 25
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY FUGRO
4. HOLE NO. (As shown on drawing title and file number) IR88-IS19
5. NAME OF DRILLER Frank Ward
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 21 ft
10. SIZE AND TYPE OF BIT 1" & 1¾" ID core barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: — UNDISTURBED: 2
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~ 8 ft BGS
16. DATE HOLE — STARTED: 11-19-97 @ 1510 — COMPLETED: 11-19-97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
						Hnu
	8		8.0 si-f. SAND, wet, gray	8		40
			8.7 si-cl-v.f. SAND w̄ peat			Strong hydrocarb smell 280
				80%		IS19-01 170
						@ 8-9' 250
	10			10		
	12					
	14					
	16					Hnu
			17.0 si-f. SAND, wet firm,	17		12
	18		18.2 grading to cl-SILT w v.f. sand & peat particles, wet, slt plast			3
				100%		.5
			18.9 grading to si-CLAY w̄ v.f. sand & peat particles, wet, low plast, soft			.5
			14.5 grading to CLAY w̄ minor silt, peat particles, v. soft, low-med plast			.5
	20					.5
	21					

ENG FORM 1836

PROJECT

HOLE NO. 3

Hole No.

DRILLING LOG	DIVISION	INSTALLATION MCB Camp Lejeune	SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe Soil Sampling @ Bldg 25
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY FUGRO
4. HOLE NO. (As shown on drawing title and file number) IRBB-IS20
5. NAME OF DRILLER Frank Ward
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 21 ft
10. SIZE AND TYPE OF BIT 1" & 1 3/4" ID core barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED ____ UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~8 ft BGS
16. DATE HOLE STARTED 11·19·97 @ 1630 COMPLETED 11·19·97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
	8		8.0 si-v.f. SAND, wet, firm, lt gray lt brn tan-gray	8 100% 10		Hnu 4 11 125 25 3
	10					
	12					
	14					
	16					
			17.0 si-v.f. SAND, wet, firm,	17 100%		Hnu slight solvent smell 38 10 IS20-02 @ 18.5 52 20 1
	18		19.0 grading to cl-SILT, wet, slt plast 19.4 grading to CLAY, wet, soft, low plast, w/ peat particles			
	20					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

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DRILLING LOG	DIVISION	INSTALLATION MCB Camp Lejeune	SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe Soil Sampling at Bldg 25	10. SIZE AND TYPE OF BIT 1" & 1¾" ID core barrel
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY FUGRO	12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
4. HOLE NO. (As shown on drawing title and file number) IR88-IS22	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: — UNDISTURBED: 3
5. NAME OF DRILLER Frank Ward	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	15. ELEVATION GROUND WATER ~8 ft BGS
	16. DATE HOLE — STARTED: 11-20-97 @ 1140 — COMPLETED: 11-20-97
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 22 ft	19. SIGNATURE OF INSPECTOR Fred Holzmer DE & S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
	8		8.0 f. to v.f. SAND, minor silt, wet, cohesive, lt. gray to buff	8		Hnu 400
						400
				100%	IS22-01 8-9'	360
						360
	10			10		425
	12					
	14					
						Hnu Strong solvent odor
	16		16.0 f. to v.f. SAND, wet, firm, lt gray	16		420
						380
						340
			17.5 grading to si-cl-f. SAND, wet firm to slt soft, slt plast		Perm Test Core	220
	18			100%	20 Hnu 400	420
			18.4 grading to cl-SILT w̄ v.f. sand, wet, soft, low plast, med gray			440
			19.2 grading to si-CLAY, wet, soft, low plast, med-dk gray		90	260
						160
	20			20	22 340	
	21		21.0 grading to CLAY w̄ silt & peat particles, peat increasing w̄ depth, low plast, brown, solvent smell			

ENG FORM 1836 | PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION MCB Camp Lejeune	SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe Soil Sampling @ Bldg 25
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY FUGRO
4. HOLE NO. (As shown on drawing title and file number) IR88-IS23
5. NAME OF DRILLER Frank Ward
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 21 ft
10. SIZE AND TYPE OF BIT 1¾" ID Core barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~8 ft BGS
16. DATE HOLE STARTED 11-21-97 COMPLETED 11-21-97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Hohner DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
	8					
	10					
	12					
	14					
	16					Hnu
		∴	17.0 v.f. SAND, wet, firm, gray	17		* PA Samples * 40
						IS23-01 @ 17.5' → 160 VOA
	18	‖	18.3 grading to SILT w̄ v.f. sand & clay, wet, firm, slt plast	95%		IS23-02 @ 18.25' → 240 VOA 380
		▨	19.0 grading to si-CLAY w̄ peat particles, wet, v. soft, low-med plast med-dk gray			IS23-03 @ 19.0' 320 VOA IS23-04: 19.5-19.9 70 Kv/CapP
	20	▨	20.2 as above grading to gray-brn. w̄ increasing peat fragments, low plast			IS23-05: 20.0-20.4 24 Kv/CapP
	21			21		

ENG FORM 1836 PROJECT HOLE NO. 40

DRILLING LOG	DIVISION	INSTALLATION MCB Camp Lejeune	SHEET OF 1 SHEETS

1. PROJECT: Geoprobe Soil Sampling @ Bldg 25

2. LOCATION (Coordinates or Station)

3. DRILLING AGENCY: FUGRO

4. HOLE NO. (As shown on drawing title and file number): IR88-IS24

5. NAME OF DRILLER: Frank Ward

6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ________ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE: 20 ft

10. SIZE AND TYPE OF BIT: 1 3/4" ID core barrel

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED | UNDISTURBED

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER: ~ 8 ft BGS

16. DATE HOLE: STARTED 11-20-97 @ 1600 | COMPLETED 11-20-97

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR: Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
	8					
	10					
						No Performance Assessment VOC samples collected here due to difficult sampling & poor recovery
	12					
	14					
						Difficulty collecting core: 1st attempt recovered ~25% 2nd " " ~40% ↳ strong solvent smell
	16				16	Estimate recovered core is from ~ 17.5-19.0 ft based on nearby logs IS07 & IW01
			~17.5 si-v.f. SAND, wet, firm			Hnu 420 — 17
	18		~18.0 grading to cl-SILT			440 — 18
						360
			~19.0 grading to si-CLAY, wet, v. soft, w̄ peat fragments v. soft, low-med plast			250 — 19
	20				20	

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PROJECT | HOLE NO.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe Soil Sampling @ Bldg 25
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY FUGRO
4. HOLE NO. (As shown on drawing title and file number) IR88-IS25
5. NAME OF DRILLER Frank Ward
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 20 ft
10. SIZE AND TYPE OF BIT 1" & 1 3/4" ID core barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~ 8 ft BGS
16. DATE HOLE STARTED 11·21·97 @ 0850 COMPLETED 11·21·97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					Hnu
	8		8.0 f. to v.f. SAND, wet, firm, lt gray to buff, sparse peat fragments		8	6
						6
				75%		7
						3
	10				10	
	12					
	14					Hnu
	16		16.0 f. SAND, wet, stiff,		16	38
						* PA Samples * 80
						IS25-01 @ 17' 440
			17.5 SILT w̄ clay & v.f. sand, sparse peat fragments, slt plast, med-dk gray	85%		260
	18					IS25-02 @ 18' 280
			18.4 grading to v.f. SAND			
			18.5 cl-SILT w̄ v.f. SAND, slt-low plast			480
			18.7 si-CLAY, med soft, low plast minor peat, med gray			IS25-03 @ 19' 420
			19.0 thin si-v.f. SAND seam followed by si-CLAY, minor peat, low-mod plast. gray-brn			
	20				20	

ENG FORM 1836

PROJECT

HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION MCB Camp Lejeune	SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe Soil Sampling at Bldg 25
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY FUGRO
4. HOLE NO. (As shown on drawing title and file number) IR88-IS26
5. NAME OF DRILLER Frank Ward
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 20 ft
10. SIZE AND TYPE OF BIT 1 3/4" ID core barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~ 8 ft BGS
16. DATE HOLE STARTED 11·21·97 @ 1000 COMPLETED 11·21·97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzner DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
	8					
	10					
	12					
	14					
						* PA Samples * Hnu
	16		16.0 f. SAND, wet, firm, sparse peat fragments, gray		16	13
						4
						IS26-01 @17.0' → 60
			17.2 si-v.f. SAND, wet, stiff, sparse peat fragments			160
			17.7 grading to cl-SILT, wet, slt plast, sparse peat fragments, med-soft			IS26-02 @17.75' → 130
	18			80%		
			18.3 grading to si-CLAY, wet, soft, low plast, sparse peat frags			IS26-03 @ 18.5' → 60
						62
		NR				
	20				20	

ENG FORM 1836 | PROJECT | HOLE NO.

Hole No.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe Soil Sampling at Bldg 25
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY FUGRO
4. HOLE NO. (As shown on drawing title and file number) IR88-IS27
5. NAME OF DRILLER Frank Ward
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 10 ft
10. SIZE AND TYPE OF BIT 1" ID core barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~ 8 ft BGS
16. DATE HOLE STARTED 11·21·97@ 1035 COMPLETED 11·21·97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
	8	⋯	8.0 f. to v.f. SAND w intermittent si-cl-f. SAND layers, wet, firm, grading from brn to yel-orange to lt gray	8 65% 10		IS27-01 @8-9' Varsol Sample Hnu 1 0 1.5
	10	NR				

ENG FORM 1836

PROJECT

HOLE NO.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe Soil Sampling inside Bldg 25

2. LOCATION (Coordinates or Station)

3. DRILLING AGENCY FUGRO

4. HOLE NO. (As shown on drawing title and file number) IR88-IS28

5. NAME OF DRILLER Frank Ward

6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE 20

10. SIZE AND TYPE OF BIT 1" & 1¾" ID core barrel

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED ____ UNDISTURBED 3

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER ~ 8 ft BGS

16. DATE HOLE STARTED 11-21-97 @ 1935 COMPLETED 11-22-97 @ 0815

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
	8		8.0 f. to v.f. SAND, wet, firm, tan to buff color	8 80% 10		Hnu 1 1 1 1
	10					No VOC sample collected since no contacts were observed between sand to silt to clay, & no evidence of contam.
	12					
	14		cl-SILT, med-firm, gray, low plast., sparse peat	14 40% 18		Poor recovery: 1.5 ft from somewhere between 14-18 ft PID malfunction but no evidence of contamination, only mild organic decay smell
	16					
	18		18.0 CLAY, wet, soft, low-med plast, sparse peat, med-gray 18.7 grading to peaty-CLAY, soft-firm, low plast, grayish-brn	18 100% 20		Hnu malfunction, but no evidence of contam; mild organic decay odor only.
	20					

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PROJECT

HOLE NO.

Hole No.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Geoprobe soil sampling inside Bldg 25
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY Fugro
4. HOLE NO. (As shown on drawing title and file number) IRBB-IS29
5. NAME OF DRILLER Frank Ward
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ________ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 20 ft
10. SIZE AND TYPE OF BIT 1" & 1¾" ID Core barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER ~ 8 ft BGS
16. DATE HOLE — STARTED 11-22-97@ 0825 — COMPLETED 11-22-97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holmer DE & S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
	8		8.0 f. SAND, moist on top then wet, firm, tan, grading to lt gray	8 75% 10		IS29-01 8-9' Strong hydrocarb smell Hnu 58 170 250 120
	10	NR				
	12					
	14					
	16			16 50% 20		* * Due to poor recovery. (50%), depth of Hnu readings & geologic descriptions are estimated to be from ~18-19.5 ft but not known w certainty of actual depth Hnu 300 260 260 200
	18		~18.0 f. to v.f. SAND, minor silt, wet, firm, gray, sparse peat 18.9 grading to CLAY, variable silt content, low-med plast, med-dk gray soft			IS29-02 ~18.8' * * free-phase DNAPL observed in voids (~⅛")
	20		TD @ ~ 19.8			

ENG FORM 1836

PROJECT

HOLE NO.

DRILLING LOG

DIVISION

INSTALLATION: MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT: Geoprobe Soil Sampling inside Bldg 25

2. LOCATION (Coordinates or Station)

3. DRILLING AGENCY

4. HOLE NO. (As shown on drawing title and file number): IR88-IS30

5. NAME OF DRILLER: Frank Ward

6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE: 20 ft

10. SIZE AND TYPE OF BIT: 1" & 1¾" dia core barrel

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ___ UNDISTURBED 2

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER

16. DATE HOLE: STARTED 11-22-97 @ 1030 COMPLETED 11-22-97

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR: Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
	8	⁘	8.0 f. SAND, wet, firm	8 60%		IS30-01 8-9' Hnu 250 200 60
	10			10		
	12					
	14					Core sample from 16-20 ft had poor recovery (~40%) Recovered core is estimated to be from a depth interval of ~18.5-20 ft
	16			16		
	18	▨	~18.5 si-CLAY, soft-firm, low plast, med-gray ~18.8 CLAY w̄ minor silt, soft, low to med plast, med-gray minor peat, grading to brn-gray w̄ increasing peat	40%		* * * Hnu IS30-02 ——→ 200 @~18.8'; abundant free-phase DNAPL in core-catcher tracks & in water in core tube 70 60
	20			20		

ENG FORM

Conten

PROJECT

HOLE NO.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 **OF** 1 **SHEETS**

1. PROJECT Geoprobe soil Sampling inside Bldg 25

2. LOCATION (Coordinates or Station) 7.7 ft

3. DRILLING AGENCY Fugro

4. HOLE NO. (As shown on drawing title and file number) IR88-IS31

5. NAME OF DRILLER Frank Ward

6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE 20 ft

10. SIZE AND TYPE OF BIT 1" & 1 3/4" dia core barrel

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN **DISTURBED** **UNDISTURBED** 2

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER

16. DATE HOLE **STARTED** 11-22-97@1400 **COMPLETED** 11-22-97

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	2					
	4					
	6					
	8	⁘	8.0 f. to v.f. SAND, wet, firm, lt yel-orange w̄ lt gray mottling assoc'ed w̄ clayey areas.	8 90% 10		IS30-01 8-9 ft Hnu 9 15 5 12
	10					
	12					
	14					
	16	⁘	16.0 v.f. SAND, wet, firm, sparse peat frags, gray	16		Hnu
		⁘	17.0 interlayered v.f. SAND & CLAY firm,			IS31-02 @ ~16.8 ft → 110 100 20
	18	▨	17.5 CLAY, soft, low-med plast, w̄ minor v.f. sand seams (< 1/8") med-dk gray, sparse peat	95%		8 1
		▨	18.9 grading to peaty-CLAY, low-med plast, soft-firm, gray-brn			1 0
	20	▨		20		

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PROJECT

HOLE NO.

Hole No.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Site 88: Bldg 25
2. LOCATION (Coordinates or Station) PITT Wellfield: 3ft W of EX04
3. DRILLING AGENCY Parratt-Wolfe
4. HOLE NO. (As shown on drawing title and file number) IR88-IS32
5. NAME OF DRILLER Layne Pech / Parratt-Wolff
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____________ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 22 ft BGS
10. SIZE AND TYPE OF BIT 3¼" ID HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL CME 55
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 5
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE STARTED 3/23/98 @ 1345 COMPLETED 1515
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	PID Reading
						Geoprobe macrocore Sampler (2" x 48") from 4-20 ft. bgs	
			4.0 v.f. SAND w̄ minor silt & clay, cohesive, friable, moist	4		Split-spoom sample 20-22 ft bgs	
	5						250
				50%			250 300
				8			
			~9 si-cl-f. SAND, moist, slt plast				200
	10						280
			~10 f SAND, minor fines, moist, lt gray	75			300
			11 as above, med-gray, wet, loose				200
	12			12			
							250
			as above				100
				40%			
	14						150
	16			16			
			as above grading to si-v.f. SAND, wet, cohesive, friable, solvent odor				250
				30%			300
	18		poor recovery				300
			contact between sand & clay not recovered				
	20		20.0 CLAY w̄ minor peat med plast,	20		Spt Spoon sample 1¾" x 24"	9 4
				100%			4 3 2
	22			22			2

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PROJECT

HOLE NO.

Hole No.

DRILLING LOG

DIVISION

INSTALLATION Camp Lejeune, NC

SHEET 1 OF 1 SHEETS

1. PROJECT Bldg. 1725 DNAPL Source Zone Borings

LOCATION (Coordinates or Station)

3. DRILLING AGENCY PARRATT - Wolff Inc.

4. HOLE NO. (As shown on drawing title and file number) IR88-RW01

5. NAME OF DRILLER Arnold CHAPEL

6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ________ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN NA

8. DEPTH DRILLED INTO ROCK NA

9. TOTAL DEPTH OF HOLE 20.0 FEET

10. SIZE AND TYPE OF BIT

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL CME 55 Adapted w/ hollow stem AUGERS

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER

16. DATE HOLE | STARTED 8/19/97 | COMPLETED 8/19/97

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING 72 %

19. SIGNATURE OF INSPECTOR INTERA JOHN T. LONDERGAN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			8-INCH MANHOLE			HNu (ppm)
			very fine sand, dry			
			water tight gripper plug			
	2		grout mixed at 600 lb Portland Cement w/ 40 gal water and 6 lbs bentonite			
			3			
	4		4 INCH DIAM. Sch. 40 Flush THREADED JOINT PVC CASING	Only 1.5' RECOVERY From 4' push		9.2 147 47
	6		Hydrocarbon odor			121
			7			3.1 10.6
	8		bentonite seal	2.5' recovery from 4' push		9.8
∇ Hw = 8.40' 8/20/97 1800 hrs			12.25-inch diam. BOREHOLE			4.6 — RW01-9.5 TPH 9.5 4.6 3.5
	10		Very fine SAND, wet, lt grey color			
			11	3.0' recovery from 4' push		4.7 1.8
	12		Drilling Service Inc. #1 Filter Sand 704-322-1100 8-50 lb bags			2.4 1.5 1.3 1.3
	14					1.5
			4 inch diam. 304 SS 0.01-inch WIRE WRAP CONTINUOUS SLOT SCREEN			
			15	3.5' recovery from 4' push		22.4 10.2
	16					4.3 10.0 — RW01-1 TCE 17.0
						165.0
	18					270.0 — RW01-2 TCE 18' 122.0
			silty clay, lt grey wet, soft			27.0
			19	1.0 ft recovery 1.0 ft push		
	20		1' sump 304 SS			RW01-3 TCE 20.0

Hole No.

DRILLING LOG

DIVISION

INSTALLATION CAMP LEJEUNE, NC

SHEET 01 OF 01 SHEETS

1. PROJECT Bldg. HP25 DNAPL Source Zone Borings

2. LOCATION (Coordinates or Station)

3. DRILLING AGENCY Parratt Wolff

4. HOLE NO. (As shown on drawing title and file number) IR88- RW02

5. NAME OF DRILLER Arnold Chapol

6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN NA

8. DEPTH DRILLED INTO ROCK NA

9. TOTAL DEPTH OF HOLE 20.0

10. SIZE AND TYPE OF BIT

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL CME55 Adapted for hollow stem augers

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 0

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER

16. DATE HOLE STARTED 8/19/97 COMPLETED 8/19/97

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING 82 %

19. SIGNATURE OF INSPECTOR INTERA JOHN T. LONDERGAN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			8 inch diameter manhole Very fine sand, dry, lt grey watertight gripper cap			HNu (ppm)
	2		grout mixed at 600 lbs portland cement w/ 40 gal. water and 6 lbs bentonite			
			3	3.5 ft recovery from 4' push		
	4		4-inch diameter schedule 40 PVC flush threaded casing			4.7 8.8 22.0 66.0
	6		12.25-inch diam. borehole			5.6 11.3
			7	3.0 ft recovery from a 4' push		5.5 4.6
	8		wet			2.7 1.3 112.0
▽ tw-8.96' 8/27 1003 hrs			change to a tan color			22.0 RW02-04 TPH 9.0-9.5' 11.0
	10		bentonite seal			4.4
			11	recovered 3.5 ft of a 4' push		97.0 72.0
	12		change back to a lt. grey color			6.7 3.3 11.2
	14		4-inch diameter 304 stainless steel			14.7 36.0 12.8
			0.01-inch wire wrap 15 continuous slot screen w/ flush threaded joints	4.0 ft recovery on a 4.0 ft push		16.7 RW02-1 PCE 17.0' 16.0
	16		Drillers Service Inc. #1 filter sand 704-322-1100 8-50 lb bags of sand			4.0 5.6 RW02-2 PCE 18.0' 19.0 13.1 RW02-09 FOC 18.0-18.5
	18					94.0 RW02-3 PCE 18.5' 20.0
			silty clay, grey, soft, wet	1.0 ft recovery on 1 ft push SS		
	20					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

HOLE NO.

Hole No.

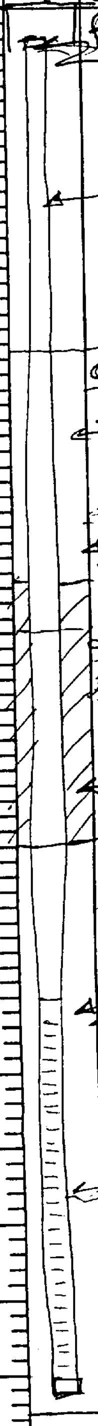
DRILLING LOG

DIVISION

INSTALLATION: CAMP LEJEUNE, NC

SHEET 1 OF 1 SHEETS

1. PROJECT: Bldg. HP25 DNAPL Source Zone Borings
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: PARRATT-WOLFF INC.
4. HOLE NO. (As shown on drawing title and file number): IR88-IW01
5. NAME OF DRILLER: ARNOLD CHAPEL
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: NA
8. DEPTH DRILLED INTO ROCK: NA
9. TOTAL DEPTH OF HOLE: 19.0 FEET
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 55 Adapted for hollow stem augers
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ______ UNDISTURBED ______
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 8/20/97 COMPLETED 8/20/97
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING: 75 %
19. SIGNATURE OF INSPECTOR: JOHN T. LONDERGAN INTERA



ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			8-inch diam. & MANhole			
			fine sand, lt brown, dry			HNu (ppm)
			water tight griffin cap			Note: 2 inch diam. well installed inside 8-inch ID augers because drillers had no other augers available above 3.25 ID.
	2		2-inch diameter schedule 40 PVC casing w/ flush threaded joints			
			3	2.5 ft recovery on a 4' push		
	4					15.9
						227.0 268.0 — IW01-04 TPH 4.0-4.5
			clayey fine sand, dk grey, moist			
			grout mixed at 400 lbs lbs portland cement w/ 7 lbs bentonite and 30 gal water			31.0 — IW01-06 PCE 4.5'
	6					42.0 48.0
			7			
			12.25-inch diam. borehole	2.5 ft recovery on a 4' push		
	8		decrease in clay content becomes fine sand lt grey wet			19.8 55.0 61.0 — ~~IW01-05 TPH 9.0-9.5'~~ Not submitted to lab 5.7
	10		BENTONITE SEAL			3.3 17.0
			11			
			becomes darker grey in color	3.0 ft recovery on a 4.0 ft push		13.0 13.6
	12		Drillers Service Inc. #1 filter sand 704-322-1100 12-50 lb bags of sand			4.9 1.2 2.0
	14					2.1 2.3
			2-inch diameter 304 stainless steel 0.01-inch wire wrap continuous slot screen w/ flush threaded joints 15.	4.0' recovery on a 4.0' push		22.0 — IW01-1 PCE 17.0'
	16					6.1 1.5 — IW01-2 TCE 18.0' 6.2
						20.1 — IW01-09 FOC 18.0-18.5'
	18		silty clay, soft, grey, wet			140.0 613.0 — IW01-3 TCE 18.5' 22.0 — IW01-09 TPH 18.5-19.0
			19			
	20					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

HOLE NO.

INTERA -TAN304

SOIL BORING LOG

SITE NAME AND LOCATION	DRILLING METHOD: 3 1/4 HSA	BORING NO. SB-EX01
	SAMPLING METHOD: 2' x 1 3/8" SPLIT SPOON	SHEET 1 OF 1
DATUM	ELEVATION	

					DRILLING START	DRILLING FINISH
WATER LEVEL (BLS)						
TIME					TIME 1119	TIME 1350
DATE					DATE 12/3	DATE 12/3
CASING DEPTH (BLS)						

DRILLER:

DRILL RIG	SURFACE CONDITIONS
ANGLE BEARING	
SAMPLE HAMMER TORQUE FT.-LBS.	

PID (ppm)	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
						0-16' A-H (Auger-No Sample)						
[illegible]	16.5			N R				EX01-01		16.5'		VOA
260			75					EX01-02		17.5'		(VOA)
320						VF SAND, some silt, trace clay; gray; wet; solvent odor						
360												
300	18							EX01-05		18.5'		(VOA)
150					18.7							
150			80									
160					20.0							
300	20					CLAY, little silt, trace sand; dark gray; wet to moist						
250												
200			90			CLAY, trace silt and peat; dark gray; moist						
100	22											

LOGGED BY: M. DeJohn (BAKER)

INTERA ~~TRG304~~ TDN304 **SOIL BORING LOG**

SITE NAME AND LOCATION	
DRILLING METHOD:	3 1/4" HSA
SAMPLING METHOD:	2' x 1 3/8" SPLIT SPOON
BORING NO.	88-EX02
SHEET	1 OF 1
DATUM	
ELEVATION	

DRILLING	START	FINISH
TIME	1534	1625
DATE	12/3	12/3

WATER LEVEL (BLS)				
TIME				
DATE				
CASING DEPTH (BLS)				

DRILLER:

DRILL RIG

SURFACE CONDITIONS

ANGLE

BEARING

SAMPLE HAMMER TORQUE FT.–LBS.

	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
						0-13' A-N						
1 15 3 2	13 14		90			13.0 VF SAND, little silt, trace clay; dark gray; wet						
5 5 5	15 16		100			VF SAND, some silt, trace clay; dark gray; wet						
40 40 170 160	17 18		100			VF SAND, some silt, trace clay; dark gray; wet						
240 260 300 160 170	19 20		100		19.3 20.0	19.3 SILT, trace fine sand: clay; gray; wet 20.0 CLAY, little silt, trace fine sand and peat; brown (dark); moist						SOLVENT ODOR
	21	30	4@	21.0'								
						PER JTL, NO SOIL SAMILES COLLECTED FOR VOA.						

LOGGED BY:

INTERA -~~IRG304~~ TDN304

SOIL BORING LOG

SITE NAME AND LOCATION

DRILLING METHOD: 3 1/4" HSA

SAMPLING METHOD: 2' x 1 3/8" SPLIT SPOON

BORING NO. 88-EX03

SHEET OF

	WATER LEVEL (BLS)				
	TIME				
	DATE				
	CASING DEPTH (BLS)				

DRILLING	
START	FINISH
TIME 0720	TIME 0800
DATE 12/4	DATE 12/4

DRILLER:

DATUM

ELEVATION

DRILL RIG

SURFACE CONDITIONS

ANGLE

BEARING

SAMPLE HAMMER TORQUE FT.—LBS.

	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
						0-16' A-N						
2	16					VF SAND, some silt, trace M sand; dark gray; wet	=	EX03-01 @ 16.0'				VOA
2												
3	17		100									
2							=	EX03-02 @ 17.5'				VOA
8	18											
2												
6							=	EX03-03 @ 19.0				VOA SL. SOLVENT ODOR
40	19		90		19.0	19.0						
18					19.4	SILT, little clay, trace f sand; dark gray; wet						
12	20					19.4'						
		BOH @ 20.0'				CLAY, little silt, trace f sand, dark gray; wet						
	21											
	22											
	23											
	24											

LOGGED BY:

INTERA - TDN304

SOIL BORING LOG

SITE NAME AND LOCATION	
DRILLING METHOD:	3 1/4" HSA
SAMPLING METHOD:	GEOPROBE MACROCORE
BORING NO.	88-EX04
SHEET	1 OF 1
DATUM	
ELEVATION	

WATER LEVEL (BLS)				
TIME				
DATE				
CASING DEPTH (BLS)				

DRILLING	START	FINISH
TIME	1154	1253
DATE	12/4	12/4

DRILL RIG

SURFACE CONDITIONS

ANGLE

BEARING

SAMPLE HAMMER TORQUE FT.-LBS.

DRILLER:

	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
	16					VF SAND, some silt, little clay; dark brown; wet						
19	17							EX04-01 (17.0') VOA				
4			80%									
0	18							EX04-02 (18.5) VOA				
3						VF SAND, some silt, trace clay; dark gray; wet						
5	19							EX04-03 (19.5) VOA				
15												
118	20				20.0							
40						SILT, some clay; dark gray; wet			SL. SOLVENT ODOR			
35	21				21.0	CLAY, some silt; dark gray; moist						
20					21.5							
4	22		80%			CLAY, little silt, peaty; dark brown; damp to moist						
0												
4	23											
	24	BOHE			24.0'							

LOGGED BY:

Hole No.

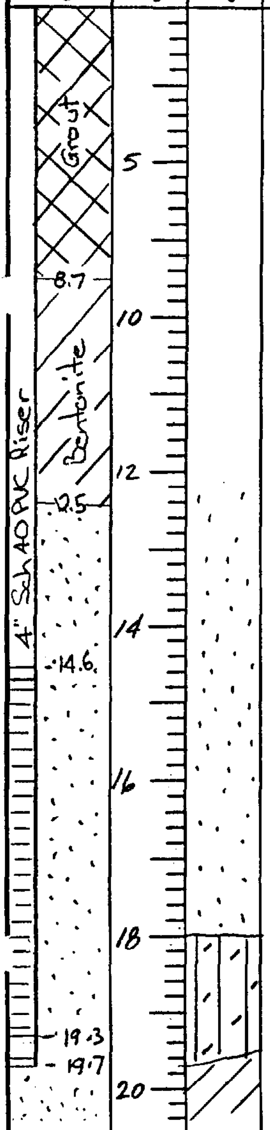
DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Site 88: Replacement Well
2. LOCATION (Coordinates or Station) PITT Wellfield: 3ft N of EX04
3. DRILLING AGENCY Parratt-Wolfe
4. HOLE NO. (As shown on drawing title and file number) EX04R
5. NAME OF DRILLER Layne Pech
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 4
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE STARTED 3/23/98 @ 1545 COMPLETED 3/23/98 @
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist



DEPTH	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
				1¾" x 24" split spoon sampler
				PID
12	f. to v.f. SAND, trace fines, wet, loose, gray	12 60%		20 280 50 70
14	as above	14 75%		
16	as above; solvent odor	16 90%		35 12 10 10 30
18	18.0 cl-sa-SILT, wet, slt plast grading to cl-SILT, low plast, soft grading to si-CLAY, soft, med plast	18 100% 20		solvent odor 200 20 10 3 3

ENG FORM

PROJECT

HOLE NO.

INTERA - TON304

SOIL BORING LOG

SITE NAME AND LOCATION	
DATUM	
ELEVATION	
DRILLING METHOD:	3 1/4" HSA
SAMPLING METHOD:	GEOPROBE MACRO CORE
BORING NO.	88-EX05
SHEET	1 OF 1

WATER LEVEL (BLS)					
TIME					
DATE					
CASING DEPTH (BLS)					

DRILLING START	DRILLING FINISH
TIME 1430	TIME
DATE 12/4	DATE

DRILL RIG

ANGLE

BEARING

SAMPLE HAMMER TORQUE FT.-LBS.

SURFACE CONDITIONS

DRILLER:

DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
					0-17' A-N						
17			NR		F SAND, little silt; tan; wet						
18	6	75			VF SAND, some silt, trace clay; dark brown; wet	=	EX05-01		(18)		VOC
19	15			19.0	SILT, trace clay & f sand; dark brown; wet	=	EX05-02		(19')		VOC
	1										
20	38			20.5	CLAY, trace silt; dark brown; moist	=	EX05-03		(20')		VOC
	20										
21	0		DONE@21.0								
22											
23											
24											

LOGGED BY:

INTERA - TDN304

SOIL BORING LOG

SITE NAME AND LOCATION

DATUM

ELEVATION

DRILLING METHOD: 3 1/4" HSA

SAMPLING METHOD: GEOPROBE MACRO CORE

BORING NO. 88-EX06

SHEET 1 OF 1

WATER LEVEL (BLS)				
TIME				
DATE				
CASING DEPTH (BLS)				

DRILLING	
START	FINISH
TIME 0758	TIME 0840
DATE 12/5	DATE 12/5

DRILLER:

DRILL RIG

ANGLE

BEARING

SAMPLE HAMMER TORQUE FT.–LBS.

SURFACE CONDITIONS

PID	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
						0-16' A-N						
2	16					F SAND, some silt; dark brown: gray; wet						
1												
1	17											
0						VF SAND, some silt, trace clay; dark gray; wet						
0	18		100									
0												
0	19				19.0	SILT, little clay; dark gray; wet						
0					19.6	CLAY, little silt; dark gray; moist						
0	20											
			Bot @ 20.0'									

LOGGED BY:

INTERA - TDN 304

SOIL BORING LOG

SITE NAME AND LOCATION

DATUM

ELEVATION

DRILLING METHOD: 3 1/4" HSA

SAMPLING METHOD: GEOPROBE MACRO CORE

BORING NO. 88-IN01

SHEET 1 OF 1

WATER LEVEL (BLS)				
TIME				
DATE				
CASING DEPTH (BLS)				

DRILLING	
START	FINISH
TIME 0740	TIME 0830
DATE 12/8	DATE 12/8

DRILLER:

DRILL RIG

ANGLE

BEARING

SAMPLE HAMMER TORQUE FT.-LBS.

SURFACE CONDITIONS

	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
						0-15' A-N						
	15											
240												
360	16					VF SAND, some silt ; clay; dark brown; wet						STRONG SOLVENT ODOR THROUGHOUT SAMPLE CORES
340												
340	17		90									
190						VF SAND, little silt; dark gray; wet						
300	18							IN01-01	(18') VOA			
300												
330	19					VF SAND, trace silt; dark gray; wet						
REE PHASE DNAPL					19.5			IN01-02 VOA	(19.5')			FREE PHASE DNAPL
	20					CLAY, some silt, trace f sand; dark gray; wet		IN01-03 VOA	(20.5')			
80			100									
130	21											
70						CLAY, trace silt & peat; dark bowrn moist						
11	22											
		Bot @ 22.0'										

LOGGED BY:

INTERA - TDN 304

SOIL BORING LOG

SITE NAME AND LOCATION	DRILLING METHOD:	BORING NO. 88-IN02
		SHEET 1 OF 1
	SAMPLING METHOD:	DRILLING
		START TIME DATE 12/8
		FINISH TIME DATE 12/8
DATUM	ELEVATION	

WATER LEVEL (BLS)				
TIME				
DATE				
CASING DEPTH (BLS)				

DRILLER:

DRILL RIG	SURFACE CONDITIONS
ANGLE BEARING	
SAMPLE HAMMER TORQUE FT.-LBS.	

	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
	16					VF SAND, trace silt; gray; wet						
104												
28	17					VF SAND, some silt; gray; wet						
70												
280	18		100		18.0	SILT, little clay, trace vf sand; dark gray; wet						
140					18.7							
350 150 82	19					CLAY, some silt; dark gray; wet						
	20		BOHe 20'			CLAY, trace silt; dark gray; moist						

LOGGED BY:

INTERA · TDN 304

SOIL BORING LOG

SITE NAME AND LOCATION

DATUM

ELEVATION

DRILLING METHOD: 3 1/4" HSA

SAMPLING METHOD: GEOPROBE MACRO CORE

BORING NO. 88-IN03

SHEET 1 OF 1

WATER LEVEL (BLS)				
TIME				
DATE				
CASING DEPTH (BLS)				

DRILLING	
START	FINISH
TIME 1508	TIME 1535
DATE 12/8	DATE 12/8

DRILL RIG

ANGLE

BEARING

SAMPLE HAMMER TORQUE FT.-LBS.

SURFACE CONDITIONS

DRILLER:

PID	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
						0-14' A-N						
	14											
13	15					VF SAND, little silt ; clay; dark brown; wet						
13												
15	16		90			VF SAND, little to some silt (inc. w/ depth) gray; wet		88-1N03-01 (16.0') VOA				
2												
9	17											
2						SILT, some vf sand; dark gray; wet		88-1N03-02 (17.5') VOA				
	18				18.0							
41								88-1N03-03 (19') VOA				
2	19				19.0							
5			80			CLAY, little silt, trace vf sand; dark gray; moist						
3	20											
2												
	21		BOH@21'									
	22											

LOGGED BY:

INTERA - TDN 304

SOIL BORING LOG

SITE NAME AND LOCATION

DATUM

ELEVATION

DRILLING METHOD: 6" CASING DRIVE

SAMPLING METHOD: GEOPROBE MACRO CORE

BORING NO. 88-HC01

SHEET 1 OF 1

WATER LEVEL (BLS)					DRILLING START TIME	FINISH TIME
TIME						
DATE					DATE	DATE
CASING DEPTH (BLS)						

DRILLER:

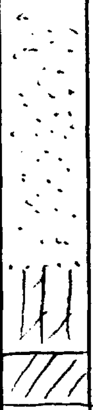
DRILL RIG

SURFACE CONDITIONS

ANGLE

BEARING

SAMPLE HAMMER TORQUE FT.–LBS.



	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
	16											
200	17											
280												
220	18					VF SAND, some silt; dark gray; wet						STRONG SOLVENT ODOR
320							=	88-HC01-01 (18.5') VOA				
390	19		19									FREE PHASE DNAPL
220												
200	20						=	88-HC01-02 (20') VOA				
400			100		20.3 ?							
150	21					SILT, little clay (increase amt w/depth to some); dark gray; wet	=	88-HC01-03 (21') VOA				
22					21.5	CLAY, trace silt; dark gray; moist						
	22		BOH@22.0									

LOGGED BY:

INTERA - TON 304

SOIL BORING LOG

SITE NAME AND LOCATION

DATUM

ELEVATION

DRILLING METHOD: 3 1/4" HSA

SAMPLING METHOD: GEOPROBE MACRO CORE

BORING NO. 88-HC02

SHEET 1 OF 1

DRILLING	
START	FINISH
TIME 0800	TIME 0830
DATE 12/9	DATE 12/9

WATER LEVEL (BLS)				
TIME				
DATE				
CASING DEPTH (BLS)				

DRILL RIG

SURFACE CONDITIONS

ANGLE

BEARING

SAMPLE HAMMER TORQUE FT.-LBS.

DRILLER:

	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
	14		14									
5	15											
5						VF SAND, some silt, trace clay; dark brown; wet						
1	16		80%					88-HC02-01 (16.0')				VOA
1												
4	17					VF SAND, some silt; gray; wet						
14								88-HC02-02 (17.5')				VOA SL. SOLVENT ODOR
19	18		18									
50					18.7			88-HC02-03 (18.5')				VOA
65	19		100			SILT, trace clay; dark gray; wet						
7					19.2							
3	20					CLAY, some to trace silt (decreasing w/depth); dark gray; wet						
			20.5	BORE 20.5'								
	21											

LOGGED BY:

INTERA - TON304

SOIL BORING LOG

SITE NAME AND LOCATION

DATUM ELEVATION

DRILLING METHOD: 3 1/4" HSA

SAMPLING METHOD: GEOPROBE MACROCORE

BORING NO. 88-RW04

SHEET 1 OF 1

WATER LEVEL (BLS)				
TIME				
DATE				
CASING DEPTH (BLS)				

DRILLING	
START	FINISH
TIME 1200	TIME
DATE 12/9	DATE 12/9

DRILLER:

DRILL RIG

ANGLE BEARING

SAMPLE HAMMER TORQUE FT.-LBS.

SURFACE CONDITIONS

PID	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
	14											
26						VF SAND, some silt, trace clay; dark brown; wet						
4	15				14.8	CLAY, some silt; gray; wet						
30					15.2	VF SAND, little silt; gray; wet to some						
10	16		100									
10												
3	17											
20						VF SAND, some silt, trace clay; dark brown; wet						
200	18							88-RW04-01 (18') VOA				STRONG SOLVENT ODOR
9					18.7	VF SAND, some silt; dark gray; wet						
300	19											
340			100			SILT, little clay; dark gray; wet		88-RW04-02 (19.5') VOA				FREE PHASE DNAPL
346	20											
200					20.3			88-RW04-03 (20.5') VOA				
360	21		BOH@21'			CLAY, trace silt; dark gray; moist						
	22											

LOGGED BY:

INTERA - TON304

SOIL BORING LOG

SITE NAME AND LOCATION

DATUM

ELEVATION

DRILLING METHOD:

SAMPLING METHOD:

BORING NO. RW06

SHEET 1 OF 1

DRILLING	
START	FINISH
TIME	TIME
DATE	DATE

WATER LEVEL (BLS)				
TIME				
DATE				
CASING DEPTH (BLS)				

DRILLER:

DRILL RIG

ANGLE

BEARING

SAMPLE HAMMER TORQUE FT.-LBS.

SURFACE CONDITIONS

	DEPTH IN FEET (BLS)	BLOWS / 6 IN. ON SAMPLER	% RECOVERY	SOIL GRAPH	MATERIAL CHANGE DEPTH (BLS)(FT)	DESCRIPTION OF MATERIAL	SAMPLED INTERVAL	SAMPLE No.	FIELD SCREENING OR HEAD SPACE ANALYSIS OVM/HNU (ppm)	DEPTH IN FEET FROM	DEPTH IN FEET TO	DESCRIPTION OF OPERATION AND REMARKS
	14											
	15											
60	16											
24						VF SAND, some silt; dark brown; wet						
30	17					VF SAND, little silt; gray; wet						
20												
	18											
	19											
	20		50									
160	21											
200												
	22											

LOGGED BY:

Hole No.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Site 88 : Replacement Well
2. LOCATION (Coordinates or Station) PITT Wellfield : 3 ft N of EX04
3. DRILLING AGENCY Parratt-Wolfe
4. HOLE NO. (As shown on drawing title and file number) EX 04R
5. NAME OF DRILLER Layne Pech
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____________ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 4
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE STARTED 3/23/98 @ 1545 COMPLETED 3/23/98 @
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
						1¾" x 24" split spoon sampler
	5					
	10					
						PID
	12		f. to v.f. SAND, trace fines, wet, loose, gray	12 60%		20 280 50 70
	14		as above	14 75%		
	16		as above; solvent odor	16 90%		35 12 10 10 30
	18		18.0 cl-sa-SILT, wet, slt plast grading to cl-SILT, low plast, soft grading to si-CLAY, soft, med plast	18 100%		solvent odor 200 20 10 3 3
	20			20		

Hole No.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Site 88 : Bldg 25 Aquitard Well Point Installation
2. LOCATION (Coordinates or Station) PITT Wellfield
3. DRILLING AGENCY Parratt-Wolfe
4. HOLE NO. (As shown on drawing title and file number) WP01AQT
5. NAME OF DRILLER Lee
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 23.5 ft BGS
10. SIZE AND TYPE OF BIT 6 1/4" ID HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL CME 55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 3
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE STARTED 6-25-98@0800 COMPLETED 6-26-98
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
						No core samples from 0-13' bgs Continuous tube sampling from 13-21' bgs w 2" ID x 4 ft long geoprobe Macrosampler
	5					
	10					PID Reading
			13.0 f. SAND w minor fines, wet, cohesive, lt gray		13	
	15			70%		14 25 ppm 14.5 20 15 3 15.5 0
	16		as above		16	
				65%		17.5 0 18 0 18.5 12
	18					
			19.0 cl-SILT w f. sand, wet low plast, lt gray, soft 19.5 grading to si-CLAY, wet, low plast, med gray, v. soft. 19.8 grading to CLAY w minor silt & minor peat, wet, soft, med plast, gray-brn. as above to 21 ft bgs		19	19.5 110
	20			100%		20 20 20.5 12 No PCE odor at 21.0
					21	-Drilled to 19.5' bgs to set surface casing. (3" ID x 21.1' steel pipe) -Pushed casing from 19.5-21.0' bgs -Grout
	22					
	24					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

HOLE NO.

Hole No.

DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Site 88 : Bldg 25 Aquitard Well Point Installation
2. LOCATION (Coordinates or Station) PITT Wellfield
3. DRILLING AGENCY Parratt Wolfe
4. HOLE NO. (As shown on drawing title and file number) WP02AQT
5. NAME OF DRILLER Lee
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 25.5 ft BGS
10. SIZE AND TYPE OF BIT 6 1/4" ID HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL CME 55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 3
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE STARTED 6-25-98 @ 1015 COMPLETED 6-26-98
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
						No Core samples collected from 0-15 ft Continuous tube sampling from 15-21' bgs w̄ 2" ID x 4 ft long geoprobe Macrosampler
	5					
	10					
						PID Reading
	15		15.0 f - v.f SAND, wet, Cohesive, lt gray	15		15.5 55 ppm 16 12 16.5 3
	16			100%		
	17		17-19 grading to si-v.f SAND, wet, cohesive, lt gray	17		
	18			50%		18 110
			19.0 grading si-CLAY, wet, soft, low plast, lt to med gray-	19		19 120 19.5 20
	20		20.0 as above, w̄ minor peat grading to gray brn to TD @ 21' bgs	100%		20 8 20.5 8 21 0
				21		TD drilling = 19.0' bgs Set Surface Casing from 19.0-21.0' bgs (3" ID x 21' steel pipe) Grout outside casing from 19' to surface
	22					
	24					
	26					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

HOLE NO.

Hole No.

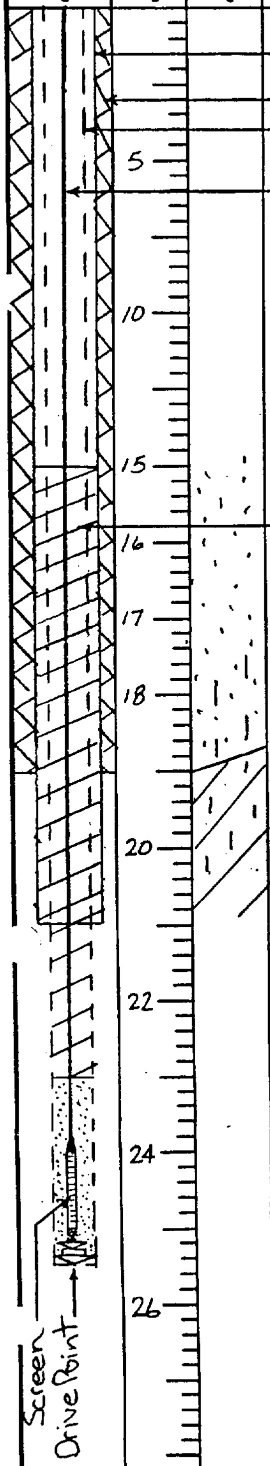
DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 1 SHEETS

1. PROJECT Site 88 : Bldg 25 Aquitard Well Point Installation
2. LOCATION (Coordinates or Station) PITT Wellfield
3. DRILLING AGENCY Parratt Wolfe
4. HOLE NO. (As shown on drawing title and file number) WP02AQT
5. NAME OF DRILLER Lee
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 25.5 ft BGS
10. SIZE AND TYPE OF BIT 6 1/4" ID HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL CME 55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED 3
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE — STARTED 6-25-98 @ 1015 — COMPLETED 6-26-98
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist



ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0–15					No core samples collected from 0-15 ft Continuous tube sampling from 15-21' bgs w 2" ID x 4 ft long geoprobe Macrosampler
	15		15.0 f - v.f SAND, wet, cohesive, lt gray	15 100%		PID Reading 15.5 55 ppm 16 12 16.5 3
	17		17-19 grading to si-v.f SAND, wet, cohesive, lt gray	17 50%		18 110
	19		19.0 grading si-CLAY, wet, soft, low plast, lt to med gray.	19		19 120 19.5 20
	20		20.0 as above, w minor peat grading to gray brn to TD @ 21' bgs	100%		20 8 20.5 8 21 0
	21			21		TD drilling = 19.0' bgs Set Surface Casing from 19.0-21.0' bgs (3" ID x 21' steel pipe) Grout outside casing from 19' to surface

WP02AQT Specs.

Drive Point @ 25.5' bgs
Sand Pack to 23.0' bgs
Bentonite to 15.0' bgs
Screen @ 24 to 25' bgs
Tubing Stickup 2.8' ags
3"dia steel casing @ 21' bgs
Surface completion includes 1' of 3"dia. PVC pipe and a press on cap with a 1/4" hole.

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

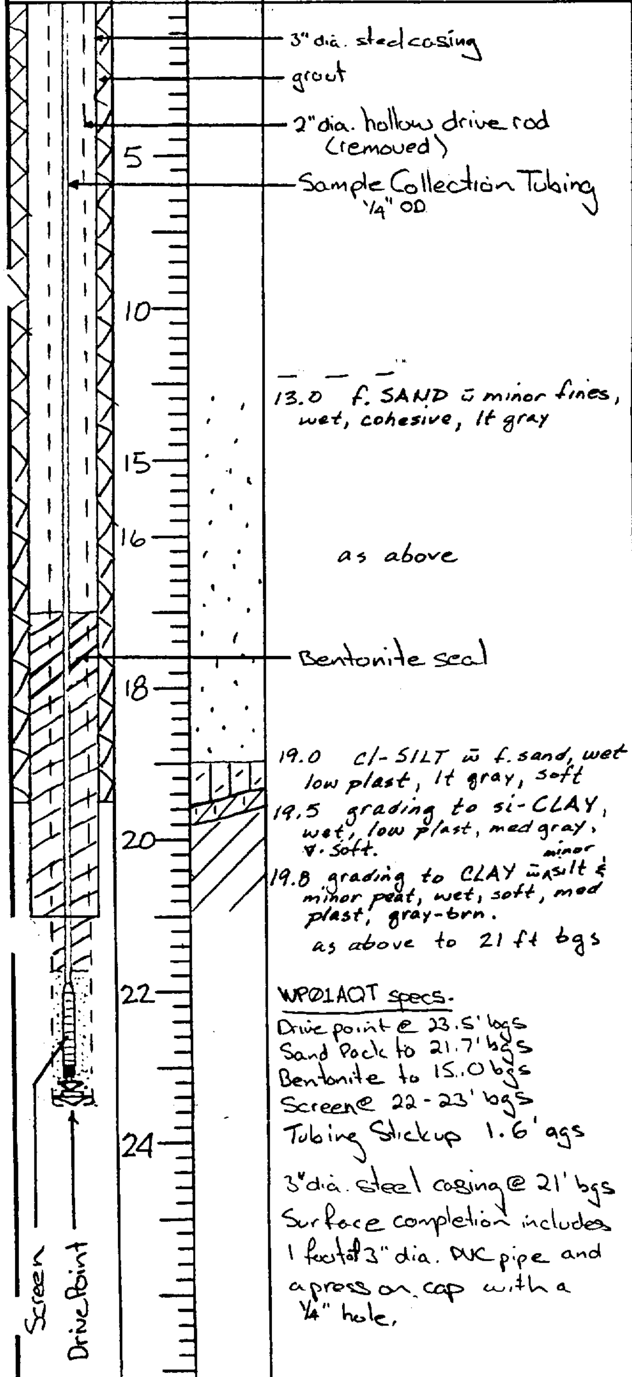
HOLE NO.

Hole No.

DRILLING LOG | DIVISION | INSTALLATION MCB Camp Lejeune | SHEET 1 OF 1 SHEETS

1. PROJECT Site 88 : Bldg 25 Aquitard Well Point Installation
2. LOCATION (Coordinates or Station) PITT Wellfield
3. DRILLING AGENCY Parratt-Wolfe
4. HOLE NO. (As shown on drawing title and file number) WP01AQT
5. NAME OF DRILLER Lee
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 23.5 ft BGS
10. SIZE AND TYPE OF BIT 6 1/4" ID HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL CME 55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED | UNDISTURBED 3
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE STARTED 6-25-98@0000 COMPLETED 6-26-98
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR Fred Holzmer DE&S Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g



No core samples from 0-13' bgs

Continuous tube sampling from 13-21' bgs w 2" ID x 4 ft long geoprobe Macrosampler

Depth	Description	% Core Recovery	Remarks
13.0	f. SAND w minor fines, wet, cohesive, lt gray	13 70% 16	
16	as above	65% 19	
19.0	cl-SILT w f. sand, wet low plast, lt gray, soft	100% 21	
19.5	grading to si-CLAY, wet, low plast, med gray, v. soft.		
19.8	grading to CLAY w minor silt & minor peat, wet, soft, med plast, gray-brn.		
	as above to 21 ft bgs		

	PID Reading
14	25 ppm
14.5	20
15	3
15.5	0
17.5	0
18	0
18.5	12
19.5	110
20	20
20.5	12

No PCE odor at 21.0

- Drilled to 19.5' bgs to set surface casing. (3" ID x 21.1' steel pipe)
- Pushed casing from 19.5-21.0' bgs
- Grout

WP01AQT specs.
Drive point @ 23.5' bgs
Sand Pack to 21.7' bgs
Bentonite to 15.0 bgs
Screen @ 22-23' bgs
Tubing Stickup 1.6' ags

3" dia. steel casing @ 21' bgs
Surface completion includes 1 foot of 3" dia. PVC pipe and a press on cap with a 1/4" hole.

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT | HOLE NO.

Hole No.

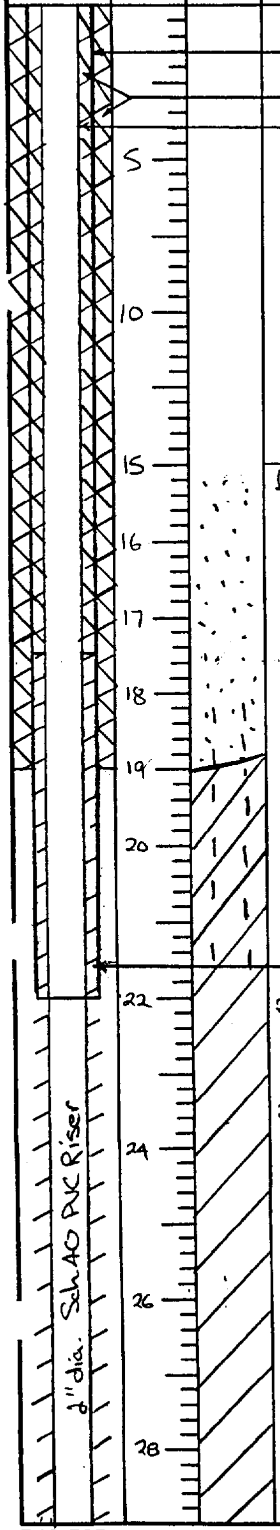
DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 1 OF 2 SHEETS

1. PROJECT Site 88: Bldg 25; Upper Castle Hayne monitor well
2. LOCATION (Coordinates or Station) PITT Wellfield
3. DRILLING AGENCY Parratt Wolfe
4. HOLE NO. (As shown on drawing title and file number) MW 10 IW
5. NAME OF DRILLER Lee
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 39'
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL CMESS
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 7
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE STARTED 6/26/98 COMPLETED 6/26/98
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR



ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
						No core samples collected from 0-15ft Continuous tube sampeing from 15-38' logs ō 2" ID x 4ft geoprobe macro sampler
	15					PID Reading
	16		fine SAND ō minor fines, wet, cohesive, lt gray (poor recovery)	25%		0ppm
	17		as above			5 ppm
	18		grading to si-cl-v.f. SAND, wet, cohesive, slt plast, med gray	65%		180 ppm
	19		grading to si-CLAY ō minor f. sand, wet, soft, low plast. med gray			180ppm
	20		20.2 grading to si-CLAY ō peat, soft. low-med plast, gray-brown to 21'	100%		100 ppm 100 ppm 20 ppm
	22		22.0 CLAY ō minor peat, wet, low-med plast, med stiff, gray ō brn in peat fraction			0
			23.5 peaty·CLAY, wet, low plast, gray-brn			0
	24			100%		0
						0
	26		26 CLAY, wet, high plast, med-stiff to stiff, med gray			0
			as above			0
	28			100%		0

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

HOLE NO.

Hole No.

DRILLING LOG

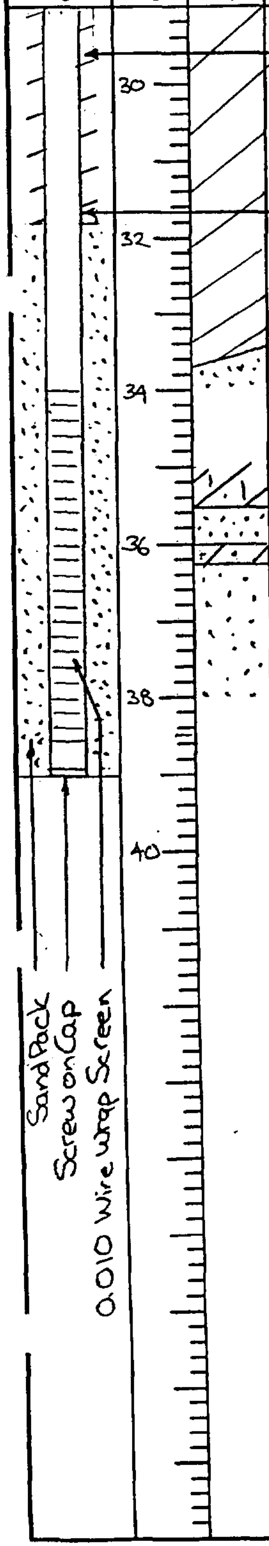
DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 2 OF 2 SHEETS

1. PROJECT Site 88: Bldg. 25 Upper Castle Hayne Monitor-Well
2. LOCATION (Coordinates or Station) PITT Wellfield
3. DRILLING AGENCY Parratt-Wolfe
4. HOLE NO. (As shown on drawing title and file number) MW10IW
5. NAME OF DRILLER Lee
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 39'
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL CME 55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 7
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE STARTED 6/26/98 COMPLETED 6/26/98
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION a | DEPTH b | LEGEND c



CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			PID Reading
30.5 peaty-CLAY, wet, friable to slt plast, med stiff, gray-brn.			0 ppm
			0
	100%		
32.5 CLAY w peat, wet, stiff low-med plast, gray			0
33.7 grading to f. SAND (no recovery 34-35'bgs)			0
			0
35 si-sa-peaty CLAY, friable, wet gray-brn, wood chips to 2" dia.			0
35.5 si-cl-f. SAND, wet friable gray	100%		0
36 sa-CLAY, wet, low plast gray			0
36.3 f. SAND wet, non-cohesive, lt. gray, clean well sorted sand to end of sample			

2" dia. well

MW10IW Specs

Well Length: 39' bgs

2" Riser groundsurface to 34' bgs

2" PVC wire wrap screen 0.010 from 34-38.5

Sand Pack 31.8-39' bgs

Bentonite 17.5-31.8 bgs

Grout 0.5-17.5' bgs

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

HOLE NO.

Hole No.

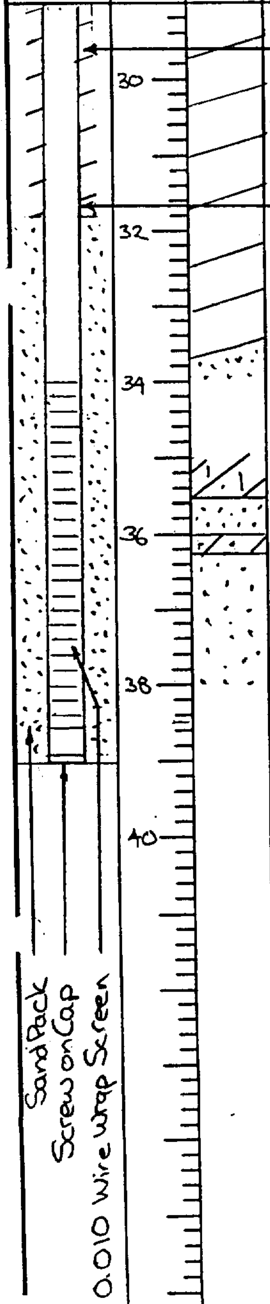
DRILLING LOG

DIVISION

INSTALLATION MCB Camp Lejeune

SHEET 2 OF 2 SHEETS

1. PROJECT Site 88: Bldg. 25 Upper Castle Hayne Monitor-Well
2. LOCATION (Coordinates or Station) PITT Wellfield
3. DRILLING AGENCY Parratt-Wolfe
4. HOLE NO. (As shown on drawing title and file number) MW10IW
5. NAME OF DRILLER Lee
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE 39'
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL CME 55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED 7
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE STARTED 6/26/98 COMPLETED 6/26/98
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR



ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Bentonite			PID Reading
			30.5 peaty-CLAY, wet, friable to slt plast, med stiff, gray-brn.			0 ppm
			2"dia. Sch. 40 PVC Riser	100%		0
			32.5 CLAY w peat, wet, stiff low-med plast, gray			0 0
			33.7 grading to f. SAND (no recovery 34-35'bgs)			0
			35 si-sa-peaty CLAY, friable, wet gray-brn, wood chips to 2" dia.			0
			35.5 si-cl-f. SAND, wet friable gray	100%		0
			36 sa-CLAY, wet, low plast gray			0
			36.3 f. SAND wet, non-cohesive, lt. gray, clean well sorted sand to end of sample			

2" dia. well

MW10IW Specs

Well Length: 39' bgs

2" Riser groundsurface to 34' bgs

2" PVC wire wrap screen 0.010 from 34-38.5

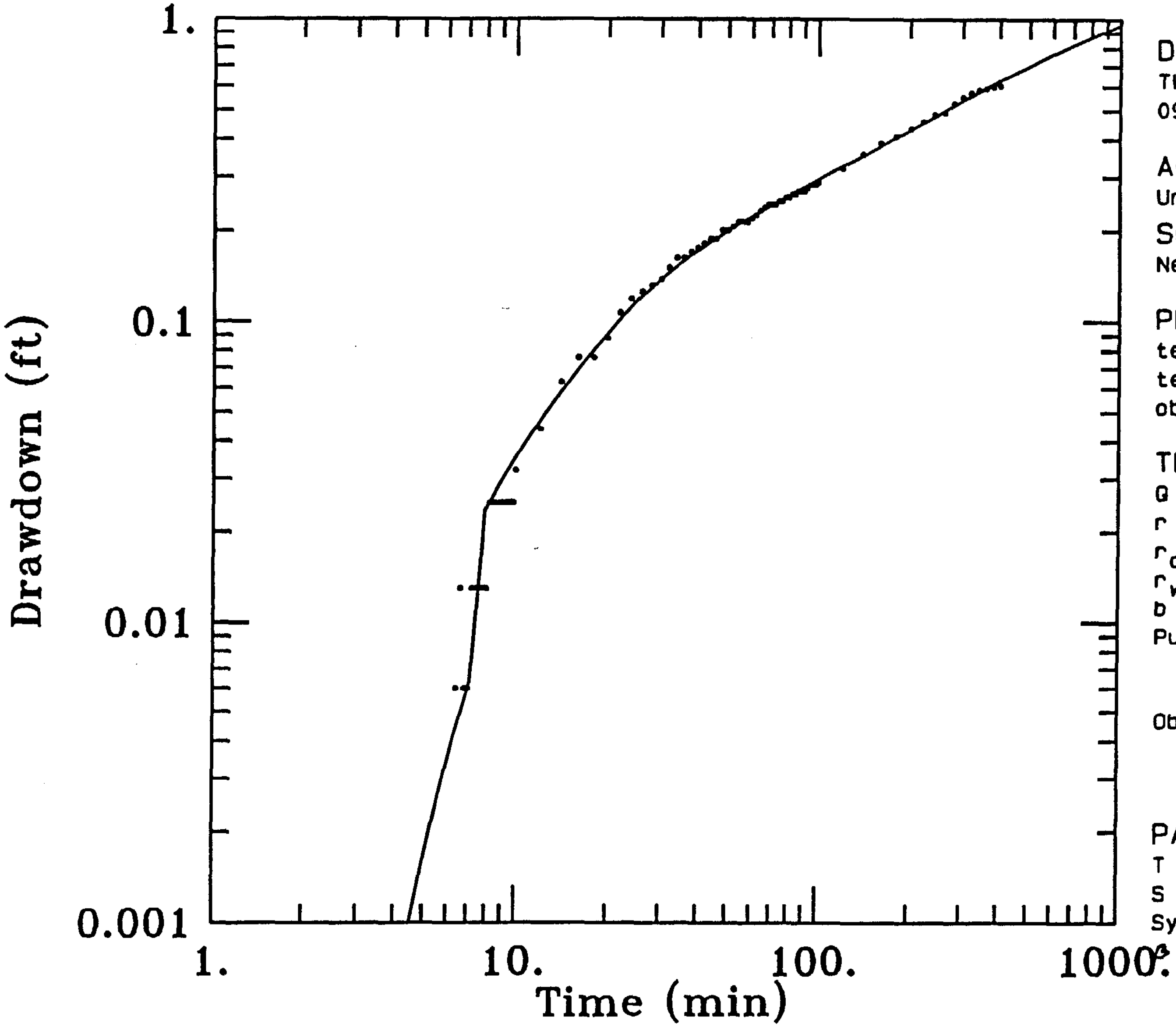
Sand Pack 31.8-39' bgs

Bentonite 17.5-31.8 bgs

Grout 0.5-17.5' bgs

APPENDIX C

Aquifer Test Data, Drawdown and Curve Match Plots



DATA SET:
TW02-PT.AQT
09/28/97

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Neuman (approx.)

PROJECT DATA:
test date: Sept 22, 1997
test well: RW-02
obs. well: TW-02

TEST DATA:
$Q = 0.067\ ft^3/min$
r = 18.8 ft
r_c = 0.17 ft
r_w = 0.5 ft
b = 11. ft
Pumping Well Screen Depth:
top = 6. ft
bot. = 11. ft
Obs. Well Screen Depth:
top = 0. ft
bot. = 7. ft

PARAMETER ESTIMATES: ✓
$T = 0.01278\ ft^2/min$ $K = 6E-4\ \frac{cm}{s}$
S = 0.002564
Sy = 0.008588
β = 1.049

AQTESOLV

Water Level Drawdown at Observation Well TW02 During Pump Test

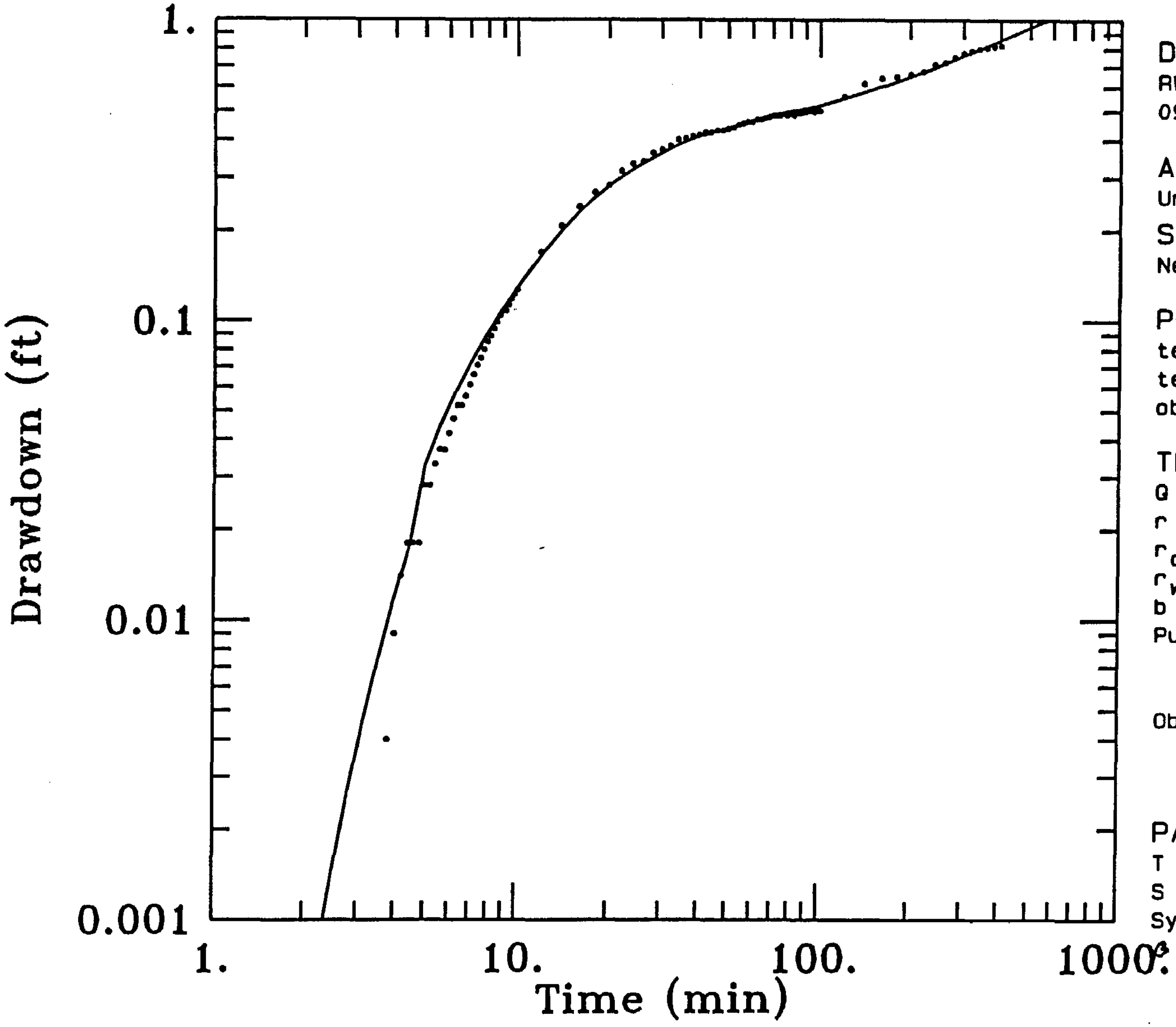
SE2000
Environmental Logger
08/23 20:17

Unit# 373 Test 1
Setups: INPUT 2
----------- ---------
Type Level (F)
Mode TOC
I.D. TW:02

Reference 8.550
PSI at Ref. 2.325
SG 1.000
Linearity 0.020
Scale factor 19.901
Offset -0.064
Delay mSEC 50.000

Step 0 08/22 11:59:35
Elapsed Time INPUT 2

Elapsed Time (min)	Water Level (ft)
0.0000	8.474
0.0083	8.474
0.0166	8.474
0.0250	8.468
0.0333	8.474
0.0416	8.474
0.0500	8.474
0.0583	8.474
0.0666	8.474
0.0750	8.474
0.0833	8.474
0.0916	8.474
0.1000	8.468
0.1083	8.474
0.1166	8.468
0.1250	8.474
0.1333	8.474
0.1416	8.474
0.1500	8.474
0.1583	8.468
0.1666	8.474
0.1750	8.468
0.1833	8.474
0.1916	8.468
0.2000	8.474
0.2083	8.474
0.2166	8.474
0.2250	8.474
0.2333	8.468
0.2416	8.474
0.2500	8.474
0.2583	8.474
0.2666	8.474
0.2750	8.474
0.2833	8.474
0.2916	8.468
0.3000	8.474
0.3083	8.474
0.3166	8.474
0.3250	8.468
0.3333	8.468
0.3500	8.468
0.3666	8.474
0.3833	8.474
0.4000	8.474
0.4166	8.474
0.4333	8.474
0.4500	8.474
0.4666	8.468
0.4833	8.468
0.5000	8.474
0.5166	8.474
0.5333	8.474
0.5500	8.468
0.5666	8.474
0.5833	8.474
0.6000	8.468
0.6166	8.474
0.6333	8.474
0.6500	8.474
0.6666	8.474
0.6833	8.474
0.7000	8.468
0.7166	8.474
0.7333	8.474
0.7500	8.474
0.7666	8.474
0.7833	8.474
0.8000	8.474
0.8166	8.474
0.8333	8.474
0.8500	8.474
0.8666	8.468
0.8833	8.468
0.9000	8.474
0.9166	8.474
0.9333	8.474
0.9500	8.474
0.9666	8.474
0.9833	8.474
1.0000	8.474
1.2000	8.474
1.4000	8.474
1.6000	8.474
1.8000	8.474
2.0000	8.474
2.2000	8.474
2.4000	8.468
2.6000	8.468
2.8000	8.474
3.0000	8.468
3.2000	8.468
3.4000	8.468
3.6000	8.474
3.8000	8.474
4.0000	8.474
4.2000	8.480
4.4000	8.474
4.6000	8.474
4.8000	8.474
5.0000	8.474
5.2000	8.480
5.4000	8.474
5.6000	8.480
5.8000	8.474
6.0000	8.480
6.2000	8.480
6.4000	8.480
6.6000	8.487
6.8000	8.480
7.0000	8.480
7.2000	8.487
7.4000	8.487
7.6000	8.487
7.8000	8.487
8.0000	8.487
8.2000	8.499
8.4000	8.499
8.6000	8.499
8.8000	8.499
9.0000	8.499
9.2000	8.499
9.4000	8.499
9.6000	8.499
9.8000	8.499
10.0000	8.506
12.0000	8.518
14.0000	8.537
16.0000	8.550
18.0000	8.550
20.0000	8.562
22.0000	8.581
24.0000	8.593
26.0000	8.600
28.0000	8.606
30.0000	8.612
32.0000	8.625
34.0000	8.637
36.0000	8.637
38.0000	8.644
40.0000	8.650
42.0000	8.656
44.0000	8.663
46.0000	8.663
48.0000	8.675
50.0000	8.675
52.0000	8.681
54.0000	8.688
56.0000	8.688
58.0000	8.688
60.0000	8.694
62.0000	8.700
64.0000	8.707
66.0000	8.713
68.0000	8.719
70.0000	8.719
72.0000	8.719
74.0000	8.725
76.0000	8.725
78.0000	8.732
80.0000	8.732
82.0000	8.738
84.0000	8.738
86.0000	8.744
88.0000	8.744
90.0000	8.744
92.0000	8.750
94.0000	8.757
96.0000	8.757
98.0000	8.757
100.000	8.763
120.000	8.794
140.000	8.832
160.000	8.864
180.000	8.882
200.000	8.908
220.000	8.933
240.000	8.958
260.000	8.964
280.000	9.002
300.000	9.027
320.000	9.046
340.000	9.058
360.000	9.065
380.000	9.071
400.000	9.077



DATA SET:
RW01-PT.OUT
09/28/97

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Neuman (approx.)

PROJECT DATA:
test date: Sept 22, 1997
test well: RW-02
obs. well: RW-01

TEST DATA:
Q = 0.067 ft^3/min
r = 15. ft
r_c = 0.17 ft
r_w = 0.5 ft
b = 11. ft
Pumping Well Screen Depth:
top = 6. ft
bot. = 11. ft
Obs. Well Screen Depth:
top = 6. ft
bot. = 11. ft

PARAMETER ESTIMATES: ✓
T = 0.008504 ft^2/min K=4E-4 $\frac{cm}{s}$
S = 0.001814
Sy = 0.01433
β = 1.104

AQTESOLV

Water Level Drawdown at Observation Well RW01 During Pump Test

SE2000
Environmental Logger
08/23 16:44

Unit# 328 Test 1
Setups: INPUT 4
----------- --------
Type Level (F)
Mode TOC
I.D. RW01

Reference 8.130
PSI at Ref. 4.329
SG 1.000
Linearity 0.112
Scale factor 14.921
Offset -0.011
Delay mSEC 50.000

Step 0 08/22 08:59:55
Elapsed Time INPUT 4

Elapsed Time (min)	Water Level (ft)
0.0000	8.059
0.0083	8.059
0.0166	8.059
0.0250	8.059
0.0333	8.059
0.0416	8.059
0.0500	8.059
0.0583	8.059
0.0666	8.059
0.0750	8.059
0.0833	8.059
0.0916	8.059
0.1000	8.059
0.1083	8.059
0.1166	8.059
0.1250	8.059
0.1333	8.059
0.1416	8.059
0.1500	8.059
0.1583	8.059
0.1666	8.059
0.1750	8.059
0.1833	8.059
0.1916	8.059
0.2000	8.059
0.2083	8.059
0.2166	8.059
0.2250	8.059
0.2333	8.059
0.2416	8.059
0.2500	8.059
0.2583	8.059
0.2666	8.054
0.2750	8.059
0.2833	8.059
0.2916	8.059
0.3000	8.059
0.3083	8.059
0.3166	8.059
0.3250	8.059
0.3333	8.059
0.3500	8.059
0.3666	8.054
0.3833	8.059
0.4000	8.059
0.4166	8.059
0.4333	8.059
0.4500	8.059
0.4666	8.059
0.4833	8.059
0.5000	8.054
0.5166	8.059
0.5333	8.059
0.5500	8.059
0.5666	8.059
0.5833	8.059
0.6000	8.059
0.6166	8.059
0.6333	8.059
0.6500	8.059
0.6666	8.059
0.6833	8.059
0.7000	8.059
0.7166	8.059
0.7333	8.059
0.7500	8.059
0.7666	8.059
0.7833	8.063
0.8000	8.059
0.8166	8.059
0.8333	8.059
0.8500	8.059
0.8666	8.059
0.8833	8.059
0.9000	8.059
0.9166	8.059
0.9333	8.059
0.9500	8.059
0.9666	8.059
0.9833	8.059
1.0000	8.059
1.2000	8.059
1.4000	8.059
1.6000	8.059
1.8000	8.059
2.0000	8.054
2.2000	8.054
2.4000	8.054
2.6000	8.059
2.8000	8.059
3.0000	8.059
3.2000	8.059
3.4000	8.059
3.6000	8.063
3.8000	8.063
4.0000	8.068
4.2000	8.073
4.4000	8.077
4.6000	8.077
4.8000	8.077
5.0000	8.087
5.2000	8.087
5.4000	8.092
5.6000	8.096
5.8000	8.096
6.0000	8.101
6.2000	8.106
6.4000	8.111
6.6000	8.111
6.8000	8.115
7.0000	8.120
7.2000	8.125
7.4000	8.130
7.6000	8.134
7.8000	8.139
8.0000	8.144
8.2000	8.148
8.4000	8.153
8.6000	8.158
8.8000	8.163
9.0000	8.167
9.2000	8.167
9.4000	8.172
9.6000	8.177
9.8000	8.182
10.0000	8.186
12.0000	8.229
14.0000	8.267
16.0000	8.300
18.0000	8.328
20.0000	8.342
22.0000	8.376
24.0000	8.394
26.0000	8.399
28.0000	8.423
30.0000	8.432
32.0000	8.442
34.0000	8.461
36.0000	8.465
38.0000	8.470
40.0000	8.475
42.0000	8.484
44.0000	8.484
46.0000	8.489
48.0000	8.489
50.0000	8.494
52.0000	8.499
54.0000	8.508
56.0000	8.513
58.0000	8.518
60.0000	8.518
62.0000	8.527
64.0000	8.527
66.0000	8.532
68.0000	8.536
70.0000	8.541
72.0000	8.541
74.0000	8.541
76.0000	8.546
78.0000	8.541
80.0000	8.546
82.0000	8.541
84.0000	8.551
86.0000	8.551
88.0000	8.555
90.0000	8.555
92.0000	8.560
94.0000	8.560
96.0000	8.555
98.0000	8.560
100.000	8.560
120.000	8.617
140.000	8.674
160.000	8.702
180.000	8.711
200.000	8.721
220.000	8.735
240.000	8.773
260.000	8.782
280.000	8.811
300.000	8.834
320.000	8.853
340.000	8.863
360.000	8.868
380.000	8.877
400.000	8.882

APPENDIX D

CPT Logs

UGRO GEOSCIENCES, INC.

6105 Rookin
Houston, TX 77074
Phone : 713-778-5580
Fax : 713-778-5501

December 5, 1997
Report Number: 0301-7257

Baker Environmental
AOP # 3
420 Brauser Rd.
Corapolis, PA 15108

Attention: Mr. John Andy

REPORT FOR CONE PENETRATION TESTING AND RELATED SERVICES CAMP LEJEUNE, NORTH CAROLINA

Dear Mr. Andy:

Please find enclosed herewith the final results of the cone penetrometer tests conducted at the above referenced location.

For your information, the soil stratigraphy was identified using Campanella and Robertson's Simplified Soil Behavior Chart. Please note that because of the empirical nature of the soil behavior chart, the soil identification should be verified locally.

Fugro Geosciences appreciates the opportunity to be of service to your organization. If you should have any questions, or if we can be of further assistance, please do not hesitate to contact us. We look forward to working with you in the future.

Very truly yours,
FUGRO GEOSCIENCES, INC.

Jeffery L. Ness

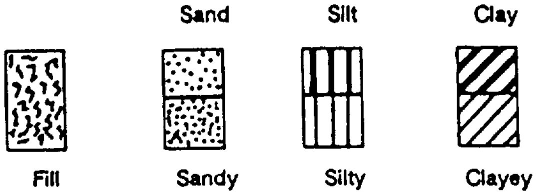
Jeffery L. Ness
General Manager
CPT Operations

JLN/mw

Key To Soil Classification and Symbols

SOIL TYPE

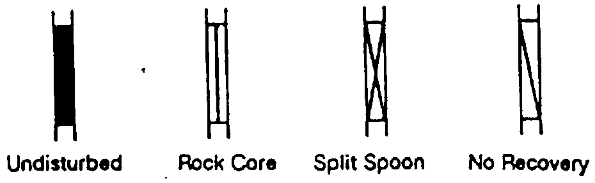
(Shown in Symbol Column)



Predominant Type Shown Heavy

SAMPLE TYPE

(Shown in Samples Column)



TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (Major portion Retained on No. 200 Sieve)

Includes (1) clean gravels and sand described as fine, medium or course, depending on distribution of grain sizes (2) silty or clayey gravels and sands and (3) fine grained low plasticity soils (PI < 10) such as sandy silts. Condition is rated according to relative density, as determined by lab tests or estimated from resistance to sampler penetration.

Descriptive Term	Penetration Resistance*	Relative Density
Loose	0 - 10	0 to 40%
Medium Dense	10 - 30	40 to 70%
Dense	30 - 50	70 to 90%
Very Dense	Over 50	90 to 100%

* Blows/Foot, 140# Hammer, 30" Drop

FINE GRAINED SOILS (Major Portion Passing No. 200 Sieve)

Includes (1) inorganic and organic silts and clays, (2) sandy, gravelly or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests for soils with PI $\geq$ 10.

Descriptive Term	Cohesive Shear Strength Tons/Square Foot
Very Soft	Less Than 0.125
Soft	0.125 to 0.25
Firm	0.25 to 0.50
Stiff	0.50 to 1.00
Very Stiff	1.00 to 2.00
Hard	2.00 and Higher

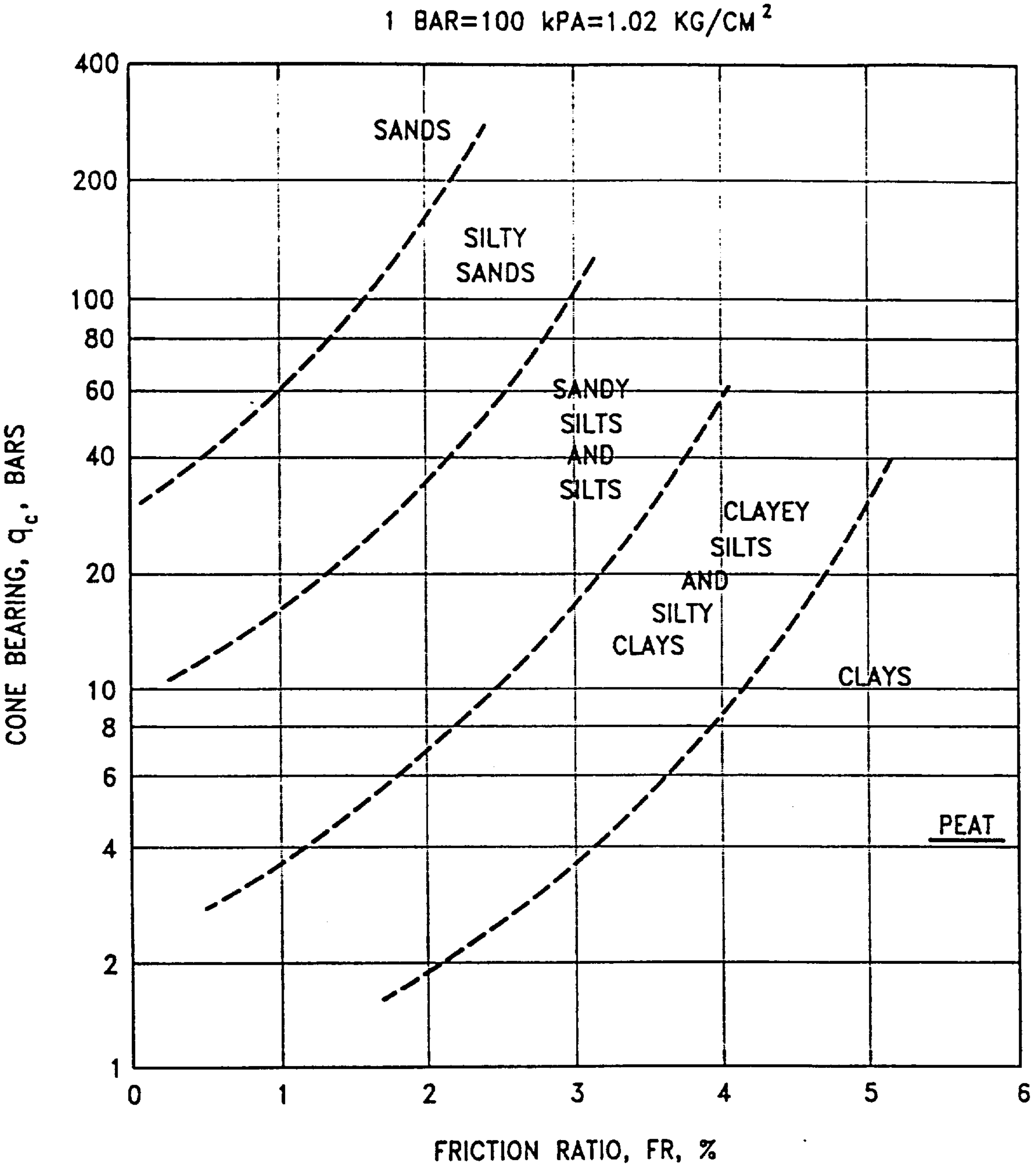
Note: Slickensided and fissured clay may have lower unconfined compressive strengths than shown above because of planes of weakness or shrinkage cracks; consistency ratings of such soils are based on hand penetrometer readings.

TERMS CHARACTERIZING SOIL STRUCTURE

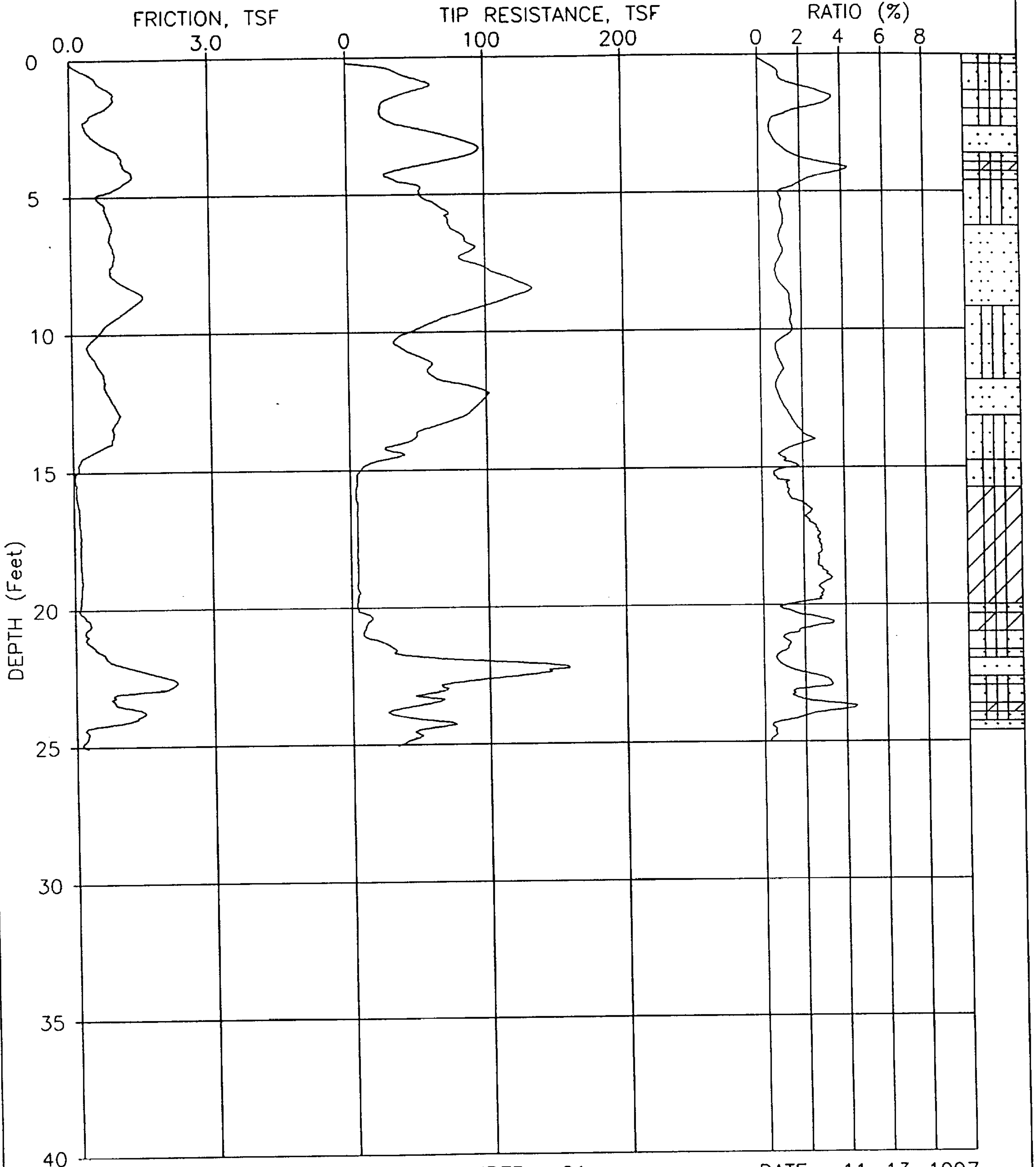
Parting:	paper thin in size
Seam:	1/8" to 3" thick
Layer:	greater than 3"
Fissured:	containing shrinkage cracks, frequently filled with fine sand or silt, usually more or less vertical
Sensitive:	pertaining to cohesive soils that are subject to appreciable loss of strength when remolded
Interbedded:	composed of alternate layers of different soil types
Laminated:	composed of thin layers of varying color and texture
Calcareous:	containing appreciable quantities of calcium carbonate
Well Graded:	having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Poorly Graded:	predominantly of one grain size, or having a range of sizes with some intermediate size missing
Flocculated:	pertaining to cohesive soils that exhibit a loose knit or flakey structure
Slickensided:	having inclined planes of weakness that are slick and glossy in appearance.

Degree of Slickensided Development

Slightly Slickensided:	slickensides present at intervals of 1' to 2', soil does not easily break along these plates
Moderately Slickensided:	slickensides spaced at intervals of 1' to 2', soil breaks easily along these planes
Extremely Slickensided:	continuous and interconnected slickensides spaced at intervals of 4" to 12", soil breaks along the slickensides into pieces 3" to 6" in size
Intensely Slickensided:	slickensides spaced at intervals of less than 4", continuous in all directions; soil breaks down along planes into nodules 1/4" to 2" in size.



CAMPANELLA AND ROBERTSON CLASSIFICATION CHART (1983)

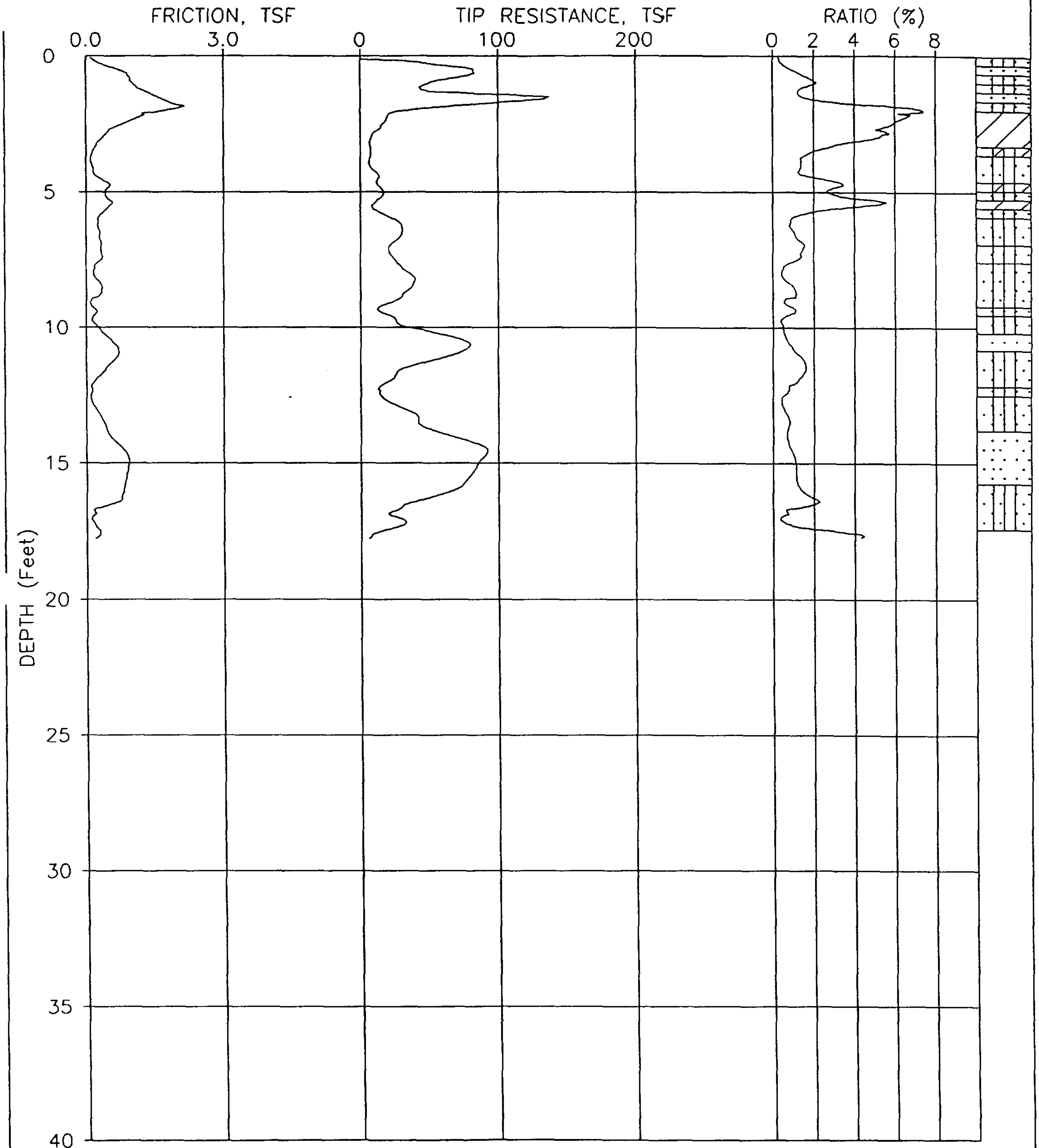


JOB NUMBER: 97-7257
ELEVATION: 0.00

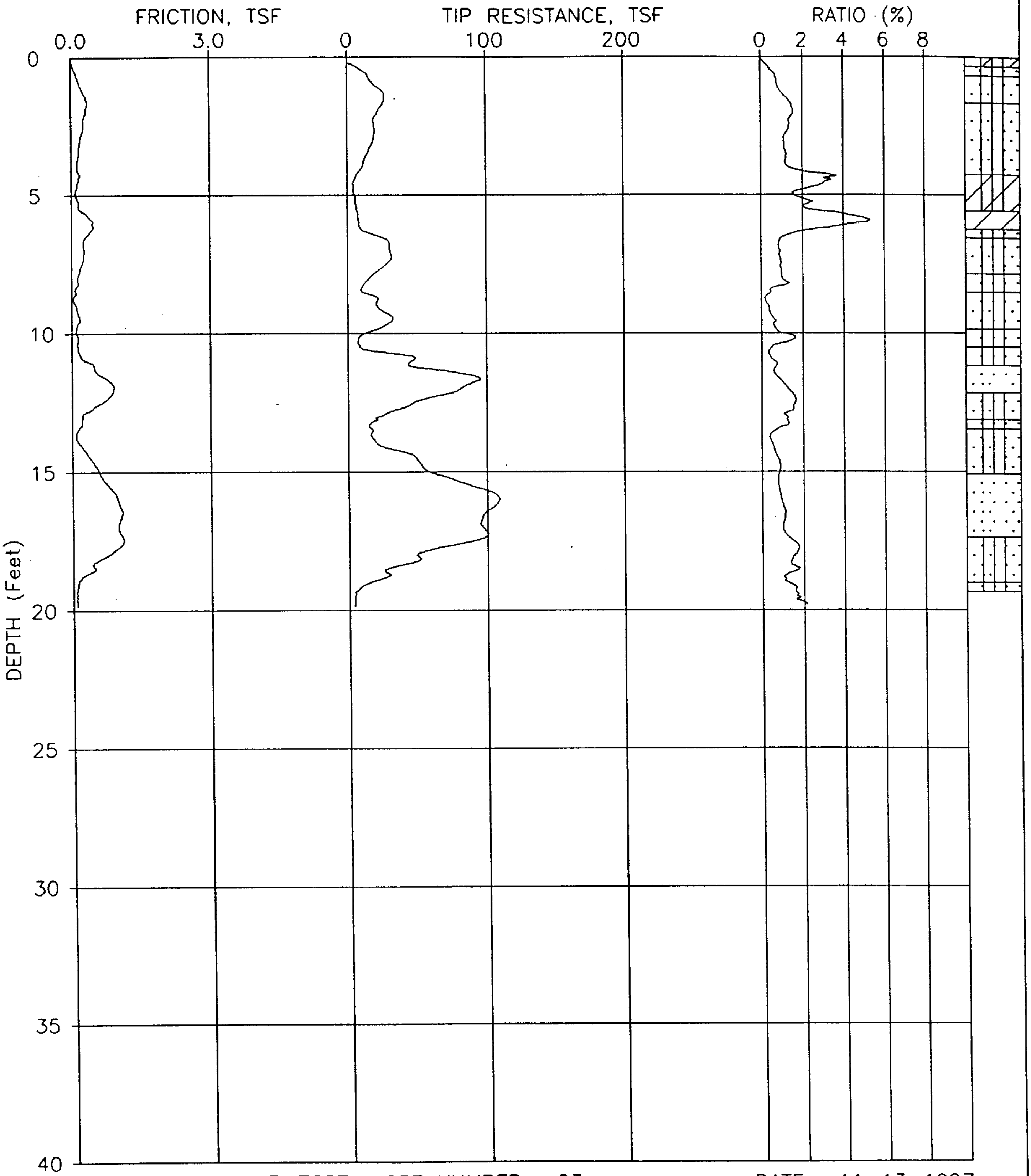
CPT NUMBER: 01
CONE NUMBER: F7.5CKEV611

DATE: 11-13-1997
PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC



JOB NUMBER: 97-7257
ELEVATION: 0.00
CPT NUMBER: 02
CONE NUMBER: F7.5CKEV611
DATE: 11-13-1997
PLATE: 1 OF 1

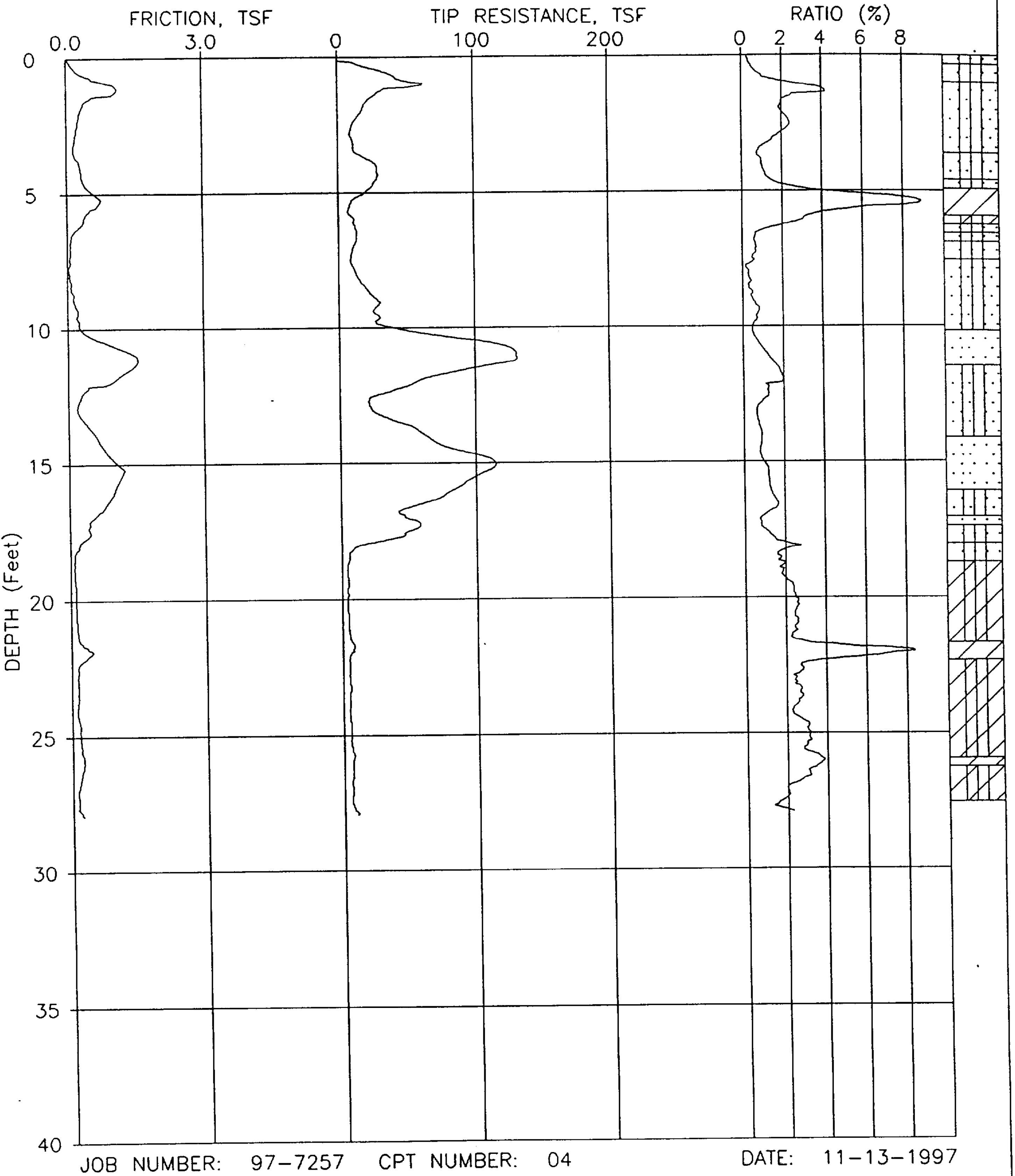


JOB NUMBER: 97-7257
ELEVATION: 0.00

CPT NUMBER: 03
CONE NUMBER: F7.5CKEV611

DATE: 11-13-1997
PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

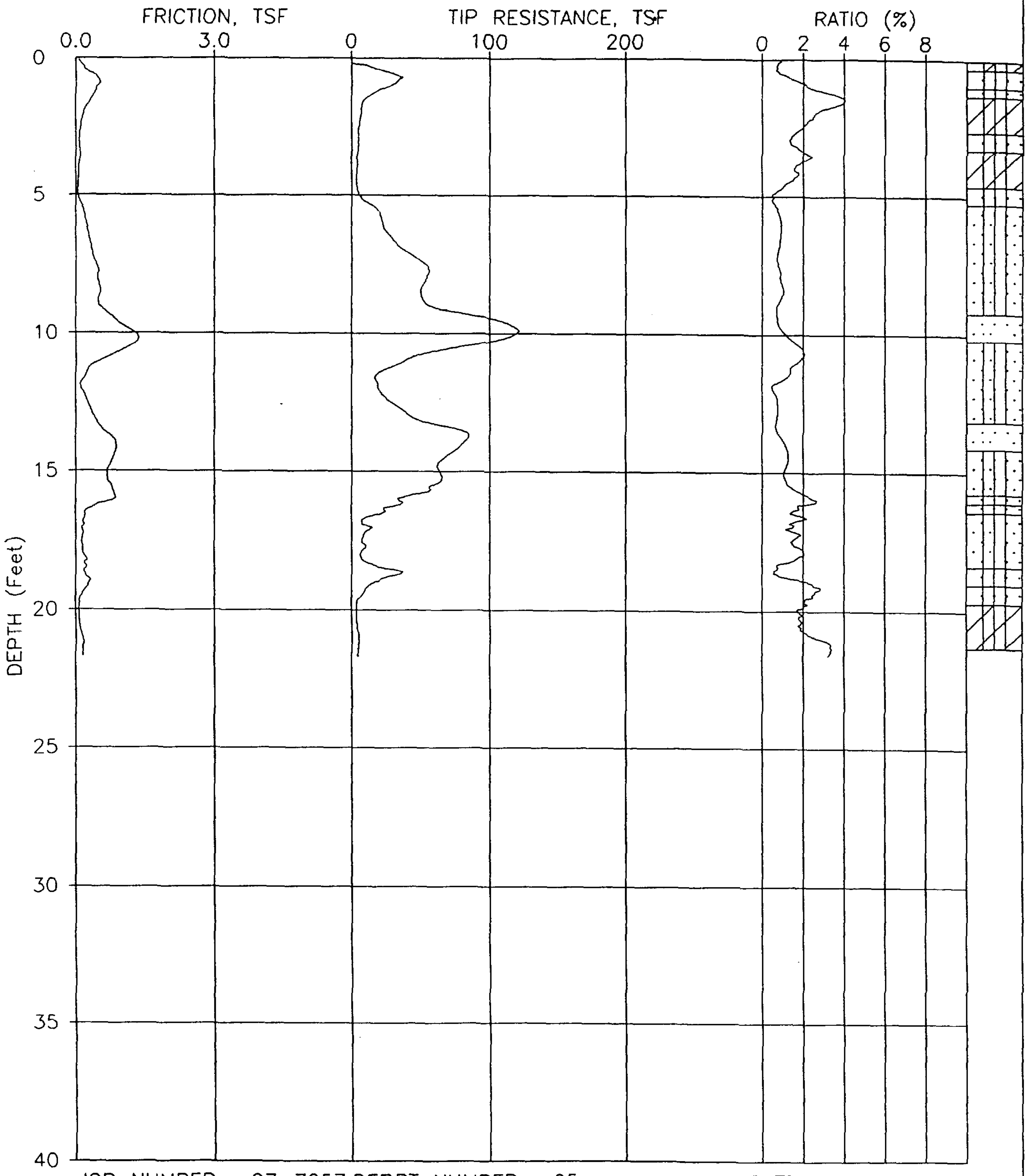


JOB NUMBER: 97–7257
ELEVATION: 0.00

CPT NUMBER: 04
CONE NUMBER: F7.5CKEV611

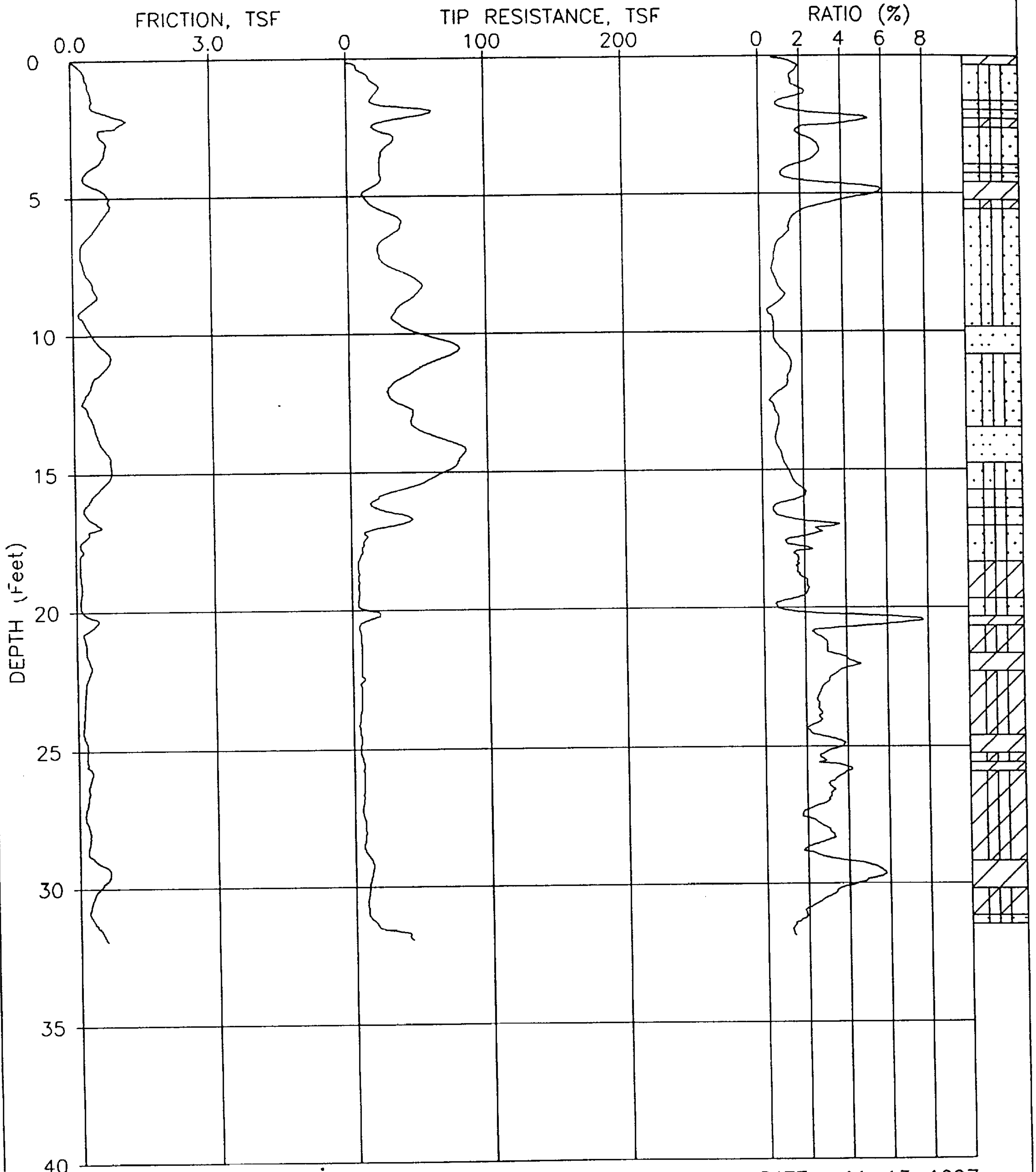
DATE: 11–13–1997
PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC



JOB NUMBER: 97–7257.DE CPT NUMBER: 05 DATE: 11–13–1997
ELEVATION: 0.00 CONE NUMBER: F7.5CKEV611 PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

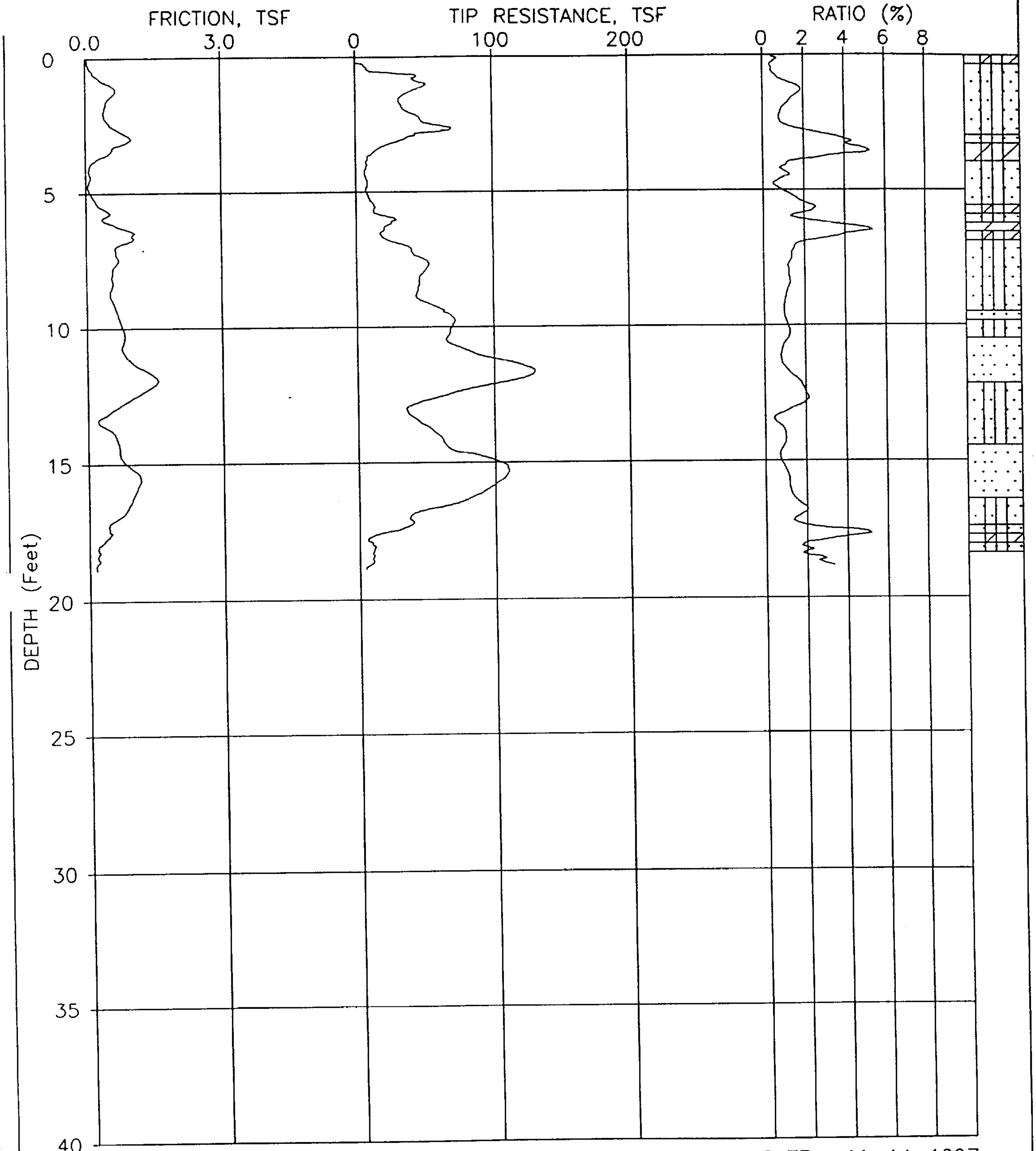


JOB NUMBER: 97-7257
ELEVATION: 0.00

CPT NUMBER: 06
CONE NUMBER: F7.5CKEV611

DATE: 11-13-1997
PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC



JOB NUMBER: 97-7257

ELEVATION: 0.00

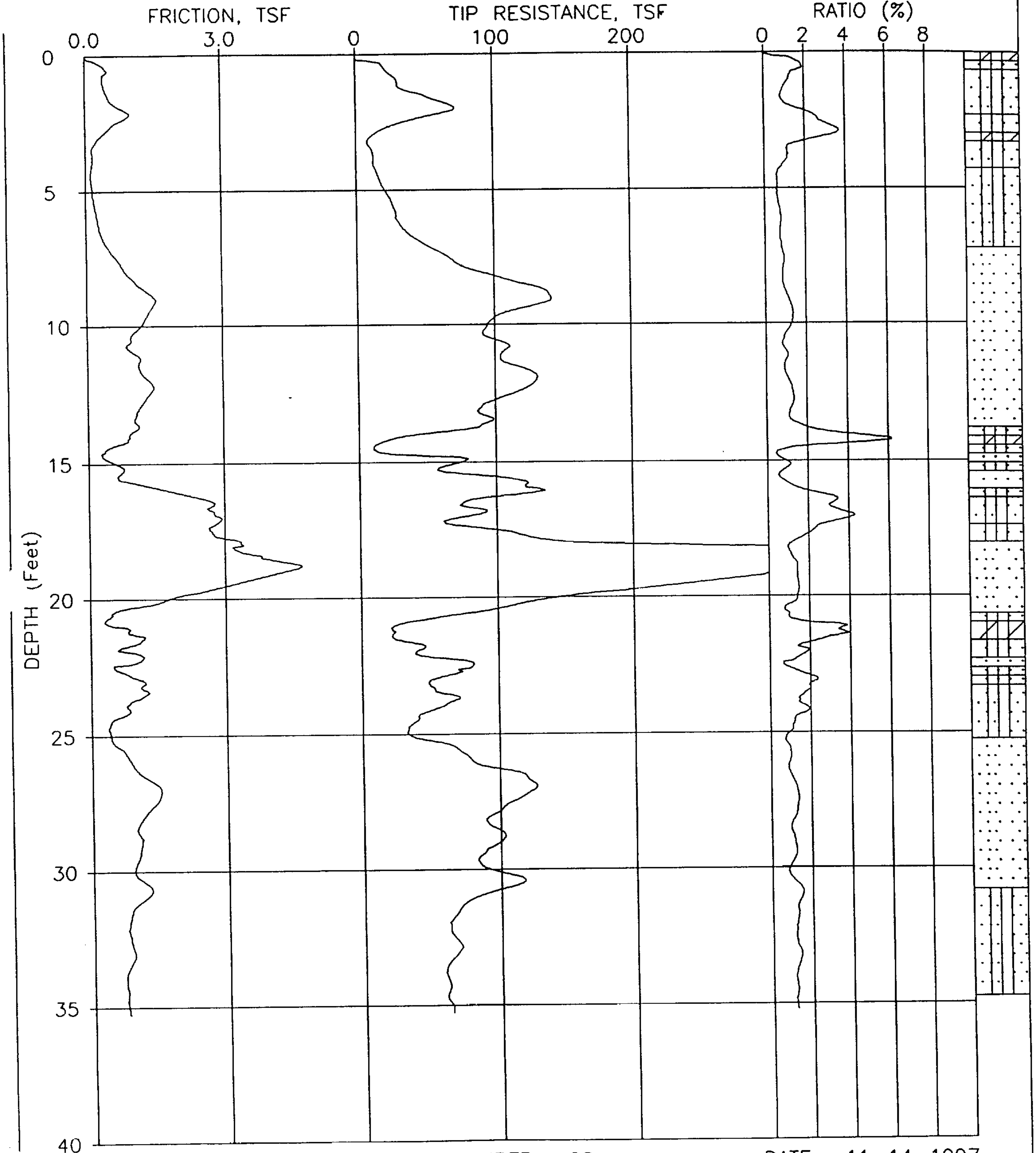
CPT NUMBER: 07

CONE NUMBER: F7.5CKEV611

DATE: 11-14-1997

PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

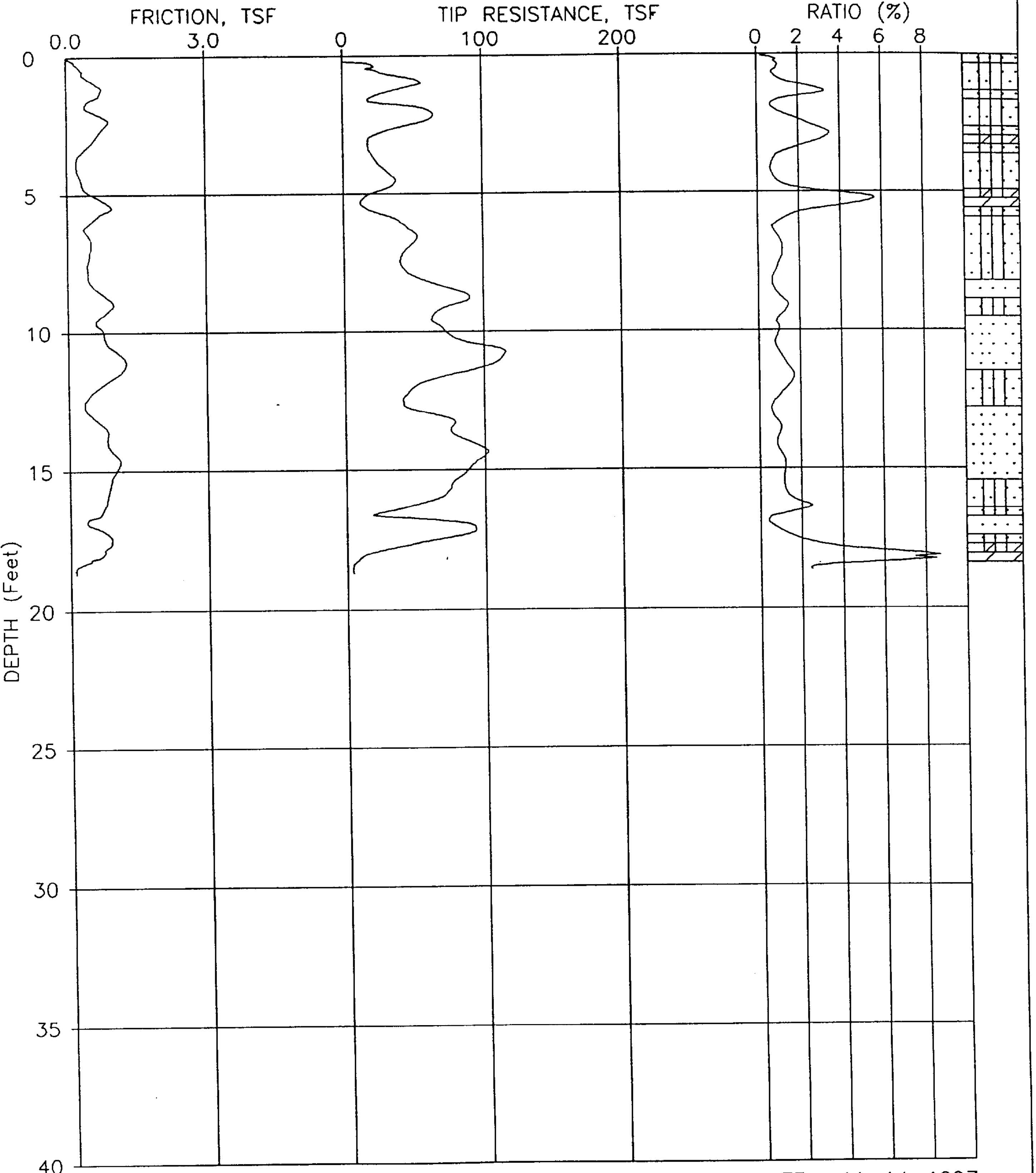


JOB NUMBER: 97-7257
ELEVATION: 0.00

CPT NUMBER: 08
CONE NUMBER: F7.5CKEV611

DATE: 11-14-1997
PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

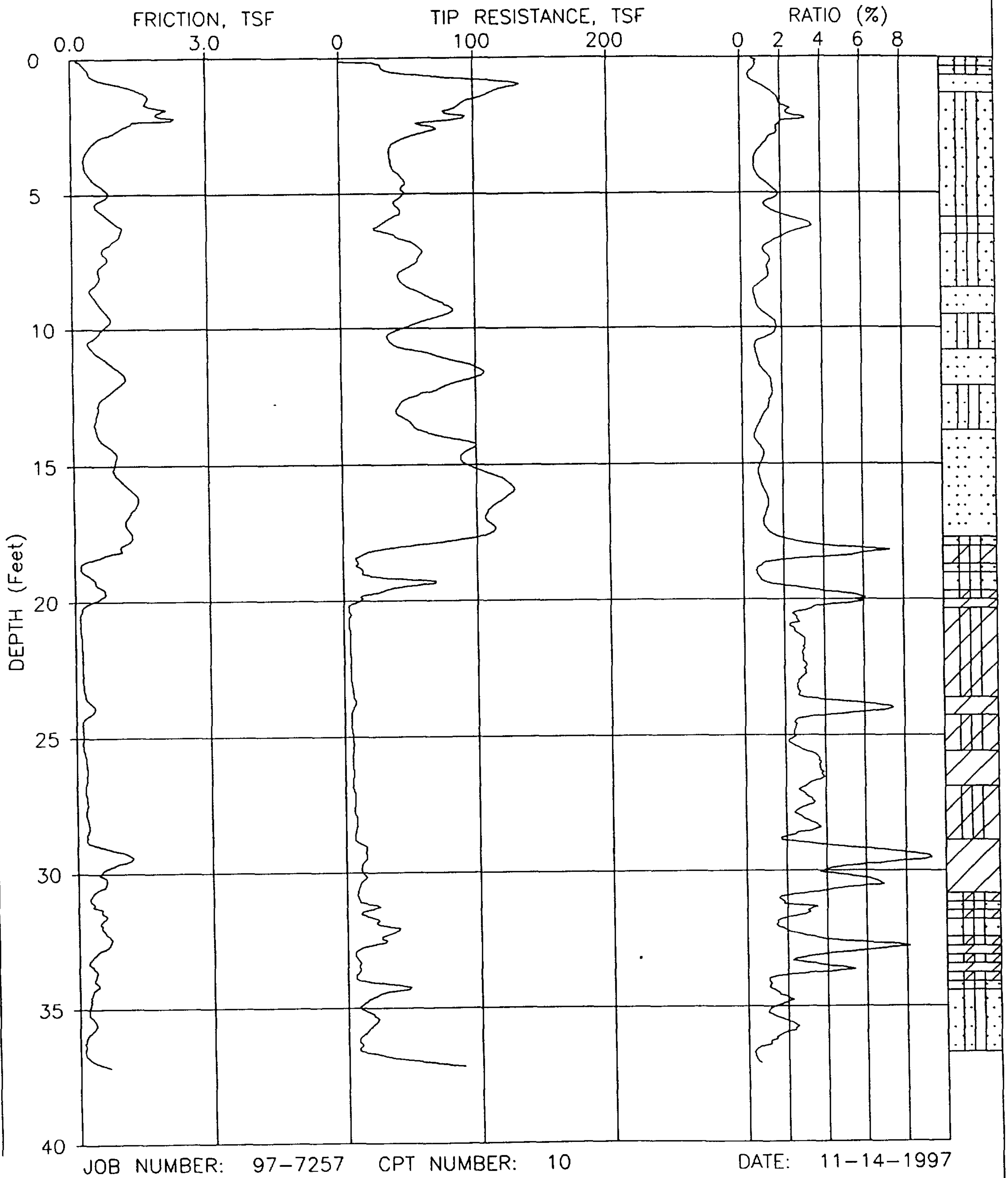


JOB NUMBER: 97-7257
ELEVATION: 0.00

CPT NUMBER: 09
CONE NUMBER: F7.5CKEV611

DATE: 11-14-1997
PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

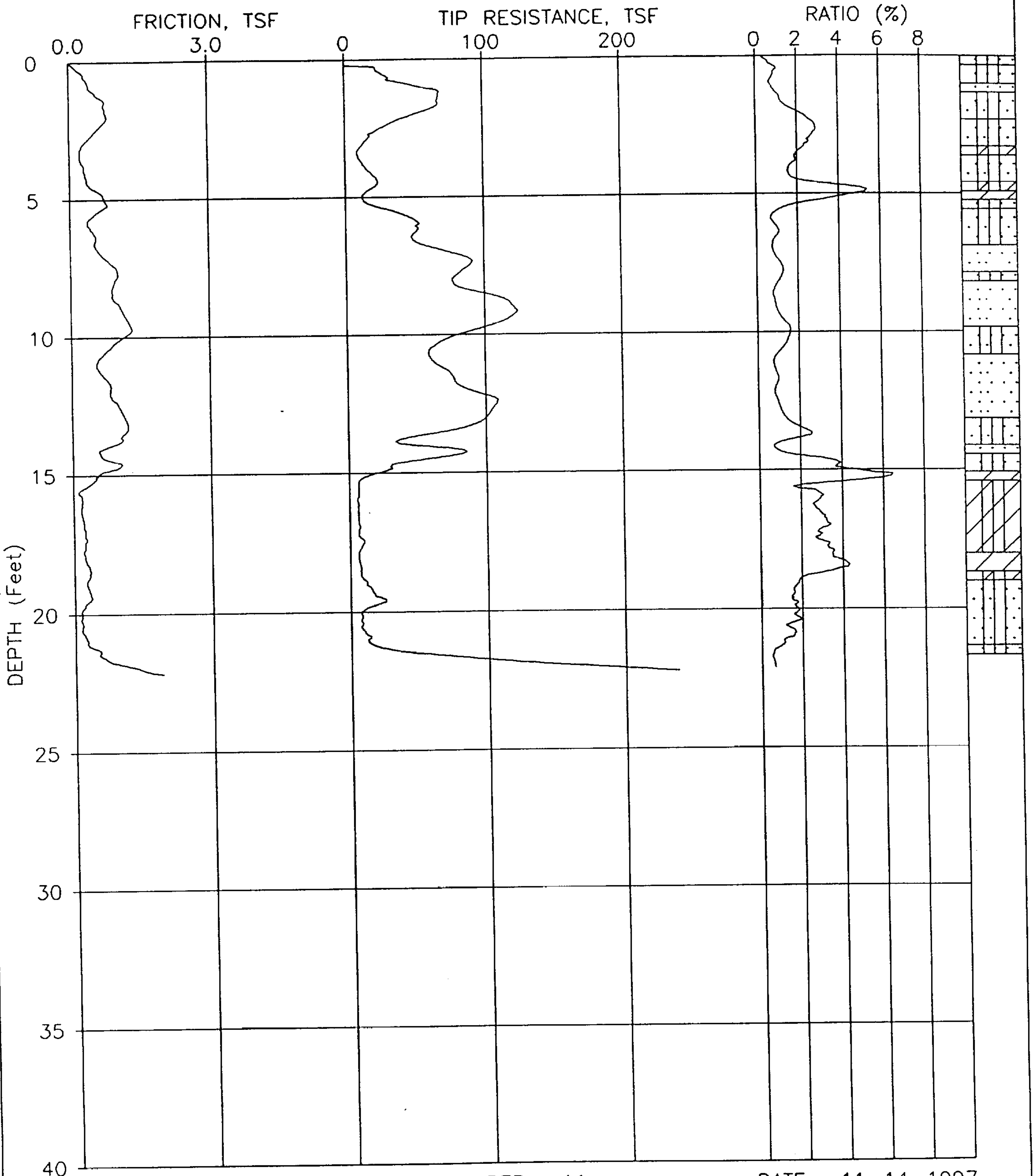


JOB NUMBER: 97-7257
ELEVATION: 0.00

CPT NUMBER: 10
CONE NUMBER: F7.5CKEV611

DATE: 11-14-1997
PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

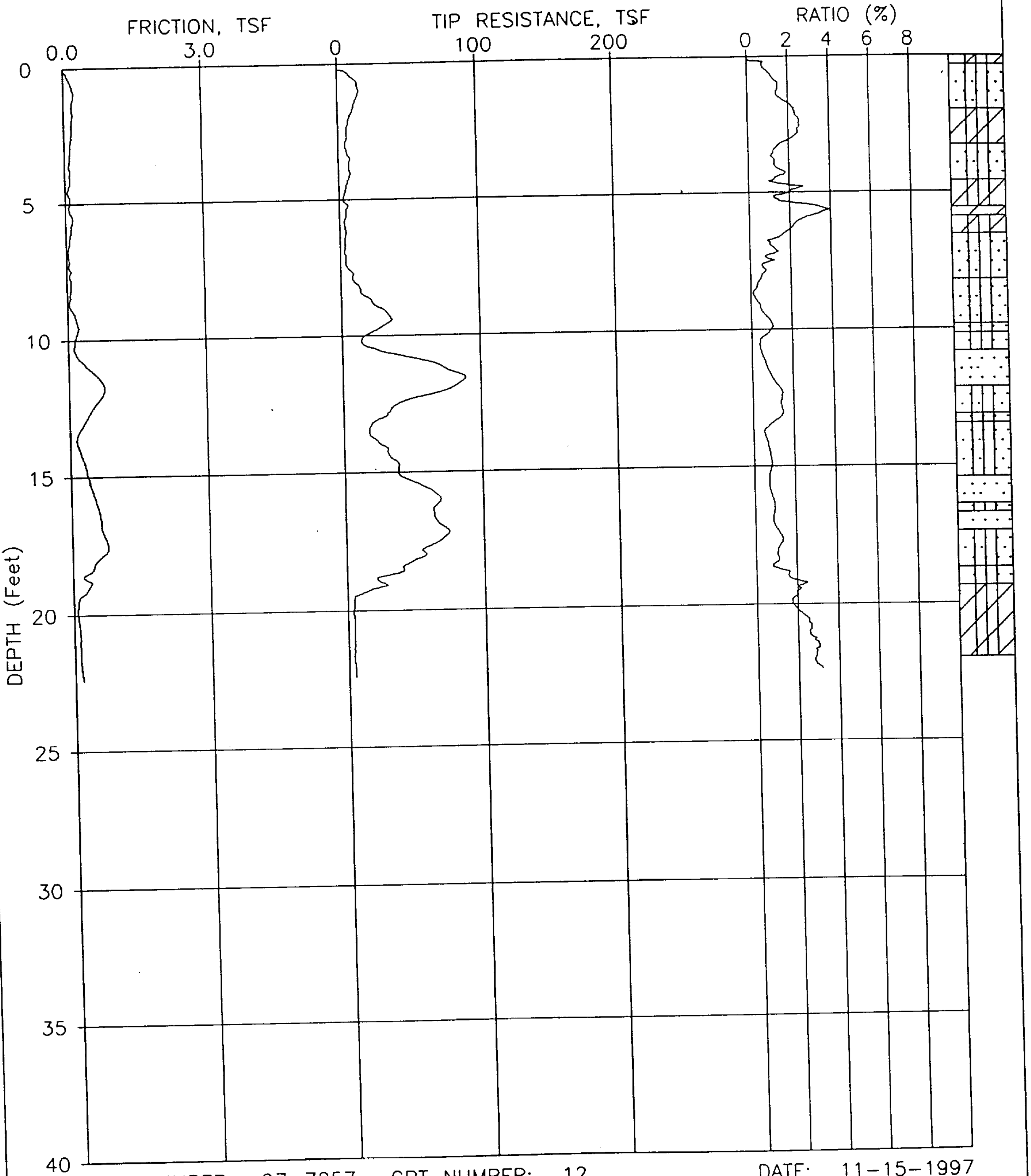


JOB NUMBER: 97-7257
ELEVATION: 0.00

CPT NUMBER: 11
CONE NUMBER: F7.5CKEV611

DATE: 11-14-1997
PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC



JOB NUMBER: 97-7257
ELEVATION: 0.00

CPT NUMBER: 12
CONE NUMBER: F7.5CKEV611

DATE: 11-15-1997
PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

Appendix E

Non-VOC Soil Analyses (Soil Moisture, f_{oc}, XRD)

Major Ion Analyses (Ground Water and Source Water)

Ground-Water VOC Analyses

ANALYSYS inc.

4221 Freidrich Lane, Suite 190, Aus TX 78744
& 9320 Up River Road, Corpus Chr. TX 78409
(512) 444-5896 • FAX (512) 447-4766

Client: Duke Engineering & Services
Attn: Fred Holzmer
Address: 9111 Research Blvd
Austin, Tx 78758

Phone: 425-2000 **FAX:** 425-2099

Report #/Lab ID#: 87533 **Report Date:** 12/9/97
Project ID: MCB Camp Lejeune
Sample Name: IS26-04
Sample Matrix: soil
Date Received: 12/5/97 **Time:** 16:30:00
Date Sampled: 11/21/97 **Time:** 00:00:00

REPORT OF ANALYSIS

QUALITY ASSURANCE DATA[1]

Parameter	Result	Units	RQL[5]	Blank	Date	Method	Prec.[2]	Recov.[3]	CCV[4]	LCS[4]
Total organic carbon (foc)	1510	mg/Kg	200	<200	12/9/97	ASA 29-3.5.2	11.34	119.62	111.25	111.24

@ 16.5 ft in f. SAND

This analytical report respectfully submitted by AnalySys, Inc. The enclosed results have been reviewed and to the best of my knowledge the analytical results are consistent with AnalySys, Inc.'s Quality Assurance/Quality Control Program.

Respectfully Submitted,

Hopkins Haden

Hopkins Haden

1. Quality assurance data reported is for the lot analyzed which included this sample.
2. Precision (Prec.) is the absolute value of the relative percent (%) difference between duplicate measurements.
3. Recovery (Recov.) is the percent (%) of analyte recovered from a spiked sample.
4. Calibration Verification (CCV) and Lab Control Sample (LCS) results expressed as the percent (%) recovery of analyte from a known standard.
5. Reporting Quantitation Limit. The Practical Quantitation Limit (PQL) or the Method Detection Limit (MDL) reported for the analyte.
6. Method numbers typically denote USEPA procedures. Less than ("<") values reflect nominal quantitation limits, adjusted for any required dilution.

AnLYSYS inc.

4221 Freidrich Lane, Suite 190, Aus TX 78744
& 9320 Up River Road, Corpus Chri. TX 78409
(512) 444-5896 • FAX (512) 447-4766

Client: Duke Engineering & Services
Attn: Fred Holzmer
Address: 9111 Research Blvd
Austin, Tx 78758

Phone: 425-2000 **FAX:** 425-2099

Report #/Lab ID#: 87534 **Report Date:** 12/9/97
Project ID: MCB Camp Lejeune
Sample Name: IS26-05
Sample Matrix: soil
Date Received: 12/5/97 **Time:** 16:30:00
Date Sampled: 11/21/97 **Time:** 00:00:00

REPORT OF ANALYSIS

QUALITY ASSURANCE DATA[1]

Parameter	Result	Units	RQL[5]	Blank	Date	Method	Prec.[2]	Recov.[3]	CCV[4]	LCS[4]
Total organic carbon (foc)	5560	mg/Kg	400	<200	12/9/97	ASA 29-3.5.2	11.34	119.62	111.25	111.24

@ 18.0ft in cl-SILT

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Respectfully Submitted,

Hopkins Haden

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6. Method numbers typically denote USEPA procedures. Less than ("<") values reflect nominal quantitation limits, adjusted for any required dilution.

4221 Freidrich Lane, Suite 190, Aust TX 78744
& 9320 Up River Road, Corpus Chri ΓX 78409
(512) 444-5896 • FAX (512) 447-4760

Client: Duke Engineering & Services
Attn: Fred Holzmer
Address: 9111 Research Blvd
Austin, Tx 78758

Phone: 425-2000 **FAX:** 425-2099

Report #/Lab ID#: 87535 **Report Date:** 12/9/97
Project ID: MCB Camp Lejeune
Sample Name: IS26-06
Sample Matrix: soil
Date Received: 12/5/97 **Time:** 16:30:00
Date Sampled: 11/21/97 **Time:** 00:00:00

REPORT OF ANALYSIS **QUALITY ASSURANCE DATA[1]**

Parameter	Result	Units	RQL[5]	Blank	Date	Method	Prec.[2]	Recov.[3]	CCV[4]	LCS[4]
Total organic carbon (f_{oc})	6420	mg/Kg	400	<200	12/9/97	ASA 29-3.5.2	11.34	119.62	111.25	111.24

@ 19.0 ft in Si-CLAY

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Respectfully Submitted,

Hopkins Haden

Hopkins Haden

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3. Recovery (Recov.) is the percent (%) of analyte recovered from a spiked sample.
4. Calibration Verification (CCV) and Lab Control Sample (LCS) results expressed as the percent (%) recovery of analyte from a known standard.
5. Reporting Quantitation Limit. The Practical Quantitation Limit (PQL) or the Method Detection Limit (MDL) reported for the analyte.
6. Method numbers typically denote USEPA procedures. Less than ("<") values reflect nominal quantitation limits, adjusted for any required dilution.

X-RAY DIFFRACTION MINERAL PERCENTAGES

Project Name: MCB Camp Lejeune

Sample ID	BULK METHOD										CLAY METHOD						Total (%)
	Qtz (%)	Feld (%)	Cal (%)	Dol (%)	Sid (%)	Pyr (%)	Bar (%)			Total Bulk (%)	Kao (%)	Ill (%)	Chl (%)	Sme (%)	EML	Total Clay (%)	
IS25-05	81	11	*	*	*	1				93	3	2	1	1		7	100
IS25-06	85	2	*	*	*	4	*			91	4	2	1	2	*	9	100

* Denotes a trace percentage

Legend

Qtz = Quartz, SiO_2
Cal = Calcite, $CaCO_3$
Sid = Siderite, $FeCO_3$
Bar = Barite $BaSO_4$

Feld = Feldspar, (K, Na, Ca, Ba) (Al, Si)$_3$ O_8
Dol = Dolomite, $CaMg(CO_3)$
Pyr = Pyrite FeS_2
EML = Expandable Mixed Layer Illite/Smectite)
Clay Minerals = Phyllosilicates

QUANTERRA INCORPORATED

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

Lot #: H7H220200

Baker Environmental
Camp LeJeune
Project Number: CTO-356

PAGE
Date Reported: 8/29/9

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
Client Sample ID: IR88IW01-04 Sample #: 001 Date Sampled: 08/20/97 08:10 Date Received: 08/22/97 Matrix: SOLID				
Inorganic Analysis				Reviewed
Percent Moisture	17.3	0.10	%	MCAWW 160.3 MOD
N-Hexane Ext. Material, Silica Gel Treated (1664)	ND	330	mg/kg	CFR136A 1664 SGT
Client Sample ID: IR88RW01-05 Sample #: 002 Date Sampled: 08/19/97 12:39 Date Received: 08/22/97 Matrix: SOLID				
Inorganic Analysis				Reviewed
Percent Moisture	17.5	0.10	%	MCAWW 160.3 MOD
N-Hexane Ext. Material, Silica Gel Treated (1664)	ND	330	mg/kg	CFR136A 1664 SGT
Client Sample ID: IR88RW02-04 Sample #: 003 Date Sampled: 08/19/97 16:29 Date Received: 08/22/97 Matrix: SOLID				
Inorganic Analysis				Reviewed
Percent Moisture	18.1	0.10	%	MCAWW 160.3 MOD
N-Hexane Ext. Material, Silica Gel Treated (1664)	ND	330	mg/kg	CFR136A 1664 SGT
Client Sample ID: IR88IS13-08 Sample #: 004 Date Sampled: 08/20/97 11:15 Date Received: 08/22/97 Matrix: SOLID				
Inorganic Analysis				Reviewed
Percent Moisture	21.2	0.10	%	MCAWW 160.3 MOD
N-Hexane Ext. Material, Silica Gel Treated (1664)	ND	330	mg/kg	CFR136A 1664 SGT
Client Sample ID: IR88IW01-09 Sample #: 005 Date Sampled: 08/20/97 08:50 Date Received: 08/22/97 Matrix: SOLID				

(Continued on next page)

PRELIMINARY DATA SUMMARY

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results shown below may still require additional laboratory review and are subject to nge. Actions taken based on these results are the responsibility of the data user.

Baker Environmental
Camp LeJeune
Project Number: CTO-356

#: H7HZZ0200

Date Reported: 8/29/97

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
lient Sample ID: IR88IW01-09				
ample #: 005 Date Sampled: 08/20/97 08:50 Date Received: 08/22/97 Matrix: SOLID				
Inorganic Analysis				Reviewed
Percent Moisture	20.2	0.10	%	MCAWW 160.3 MOD
N-Hexane Ext. Material, Silica Gel Treated (1664)	ND	330	mg/kg	CFR136A 1664 SGT

QUANTERRA INCORPORATED

PRELIMINARY DATA SUMMARY

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e results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

Baker Environmental, Inc.
Camp LeJeune
Project Number: CTO-356

Lot #: H7H250122

PAGE 1
Date Reported: 9/03/97

Client Sample ID: IR88-RW01-97C
Sample #: 001 Date Sampled: 08/21/97 12:20 Date Received: 08/25/97 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Inductively Coupled Plasma					In Review
Silver	ND	10.0	ug/L	ICLP ILM03.0	
Aluminum	273	200	ug/L	ICLP ILM03.0	
Barium	141 B	200	ug/L	ICLP ILM03.0	
Beryllium	ND	5.0	ug/L	ICLP ILM03.0	
Calcium	15600	5000	ug/L	ICLP ILM03.0	
Cadmium	ND	5.0	ug/L	ICLP ILM03.0	
Cobalt	4.5 B	50.0	ug/L	ICLP ILM03.0	
Chromium	8.9 B	10.0	ug/L	ICLP ILM03.0	
Copper	ND	25.0	ug/L	ICLP ILM03.0	
Iron	15100	100	ug/L	ICLP ILM03.0	
Potassium	2080 B	5000	ug/L	ICLP ILM03.0	
Magnesium	4510 B	5000	ug/L	ICLP ILM03.0	
Manganese	126	15.0	ug/L	ICLP ILM03.0	
Sodium	12200	5000	ug/L	ICLP ILM03.0	
Nickel	75.1	40.0	ug/L	ICLP ILM03.0	
Antimony	ND	60.0	ug/L	ICLP ILM03.0	
Vanadium	ND	50.0	ug/L	ICLP ILM03.0	
Zinc	14.7 B	20.0	ug/L	ICLP ILM03.0	
Mercury (Cold Vapor Technique)					In Review
Mercury	ND	0.20	ug/L	ICLP ILM03.0	
Inductively Coupled Plasma					In Review
Arsenic	4.3 B	10.0	ug/L	ICLP ILM03.0	
Lead	1.4 B	3.0	ug/L	ICLP ILM03.0	
Selenium	ND	5.0	ug/L	ICLP ILM03.0	
Thallium	ND	10.0	ug/L	ICLP ILM03.0	

B Estimated result. Result is less than RL.

Volatile Organics by GC/MS					In Review
Benzene	ND	10000	ug/L	SW846 8260A	
Bromobenzene	ND	10000	ug/L	SW846 8260A	
Bromochloromethane	ND	10000	ug/L	SW846 8260A	
Bromodichloromethane	ND	10000	ug/L	SW846 8260A	
Bromoform	ND	10000	ug/L	SW846 8260A	

(Continued on next page)

QUANTERRA INCORPORATED

PRELIMINARY DATA SUMMARY

e results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

Baker Environmental, Inc.
Camp LeJeune
Project Number: CTO-356

Lot #: H7H250122

PAGE 2
Date Reported: 9/03/97

Client Sample ID: IR88-RW01-97C
Sample #: 001 Date Sampled: 08/21/97 12:20 Date Received: 08/25/97 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Volatile Organics by GC/MS					In Review
Bromomethane	ND	20000	ug/L	SW846 8260A	
n-Butylbenzene	ND	10000	ug/L	SW846 8260A	
sec-Butylbenzene	ND	10000	ug/L	SW846 8260A	
tert-Butylbenzene	ND	10000	ug/L	SW846 8260A	
Carbon tetrachloride	ND	10000	ug/L	SW846 8260A	
Chlorobenzene	ND	10000	ug/L	SW846 8260A	
Chlorodibromomethane	ND	10000	ug/L	SW846 8260A	
Chloroethane	ND	20000	ug/L	SW846 8260A	
Chloroform	ND	10000	ug/L	SW846 8260A	
Chloromethane	ND	20000	ug/L	SW846 8260A	
2-Chlorotoluene	ND	10000	ug/L	SW846 8260A	
4-Chlorotoluene	ND	10000	ug/L	SW846 8260A	
1,2-Dibromo-3-chloropropane	ND	20000	ug/L	SW846 8260A	
1,2-Dibromoethane	ND	10000	ug/L	SW846 8260A	
Dibromomethane	ND	10000	ug/L	SW846 8260A	
1,2-Dichlorobenzene	ND	10000	ug/L	SW846 8260A	
1,3-Dichlorobenzene	ND	10000	ug/L	SW846 8260A	
1,4-Dichlorobenzene	ND	10000	ug/L	SW846 8260A	
Dichlorodifluoromethane	ND	20000	ug/L	SW846 8260A	
1,1-Dichloroethane	ND	10000	ug/L	SW846 8260A	
1,2-Dichloroethane	ND	10000	ug/L	SW846 8260A	
1,1-Dichloroethene	ND	10000	ug/L	SW846 8260A	
cis-1,2-Dichloroethene	11000	5000	ug/L	SW846 8260A	
trans-1,2-Dichloroethene	ND	5000	ug/L	SW846 8260A	
1,2-Dichloropropane	ND	10000	ug/L	SW846 8260A	
1,3-Dichloropropane	ND	10000	ug/L	SW846 8260A	
2,2-Dichloropropane	ND	10000	ug/L	SW846 8260A	
1,1-Dichloropropene	ND	10000	ug/L	SW846 8260A	
Ethylbenzene	ND	10000	ug/L	SW846 8260A	
Hexachlorobutadiene	ND	10000	ug/L	SW846 8260A	
Isopropylbenzene	ND	10000	ug/L	SW846 8260A	
p-Isopropyltoluene	ND	10000	ug/L	SW846 8260A	
Methylene chloride	ND	10000	ug/L	SW846 8260A	
Naphthalene	ND	10000	ug/L	SW846 8260A	
n-Propylbenzene	ND	10000	ug/L	SW846 8260A	
Styrene	ND	10000	ug/L	SW846 8260A	

(Continued on next page)

QUANTERRA INCORPORATED

PRELIMINARY DATA SUMMARY

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Baker Environmental, Inc.
Camp LeJeune
Project Number: CTO-356

Lot #: H7H250122

Date Reported: 9/03/97

Client Sample ID: IR88-RW01-97C
Sample #: 001 Date Sampled: 08/21/97 12:20 Date Received: 08/25/97 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Volatile Organics by GC/MS					In Review
1,1,1,2-Tetrachloroethane	ND	10000	ug/L	SW846 8260A	
1,1,2,2-Tetrachloroethane	ND	10000	ug/L	SW846 8260A	
Tetrachloroethene	170000	10000	ug/L	SW846 8260A	
Toluene	ND	10000	ug/L	SW846 8260A	
1,2,3-Trichlorobenzene	ND	10000	ug/L	SW846 8260A	
1,2,4-Trichlorobenzene	ND	10000	ug/L	SW846 8260A	
1,1,1-Trichloroethane	ND	10000	ug/L	SW846 8260A	
1,1,2-Trichloroethane	ND	10000	ug/L	SW846 8260A	
Trichloroethene	3200 J	10000	ug/L	SW846 8260A	
Trichlorofluoromethane	ND	20000	ug/L	SW846 8260A	
1,2,3-Trichloropropane	ND	10000	ug/L	SW846 8260A	
1,2,4-Trimethylbenzene	ND	10000	ug/L	SW846 8260A	
1,3,5-Trimethylbenzene	ND	10000	ug/L	SW846 8260A	
Vinyl chloride	ND	20000	ug/L	SW846 8260A	
o-Xylene	ND	5000	ug/L	SW846 8260A	
m-Xylene & p-Xylene	ND	5000	ug/L	SW846 8260A	

J Estimated result. Result is less than RL.

Client Sample ID: IR88-RW02-97C
Sample #: 002 Date Sampled: 08/22/97 09:12 Date Received: 08/25/97 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Volatile Organics by GC/MS					In Review
Benzene	ND	10000	ug/L	SW846 8260A	
Bromobenzene	ND	10000	ug/L	SW846 8260A	
Bromochloromethane	ND	10000	ug/L	SW846 8260A	
Bromodichloromethane	ND	10000	ug/L	SW846 8260A	
Bromoform	ND	10000	ug/L	SW846 8260A	
Bromomethane	ND	20000	ug/L	SW846 8260A	
n-Butylbenzene	ND	10000	ug/L	SW846 8260A	
sec-Butylbenzene	ND	10000	ug/L	SW846 8260A	
tert-Butylbenzene	ND	10000	ug/L	SW846 8260A	
Carbon tetrachloride	ND	10000	ug/L	SW846 8260A	
Chlorobenzene	ND	10000	ug/L	SW846 8260A	
Chlorodibromomethane	ND	10000	ug/L	SW846 8260A	

(Continued on next page)

QUANTERRA INCORPORATED

PRELIMINARY DATA SUMMARY

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Baker Environmental, Inc.
Camp LeJeune
Project Number: CTO-356

Lot #: H7H250122

Date Reported: 9/03/97

Client Sample ID: IR88-RW02-97C
Sample #: 002 Date Sampled: 08/22/97 09:12 Date Received: 08/25/97 Matrix: WATER

Volatile Organics by GC/MS In Review

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
Chloroethane	ND	20000	ug/L	SW846 8260A
Chloroform	ND	10000	ug/L	SW846 8260A
Chloromethane	ND	20000	ug/L	SW846 8260A
2-Chlorotoluene	ND	10000	ug/L	SW846 8260A
4-Chlorotoluene	ND	10000	ug/L	SW846 8260A
1,2-Dibromo-3-chloro-propane	ND	20000	ug/L	SW846 8260A
1,2-Dibromoethane	ND	10000	ug/L	SW846 8260A
Dibromomethane	ND	10000	ug/L	SW846 8260A
1,2-Dichlorobenzene	ND	10000	ug/L	SW846 8260A
1,3-Dichlorobenzene	ND	10000	ug/L	SW846 8260A
1,4-Dichlorobenzene	ND	10000	ug/L	SW846 8260A
Dichlorodifluoromethane	ND	20000	ug/L	SW846 8260A
1,1-Dichloroethane	ND	10000	ug/L	SW846 8260A
1,2-Dichloroethane	ND	10000	ug/L	SW846 8260A
1,1-Dichloroethene	ND	10000	ug/L	SW846 8260A
cis-1,2-Dichloroethene	10000	5000	ug/L	SW846 8260A
trans-1,2-Dichloroethene	ND	5000	ug/L	SW846 8260A
1,2-Dichloropropane	ND	10000	ug/L	SW846 8260A
1,3-Dichloropropane	ND	10000	ug/L	SW846 8260A
2,2-Dichloropropane	ND	10000	ug/L	SW846 8260A
1,1-Dichloropropene	ND	10000	ug/L	SW846 8260A
Ethylbenzene	ND	10000	ug/L	SW846 8260A
Hexachlorobutadiene	ND	10000	ug/L	SW846 8260A
Isopropylbenzene	ND	10000	ug/L	SW846 8260A
p-Isopropyltoluene	ND	10000	ug/L	SW846 8260A
Methylene chloride	ND	10000	ug/L	SW846 8260A
Naphthalene	ND	10000	ug/L	SW846 8260A
n-Propylbenzene	ND	10000	ug/L	SW846 8260A
Styrene	ND	10000	ug/L	SW846 8260A
1,1,1,2-Tetrachloroethane	ND	10000	ug/L	SW846 8260A
1,1,2,2-Tetrachloroethane	ND	10000	ug/L	SW846 8260A
Tetrachloroethene	150000	10000	ug/L	SW846 8260A
Toluene	ND	10000	ug/L	SW846 8260A
1,2,3-Trichlorobenzene	ND	10000	ug/L	SW846 8260A
1,2,4-Trichlorobenzene	ND	10000	ug/L	SW846 8260A
1,1,1-Trichloroethane	ND	10000	ug/L	SW846 8260A

(Continued on next page)

QUANTERRA INCORPORATED

PRELIMINARY DATA SUMMARY

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Baker Environmental, Inc.
Camp LeJeune
Project Number: CTO-356

Lot #: H7H250122

Date Reported: 9/03/97

Client Sample ID: IR88-RW02-97C
Sample #: 002 Date Sampled: 08/22/97 09:12 Date Received: 08/25/97 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Volatile Organics by GC/MS					In Review
1,1,2-Trichloroethane	ND	10000	ug/L	SW846 8260A	
Trichloroethene	3500 J	10000	ug/L	SW846 8260A	
Trichlorofluoromethane	ND	20000	ug/L	SW846 8260A	
1,2,3-Trichloropropane	ND	10000	ug/L	SW846 8260A	
1,2,4-Trimethylbenzene	ND	10000	ug/L	SW846 8260A	
1,3,5-Trimethylbenzene	ND	10000	ug/L	SW846 8260A	
Vinyl chloride	ND	20000	ug/L	SW846 8260A	
o-Xylene	ND	5000	ug/L	SW846 8260A	
m-Xylene & p-Xylene	ND	5000	ug/L	SW846 8260A	

J Estimated result. Result is less than RL.

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
norganic Analysis					In Review
Carbonate Alkalinity	ND	5.0	mg/L	SM18 2320 B	

Client Sample ID: IR88-DRM01
Sample #: 003 Date Sampled: 08/22/97 16:40 Date Received: 08/25/97 Matrix: SOLID

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Volatile Organics by GC/MS TCLP					In Review
Benzene	ND	0.62	mg/L	SW846 8260A	
Carbon tetrachloride	0.50 J	0.62	mg/L	SW846 8260A	
Chlorobenzene	ND	0.62	mg/L	SW846 8260A	
Chloroform	ND	0.62	mg/L	SW846 8260A	
1,2-Dichloroethane	ND	0.62	mg/L	SW846 8260A	
1,1-Dichloroethylene	ND	0.62	mg/L	SW846 8260A	
Methyl ethyl ketone	ND	3.0	mg/L	SW846 8260A	
Tetrachloroethylene	37	0.62	mg/L	SW846 8260A	
Trichloroethylene	0.42 J	0.62	mg/L	SW846 8260A	
Vinyl chloride	ND	1.2	mg/L	SW846 8260A	

J Estimated result. Result is less than RL.

(Continued on next page)

QUANTERRA INCORPORATED

PRELIMINARY DATA SUMMARY

Baker Environmental
Camp LeJeune
Project Number: CTO-356

Lot #: H7K180134

PAGE 4
Date Reported: 12/15/97

Client Sample ID: IR88-RW01-97D
Sample #: 012 Date Sampled: 11/17/97 12:20 Date Received: 11/18/97 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Aluminum	0.28	0.20	mg/L	SW846 6010A	
Barium	ND	0.20	mg/L	SW846 6010A	
Beryllium	ND	0.0050	mg/L	SW846 6010A	
Calcium	15.7	5.0	mg/L	SW846 6010A	
Cadmium	ND	0.0050	mg/L	SW846 6010A	
Cobalt	ND	0.050	mg/L	SW846 6010A	
Chromium	ND	0.010	mg/L	SW846 6010A	
Copper	ND	0.025	mg/L	SW846 6010A	
Iron	25.8	0.10	mg/L	SW846 6010A	
Potassium	ND	5.0	mg/L	SW846 6010A	
Magnesium	ND	5.0	mg/L	SW846 6010A	
Manganese	0.094	0.015	mg/L	SW846 6010A	
Sodium	19.7	5.0	mg/L	SW846 6010A	
Nickel	ND	0.040	mg/L	SW846 6010A	
Antimony	ND	0.060	mg/L	SW846 6010A	
Vanadium	ND	0.050	mg/L	SW846 6010A	
Zinc	0.023	0.020	mg/L	SW846 6010A	
Mercury in Liquid Waste (Manual Cold-Vapor)					Reviewed
Mercury	ND	0.00020	mg/L	SW846 7470A	
Inorganic Analysis					Reviewed
Alkalinity, Total	28.2	5.0	mg/L	SM18 2320 B	
Alkalinity, Total	31.5	5.0	mg/L	SM18 2320 B	
Bromide	0.84	0.50	mg/L	MCAWW 300.0A	
Chloride	66.0	5.0	mg/L	MCAWW 300.0A	
Fluoride	ND	1.0	mg/L	MCAWW 300.0A	
Nitrite as N	ND	0.50	mg/L	MCAWW 300.0A	
Nitrate as N	ND	0.50	mg/L	MCAWW 300.0A	
o-Phosphate as P	ND	1.0	mg/L	MCAWW 300.0A	
Sulfate	16.1	1.0	mg/L	MCAWW 300.0A	

(Continued on next page)

QUANTERRA INCORPORATED

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

Baker Environmental
Camp LeJeune
Project Number: CTO-356

Lot #: H7K180134

Date Reported: 12/15/97

Client Sample ID: IR88-RW02-97D
Sample #: 013 Date Sampled: 11/17/97 12:35 Date Received: 11/18/97 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Arsenic	ND	0.010	mg/L	SW846 6010A	
Lead	ND	0.0030	mg/L	SW846 6010A	
Selenium	ND	0.0050	mg/L	SW846 6010A	
Thallium	ND	0.010	mg/L	SW846 6010A	
Inductively Coupled Plasma (ICP) Metals					Reviewed
Silver	ND	0.010	mg/L	SW846 6010A	
Aluminum	0,33	0.20	mg/L	SW846 6010A	
Barium	ND	0.20	mg/L	SW846 6010A	
Beryllium	ND	0.0050	mg/L	SW846 6010A	
Calcium	15.1	5.0	mg/L	SW846 6010A	
Cadmium	ND	0.0050	mg/L	SW846 6010A	
Cobalt	ND	0.050	mg/L	SW846 6010A	
Chromium	ND	0.010	mg/L	SW846 6010A	
Copper	ND	0.025	mg/L	SW846 6010A	
Iron	6.1	0.10	mg/L	SW846 6010A	
Potassium	9.9	5.0	mg/L	SW846 6010A	
Magnesium	5.3	5.0	mg/L	SW846 6010A	
Manganese	0.10	0.015	mg/L	SW846 6010A	
Sodium	30.9	5.0	mg/L	SW846 6010A	
Nickel	ND	0.040	mg/L	SW846 6010A	
Antimony	ND	0.060	mg/L	SW846 6010A	
Vanadium	ND	0.050	mg/L	SW846 6010A	
Zinc	0.039	0.020	mg/L	SW846 6010A	
Mercury in Liquid Waste (Manual Cold-Vapor)					Reviewed
Mercury	ND	0.00020	mg/L	SW846 7470A	
Inorganic Analysis					Reviewed
Alkalinity, Total	ND	5.0	mg/L	SM18 2320 B	
Bromide	ND	0,50	mg/L	MCAWW 300.0A	
Chloride	45.5	5.0	mg/L	MCAWW 300.0A	
Fluoride	ND	1.0	mg/L	MCAWW 300.0A	
Nitrite as N	ND	0.50	mg/L	MCAWW 300.0A	
Nitrate as N	1.0	0.50	mg/L	MCAWW 300.0A	
o-Phosphate as P	ND	1.0	mg/L	MCAWW 300.0A	

(Continued on next page)

QUANTERRA INCORPORATED

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

Baker Environmental
Camp LeJeune
Project Number: CTO-356

Lot #: H7K180134

Date Reported: 12/15/97

Client Sample ID: IR88-FB02
Sample #: 014 Date Sampled: 11/17/97 14:20 Date Received: 11/18/97 Matrix: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
Inorganic Analysis				Reviewed
Alkalinity, Total	63.9	5.0	mg/L	SM18 2320 B
Bromide	ND	0.50	mg/L	MCAWW 300.0A
Chloride	12.4	1.0	mg/L	MCAWW 300.0A
Fluoride	ND	1.0	mg/L	MCAWW 300.0A
Nitrite as N	ND	0.50	mg/L	MCAWW 300.0A
Nitrate as N	ND	0.50	mg/L	MCAWW 300.0A
o-Phosphate as P	ND	1.0	mg/L	MCAWW 300.0A
Sulfate	5.4	1.0	mg/L	MCAWW 300.0A

QUANTERRA INCORPORATED

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

Baker Environmental
Camp LeJeune
Project Number: CTO-356

Lot #: H7K180134

PAGE 6
Date Reported: 12/15/97

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Client Sample ID: IR88-RW02-97D Sample #: 013 Date Sampled: 11/17/97 12:35 Date Received: 11/18/97 Matrix: WATER					
Sulfate					Reviewed
Sulfate	46.7	5.0	mg/L	MCAWW 300.0A	
Client Sample ID: IR88-FB02 SOURCE WATER SAMPLE Sample #: 014 Date Sampled: 11/17/97 14:20 Date Received: 11/18/97 Matrix: WATER					
Trace Inductively Coupled Plasma (ICP) Metals					Reviewed
Arsenic	ND	0.010	mg/L	SW846 6010A	
Lead	ND	0.0030	mg/L	SW846 6010A	
Selenium	ND	0.0050	mg/L	SW846 6010A	
Thallium	ND	0.010	mg/L	SW846 6010A	
Inductively Coupled Plasma (ICP) Metals					Reviewed
Silver	ND	0.010	mg/L	SW846 6010A	
Aluminum	0.20	0.20	mg/L	SW846 6010A	
Barium	ND	0.20	mg/L	SW846 6010A	
Beryllium	ND	0.0050	mg/L	SW846 6010A	
Calcium	26.9	5.0	mg/L	SW846 6010A	
Cadmium	ND	0.0050	mg/L	SW846 6010A	
Cobalt	ND	0.050	mg/L	SW846 6010A	
Chromium	ND	0.010	mg/L	SW846 6010A	
Copper	ND	0.025	mg/L	SW846 6010A	
Iron	ND	0.10	mg/L	SW846 6010A	
Potassium	ND	5.0	mg/L	SW846 6010A	
Magnesium	ND	5.0	mg/L	SW846 6010A	
Manganese	ND	0.015	mg/L	SW846 6010A	
Sodium	9.0	5.0	mg/L	SW846 6010A	
Nickel	ND	0.040	mg/L	SW846 6010A	
Antimony	ND	0.060	mg/L	SW846 6010A	
Vanadium	ND	0.050	mg/L	SW846 6010A	
Zinc	ND	0.020	mg/L	SW846 6010A	
Mercury in Liquid Waste (Manual Cold-Vapor)					Reviewed
Mercury	ND	0.00020	mg/L	SW846 7470A	

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STAR ANALYTICAL
14500 Trinity Boulevard, Suite 106 • Fort Worth, Texas 76155
(817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

Duke Engineering & Services	Project:	MCB Camp Lejune - Site 88 Sear		Sampled:	9/24/98
9111 Research Blvd.	Project Number:	none		Received:	9/25/98
Austin, TX 78758	Project Manager:	Fred Holzmer		Reported:	10/21/98 13:13

ANALYTICAL REPORT FOR SAMPLES:

Sample Description	Laboratory Sample Number	Sample Matrix	Date Sampled
88 Source - 98	8090283-01	Water	9/24/98
88 Source - 98	8090283-02	Water	9/24/98

Source Water: Major ion analysis

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Star Analytical, Inc.

Lari Hall, Project Manager

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Duke Engineering & Services	Project:	MCB Camp Lejune - Site 88 Sear	Sampled:	9/24/98
9111 Research Blvd.	Project Number:	none	Received:	9/25/98
Austin, TX 78758	Project Manager:	Fred Holzmer	Reported:	10/21/98 13:13

Total Metals by EPA 200 Series Methods
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	Reporting Limit	Result	Units	Notes*
<u>88 Source - 98</u>			<u>8090283-01</u>				<u>Water</u>	
Magnesium	10V8211	10/11/98	10/14/98	EPA 200.7	0.500	**2.00**	mg/l	
Calcium	"	"	"	EPA 200.7	2.00	**21.0**	"	
Potassium	10V8323	"	10/20/98	EPA 200.7	0.500	**1.40**	"	
Sodium	"	"	"	EPA 200.7	5.00	**8.00**	"	

Star Analytical, Inc.

**Refer to end of report for text of notes and definitions.*

LHall

Lari Hall, Project Manager

Duke Engineering & Services	Project:	MCB Camp Lejune - Site 88 Sear		Sampled:	9/24/98
9111 Research Blvd.	Project Number:	none		Received:	9/25/98
Austin, TX 78758	Project Manager:	Fred Holzmer		Reported:	10/21/98 13:13

Conventional Chemistry Parameters by APHA/EPA Methods
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	Reporting Limit	Result	Units	Notes*
88 Source - 98			**8090283-02**				**Water**	
Chloride	10V8138	10/8/98	10/8/98	EPA 325.3	0.30	**13**	mg/l	
Fluoride	10V8074	10/2/98	10/2/98	EPA 340.2	0.100	ND	"	
Nitrate-Nitrogen	09V8385	9/28/98	9/25/98	EPA 352.1	0.20	ND	"	
Nitrate/Nitrite-Nitrogen	09V8397	9/18/98	"	EPA 353.3	0.10	ND	"	
Phosphorus	10V8120	10/5/98	10/1/98	EPA 365.2	0.10	ND	"	
Sulfate	09V8456	9/29/98	9/29/98	EPA 375.4	1.0	**7.7**	"	
Bicarbonate Alkalinity	10V8194	10/7/98	10/7/98	SM 2320B	10	**33**	"	

Star Analytical, Inc.

LHall

Lari Hall, Project Manager

**Refer to end of report for text of notes and definitions.*

Duke Engineering & Services	Project:	MCB Camp Lejune - Site 88 Sear	Sampled:	9/24/98
9111 Research Blvd.	Project Number:	none	Received:	9/25/98
Austin, TX 78758	Project Manager:	Fred Holzmer	Reported:	10/21/98 13:13

Total Metals by EPA 200 Series Methods/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 10V8211	**Date Prepared: 10/11/98**				**Extraction Method: General Preparation**					
Blank	**10V8211-BLK1**									
Calcium	10/14/98			**ND**	mg/l	**0.200**				
Magnesium	"			**ND**	"	**0.100**				
Blank	**10V8211-BLK2**									
Calcium	10/14/98			**ND**	mg/l	**0.200**				
Magnesium	"			**ND**	"	**0.100**				
LCS	**10V8211-BS1**									
Calcium	10/14/98	1.00		1.30	mg/l	80.0-120	130			
Magnesium	"	1.00		1.20	"	80.0-120	120			
LCS	**10V8211-BS2**									
Calcium	10/14/98	1.00		1.10	mg/l	80.0-120	110			
LCS Dup	**10V8211-BSD1**									
Calcium	10/14/98	1.00		1.10	mg/l	80.0-120	110	20.0	16.7	
Magnesium	"	1.00		1.10	"	80.0-120	110	20.0	8.70	
LCS Dup	**10V8211-BSD2**									
Calcium	10/14/98	1.00		1.30	mg/l	80.0-120	130	20.0	16.7	
Batch: 10V8323	**Date Prepared: 10/11/98**				**Extraction Method: General Preparation**					
Blank	**10V8323-BLK1**									
Potassium	10/20/98			**ND**	mg/l	**0.500**				
Sodium	"			**ND**	"	**0.500**				
LCS	**10V8323-BS1**									
Potassium	10/20/98	10.0		10.0	mg/l	80.0-120	100			
Sodium	"	1.00		0.960	"	80.0-120	96.0			
LCS Dup	**10V8323-BSD1**									
Potassium	10/20/98	10.0		9.70	mg/l	80.0-120	97.0	20.0	3.05	
Sodium	"	1.00		0.900	"	80.0-120	90.0	20.0	6.45	

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**Refer to end of report for text of notes and definitions.*

LHall

Lari Hall, Project Manager

Duke Engineering & Services	Project: MCB Camp Lejune - Site 88 Sear	Sampled: 9/24/98
9111 Research Blvd.	Project Number: none	Received: 9/25/98
Austin, TX 78758	Project Manager: Fred Holzmer	Reported: 10/21/98 13:13

Conventional Chemistry Parameters by APHA/EPA Methods/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 09V8385	**Date Prepared: 9/18/98**				**Extraction Method: General Preparation**					
Blank	**09V8385-BLK1**									
Nitrate-Nitrogen	9/18/98			**ND**	mg/l	**0.20**				
Duplicate	**09V8385-DUP1**		**8090192-02**							
Nitrate-Nitrogen	9/28/98		ND	ND	mg/l					
Batch: 09V8397	**Date Prepared: 9/18/98**				**Extraction Method: EPA 1311/3010**					
Blank	**09V8397-BLK1**									
Nitrate/Nitrite-Nitrogen	9/25/98			**ND**	mg/l	**0.10**				
LCS	**09V8397-BS1**									
Nitrate/Nitrite-Nitrogen	9/18/98	0.80		0.85	mg/l	70-130	110			
LCS Dup	**09V8397-BSD1**									
Nitrate/Nitrite-Nitrogen	9/18/98	0.80		0.85	mg/l	70-130	110	30	0	
Duplicate	**09V8397-DUP1**		**8090283-02**							
Nitrate/Nitrite-Nitrogen	9/25/98		ND	ND	mg/l			30		
Batch: 09V8456	**Date Prepared: 9/29/98**				**Extraction Method: General Preparation**					
Blank	**09V8456-BLK1**									
Sulfate	9/23/98			**1.8**	mg/kg	**1.0**				
LCS	**09V8456-BS1**									
Sulfate	9/23/98	20		9.8	mg/kg	70-130	49			
LCS Dup	**09V8456-BSD1**									
Sulfate	9/29/98	20		9.5	mg/kg	70-130	48	30	2.1	
Duplicate	**09V8456-DUP1**		**8090283-02**							
Sulfate	9/29/98		7.7	7.7	mg/kg			30	**0**	
Batch: 10V8074	**Date Prepared: 10/2/98**				**Extraction Method: General Preparation**					
Blank	**10V8074-BLK1**									
Fluoride	10/2/98			**ND**	mg/l	**0.100**				
LCS	**10V8074-BS1**									
Fluoride	10/2/98	0.100		0.100	mg/l	78.0-113	100			
Duplicate	**10V8074-DUP1**		**8090283-02**							
Fluoride	10/2/98		ND	ND	mg/l			25.0		

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Lari Hall, Project Manager

**Refer to end of report for text of notes and definitions.*

Duke Engineering & Services	Project: MCB Camp Lejune - Site 88 Sear	Sampled: 9/24/98
9111 Research Blvd.	Project Number: none	Received: 9/25/98
Austin, TX 78758	Project Manager: Fred Holzmer	Reported: 10/21/98 13:13

Conventional Chemistry Parameters by APHA/EPA Methods/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 10V8120	**Date Prepared: 10/5/98**				**Extraction Method: General Preparation**					
Blank	**10V8120-BLK1**									
Phosphorus	10/1/98			**ND**	mg/l	**0.10**				
Duplicate	**10V8120-DUP1**		**8090304-06**							
Phosphorus	10/1/98		1.5	1.8	mg/l			30	**18**	
Batch: 10V8138	**Date Prepared: 10/8/98**				**Extraction Method: General Preparation**					
Blank	**10V8138-BLK1**									
Chloride	10/8/98			**ND**	mg/l	**0.30**				
LCS	**10V8138-BS1**									
Chloride	10/8/98	890		910	mg/l	90-110	100			
Duplicate	**10V8138-DUP1**		**8090283-02**							
Chloride	10/8/98		13	12	mg/l			16	**8.0**	
Batch: 10V8194	**Date Prepared: 10/7/98**				**Extraction Method: General Preparation**					
Blank	**10V8194-BLK1**									
Bicarbonate Alkalinity	10/7/98			**ND**	mg/l	**1.00**				
Duplicate	**10V8194-DUP1**		**8090283-02**							
Bicarbonate Alkalinity	10/7/98		33	26	mg/l			30.0	**24**	

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Lari Hall, Project Manager

**Refer to end of report for text of notes and definitions.*

Duke Engineering & Services 9111 Research Blvd. Austin, TX 78758	Project: MCB Camp Lejune - Site 88 Sear Project Number: none Project Manager: Fred Holzmer	Sampled: 9/24/98 Received: 9/25/98 Reported: 10/21/98 13:13

Notes and Definitions

#	Note
D	Data reported from a dilution.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
Recov.	Recovery
RPD	Relative Percent Difference

Star Analytical, Inc.

LHall

Lari Hall, Project Manager

APPENDIX F

Soil Concentration Correction Calculations: Extract Volume Calculation and Soil Concentration Conversion

Appendix F

Extract Volume Calculation and Soil Concentration Conversion

Extract Volume Correction Calculation (V_E)

$$V_E = V_{meoh} + V_{sw}$$

Where:

V_E = Extract Volume (mL)
V_{meoh} = Volume of methanol (mL)
V_{sw} = Volume of soil water (mL)

$$V_{meoh} = M_{meoh}\ \rho_{meoh}$$

Where:

M_{meoh} = mass Methanol (gms)
ρ_{meoh} = density of methanol (0.79 gms/mL)

$$M_w = \%\text{ soil moisture }(M_s)$$

Where:

M_w = Mass soil water (gms)
M_s = Mass soil (gms)

Since density of water = 1 gm/ml then mass in grams is equal to volume in ml.

Sample calculation for sample IS07-02

Volume of methanol	(57.0gms -126.9gms)/ 0.79gm/ml = 38.1ml
Mass of Soil	303.0 gms– 157.0 gms = 146 gms
Mass of Water	146gms (0.2) = 29.2 gms percent soil moisture = 20%
Volume of water	29.2 ml assuming density of water = 1 gm/ml
Extract Volume	38.1ml + 29.2 ml = 67.3 ml

Extract Concentration from Reported Soil Concentration

$$RC = OCC\ (df)\ (V_{meoh})/[1{,}000(M_s)]$$

Where:

RC = Reported soil concentration (µg/kg)
OCC = On column concentration (µg/L)
df = sample dilution factor
M_s= Mass of soil (gms)
1,000 = unit conversion factor

$$EC = OCC(df)$$

Where:

EC = extract concentration (µg/L)

Then:

$$EC = RC(M_s)(1000)/V_{meoh}$$

Sample calculation for sample IS07-02

Extract concentration (µg/L)

110,830µg/kg(146gms)(1,000)/38,100µl = 424,703 (µg/L)

Soil concentration Conversion

$$M_{pce} = EC(V_E)(1{,}000)$$

Where:

M_{pce} = mass of PCE (mg)

$$SC = M_{pce}(1000)/M_s$$

Where:

SC = concentration of PCE in soil (µg/kg)

Sample calculation for sample IS07-02

Mass of PCE (µg)

424,703 (µg/L) (67.3 ml)/(1,000 ml/L) = 28582.5 µg

Concentration in soil (µg/kg)

28582.5 µg (1,000 gms/kg)/146 gms = 195,771µg/kg

Soil VOC Concentration Correction Calculations

The reason for the correction to the lab-reported soil VOC concentrations is explained as follows. As discussed in Section 3.1.1, the soil samples collected for VOC analysis were preserved in the field with methanol to minimize volatile losses of VOCs from the samples during sample collection, shipment, and analysis. In addition to acting as a VOC preservative for the samples, the methanol also functions as a solvent to extract VOCs from the soil samples. The liquid extract in each soil sample jar, "as received" by the lab, was then analyzed for VOCs by the lab. The soil concentration results reported by the laboratory were incorrect because the calculations to determine soil VOC concentrations were based on the assumption that the total volume of liquid extract in each sample jar was composed only of methanol and VOCs. However, since water is also miscible with methanol, along with the VOCs, the total liquid volume in the soil samples received by the lab consisted of methanol, soil water, and VOCs. Soil water can account for as much as 45% of the total liquid volume in a methanol-preserved soil sample, and therefore, must be accounted for in the analysis in order to accurately convert to soil VOC concentrations. The volume of water in the soil samples can be calculated if the percent soil moisture (by weight) is known. The soil moisture values in Table 3.3 indicates that 20% is generally representative of the moisture content of the soil samples collected at Site 88. The laboratory-reported analytical values were corrected for the sample volume error by assuming 20% moisture content for all samples. The corrected raw analytical results were then converted from a concentration of VOC in μg/L of extract solution to μg/Kg of wet soil.

The correction calculations are a 3-part calculation process:

1) Extract volume correction;

2) Extract concentration from misreported soil concentration;

3) Soil concentration conversion

The process is shown below and includes a sample calculation.

1) Extract Volume Correction (V_E)

$$V_E = V_{meoh} + V_{sw}$$

Where:

V_E = Extract Volume (mL)
V_{meoh} = Volume of methanol (mL)
V_{sw} = Volume of soil water (mL)

$$V_{meoh} = M_{meoh}\ \rho_{meoh}$$

Where:

M_{meoh} = mass Methanol (gms)
ρ_{meoh} = density of methanol (0.79 gms/mL)

$$M_w = \%\ \text{soil moisture}\ (M_s)$$

Where:

M_w = Mass soil water (gms)
M_s = Mass soil (gms)

Since density of water = 1 gm/ml then mass in grams is equal to volume in ml.

Sample calculation for sample IS07-02

Volume of methanol	(157.0gms -126.9gms)/ 0.79gm/ml = 38.1ml
Mass of Soil	303.0 gms– 157.0 gms = 146 gms
Mass of Water	146gms (0.2) = 29.2 gms percent soil moisture = 20%
Volume of water	29.2 ml assuming density of water = 1 gm/ml
Extract Volume	38.1ml + 29.2 ml = 67.3 ml

2) Extract Concentration from Misreported Soil Concentration

$$RC = OCC\ (df)\ (V_{meoh})/[1{,}000(M_s)]$$

Where:

RC = Reported soil concentration (µg/kg)
OCC = On column concentration (µg/L)
df = sample dilution factor
M_s= Mass of soil (gms)
1,000 = unit conversion factor

$$EC = OCC(df)$$

Where:

EC = extract concentration (µg/L)

Then:

$$EC = RC(M_s)(1000)/V_{meoh}$$

Sample calculation for sample IS07-02

Extract concentration (µg/L)

110,830µg/kg(146gms)(1,000)/38,100µl = 424,703 (µg/L)

3) Soil concentration Conversion

$$M_{pce} = EC(V_E)(1,000)$$

Where:

M_{pce} = mass of PCE (mg)

$$SC = M_{pce}(1000)/M_s$$

Where:

SC = concentration of PCE in soil (µg/kg)

Sample calculation for sample IS07-02

Mass of PCE (µg)

424,703 (µg/L) (67.3 ml)/(1,000 ml/L) = 28582.5 µg

Concentration in soil (µg/kg)

28582.5 µg (1,000 gms/kg)/146 gms = 195,771µg/kg

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Project Number TDN 200
Date 7-25 to 7/27/97
Page 1 of 3

SOIL SAMPLES PRESERVATIVE LOG

Sample Number	Tare (gm)	Tare + Methanol (gm)	Final Weight (gm) Soil + methanol	Volume Added (ml)
1501-1	127.3	156.8	264.7	
1501-2	127.3	150.5	291.3	
1501-3	128.6	161.2	285.9	
1501-4	127.5	152.7	271.9	
1502-1	126.6	153.0	297.0	
1502-2	126.3	152.8	302.3	
1502-3	128.4	161.5	274.9	
1503-1	127.6	150.8	251.2	
1503-2	128.6	163.2	288.2	
1503-3	126.6	152.8	280.3	
1502-4	127.6	159.5	232.1	
1504-1	127.6	157.8	299.3	
1505-1	127.3	156.6	268.6	
1505-2	127.1	156.2	279.5	
1505-3	128.2	158.7	287.1	
1505-4	127.0	155.7	280.3	
1506-1	127.4	159.2	317.9	
1507-1	127.4	156.9	292.3	
1507-2	126.9	157.0	303.0	
1507-3	125.6	156.1	311.9	
1507-4	126.0	152.7	250.6	
1508-1	126.5	156.6	241.1	
1508-2	127.5	153.7	229.8	
1508-3	126.0	151.8	225.3	
[illegible]	126.3	159.2	280.0	

MILD SPLASH

1508-4

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 019

Sample WT/Vol: 5 / mL

Work Order: CC006202

Dilution factor: 870

Moisture %:

Date Received: 07/29/97

Date Extracted:08/03/97

Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS07-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	4400	U
108-86-1	Bromobenzene	4400	U
74-97-5	Bromochloromethane	4400	U
75-27-4	Bromodichloromethane	4400	U
75-25-2	Bromoform	4400	U
74-83-9	Bromomethane	8700	U
104-51-8	n-Butylbenzene	4400	U
135-98-8	sec-Butylbenzene	4400	U
98-06-6	tert-Butylbenzene	4400	U
56-23-5	Carbon tetrachloride	4400	U
108-90-7	Chlorobenzene	4400	U
124-48-1	Chlorodibromomethane	4400	U
75-00-3	Chloroethane	8700	U
67-66-3	Chloroform	4400	U
74-87-3	Chloromethane	8700	U
95-49-8	2-Chlorotoluene	4400	U
106-43-4	4-Chlorotoluene	4400	U
96-12-8	1,2-Dibromo-3-chloropropane	8700	U
106-93-4	1,2-Dibromoethane	4400	U
74-95-3	Dibromomethane	4400	U
95-50-1	1,2-Dichlorobenzene	4400	U
541-73-1	1,3-Dichlorobenzene	4400	U
106-46-7	1,4-Dichlorobenzene	4400	U
75-71-8	Dichlorodifluoromethane	8700	U
75-34-3	1,1-Dichloroethane	4400	U
107-06-2	1,2-Dichloroethane	4400	U
75-35-4	1,1-Dichloroethene	4400	U
156-59-2	**cis-1,2-Dichloroethene**	**46000**	
156-60-5	trans-1,2-Dichloroethene	2200	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 019

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC006202
Dilution factor: 870
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS07-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	4400	U
142-28-9	1,3-Dichloropropane	4400	U
594-20-7	2,2-Dichloropropane	4400	U
563-58-6	1,1-Dichloropropene	4400	U
100-41-4	Ethylbenzene	4400	U
87-68-3	Hexachlorobutadiene	4400	U
98-82-8	Isopropylbenzene	4400	U
99-87-6	p-Isopropyltoluene	4400	U
75-09-2	Methylene chloride	4400	U
91-20-3	Naphthalene	4400	U
103-65-1	n-Propylbenzene	4400	U
100-42-5	Styrene	4400	U
630-20-6	1,1,1,2-Tetrachloroethane	4400	U
79-34-5	1,1,2,2-Tetrachloroethane	4400	U
127-18-4	**Tetrachloroethene**	**110000**	
108-88-3	Toluene	4400	U
87-61-6	1,2,3-Trichlorobenzene	4400	U
120-82-1	1,2,4-Trichlorobenzene	4400	U
71-55-6	1,1,1-Trichloroethane	4400	U
79-00-5	1,1,2-Trichloroethane	4400	U
79-01-6	**Trichloroethene**	**3900**	J
75-69-4	Trichlorofluoromethane	8700	U
96-18-4	1,2,3-Trichloropropane	4400	U
95-63-6	**1,2,4-Trimethylbenzene**	**3800**	J
108-67-8	**1,3,5-Trimethylbenzene**	**1700**	J
75-01-4	**Vinyl chloride**	**4800**	J
95-47-6	o-Xylene	2200	U
136777-61-2	m-Xylene & p-Xylene	2200	U

```
Data File: /chem/gcms/mw.i/W080397.b/CC006202.d
Report Date: 03-Aug-97 17:46:16


                          Quanterra - Knoxville

                   SW-846 Method 8260A - Volatile Organics
Data file : /chem/gcms/mw.i/W080397.b/CC006202.d
Lab Smp Id: CC006202
Inj Date  : 03-AUG-97 16:12:00
Operator  : 60487                          Inst ID: mw.i
Smp Info  : CC006202,870,0,,,
Misc Info : W080397,MS8260_L,
Comment   :
Method    : /chem/gcms/mw.i/W080397.b/MS8260_L.m
Meth Date : 03-Aug-97 13:19:28 wilesd     Quant Type: ISTD
Cal Date  : 30-JUL-97 20:57:00            Cal File: WI0730A.d
Als bottle: 1
Dil Factor: 870.00000
Integrator: HP RTE                         Compound Sublist: all.sub
Target Version:  3.30
Processing Host: hpuxcs12

Concentration Formula: Vt/(Ws*1000)

     Name         Value     Description
-------------- ---------- ----------------------
      Vt        5000.000  Sample Volume Purged
      Ws           5.000  Weight of sample


                                                                            CONCENTRATIONS
                                     QUANT SIG                              ON-COLUMN   FINAL
Compounds                              MASS       RT   EXP RT REL RT  RESPONSE ( ug/L)    (ug/Kg)
=========================              ====       ==   ====== ======  ======== =======    =======
*   1 Fluorobenzene                     96      9.483   9.517 (1.000)   255535  50.0000
*   2 Chlorobenzene-d5                 117     13.833  13.900 (1.000)   237432  50.0000
*   3 1,4 Dichlorobenzene-d4           152     17.417  17.517 (1.000)   176643  50.0000
$   4 1,2-Dichloroethane-d4             65      9.100   9.133 (0.960)    86542  37.8135    37.814(a)
$   5 Toluene-d8                        98     11.683  11.733 (0.845)   221489  46.1209    46.121(a)
$   6 4-Bromofluorobenzene              95     15.617  15.700 (0.897)   195307  41.3967    41.397(a)
    7 Dichlorodifluoromethane          85.00          Compound Not Detected.
    8 Chloromethane (spcc)             50.00          Compound Not Detected.
    9 Vinyl Chloride (ccc)              62      3.050   3.050 (0.322)     9396  5.54636    4825.3(a)
   10 Bromomethane                     94.00          Compound Not Detected.
   11 Chloroethane                     64.00          Compound Not Detected.
   12 Trichlorofluoromethane          101.00          Compound Not Detected.
   13 1,1-Dichloroethene (ccc)         96.00          Compound Not Detected.
   14 Carbon Disulfide                 76.00          Compound Not Detected.
   15 Acetone                           43      5.383   5.400 (0.568)      625  1.03861    903.59(a)
   16 Methylene Chloride                84      6.017   6.033 (0.634)     2030  1.03158    897.48(a)
   17 trans-1,2-Dichloroethene         96.00          Compound Not Detected.
```

```
Data File: /chem/gcms/mw.i/W080397.b/CC006202.d
Report Date: 03-Aug-97 17:46:16

                                                                                    CONCENTRATIONS
                                     QUANT SIG                                    ON-COLUMN      FINAL
Compounds                              MASS       RT     EXP RT REL RT  RESPONSE   ( ug/L)      (ug/Kg)
========================               ====       ==     ====== ======  ========   =======      =======
   18 1,1-Dichloroethane (spcc)        63.00        Compound Not Detected.
   19 2,2-Dichloropropane              77.00        Compound Not Detected.
   20 cis 1,2-Dichloroethene            96       7.917   7.950 (0.835)   108219    53.3411       46407
 M 21 1,2-Dichloroethene (total)        96                                108219    53.3411       46407
   22 2-Butanone                        43       7.967   7.983 (0.840)      736    0.58136     ~~505.78(aQ)~~
   23 Bromochloromethane               128.00       Compound Not Detected.
   24 Chloroform (ccc)                 83.00        Compound Not Detected.
   25 1,1,1-Trichloroethane            97.00        Compound Not Detected.
   26 Carbon Tetrachloride            117.00        Compound Not Detected.
   27 1,1-Dichloropropene              75.00        Compound Not Detected.
   28 Benzene                          78.00        Compound Not Detected.
   29 1,2-Dichloroethane                62       9.483   9.233 (1.000)     2706    1.00733     ~~876.36(a)~~
   30 Trichloroethene                  130       9.967  10.017 (1.051)    12495    4.52553      3937.2(a)
   31 1,2-Dichloropropane (ccc)        63.00        Compound Not Detected.
   32 Dibromomethane                   93.00        Compound Not Detected.
   33 Bromodichloromethane             83.00        Compound Not Detected.
   34 cis-1,3-Dichloropropene          75.00        Compound Not Detected.
   35 4-Methyl-2-pentanone             43.00        Compound Not Detected.
   36 Toluene (ccc)                    91.00        Compound Not Detected.
   37 trans-1,3-Dichloropropene        75.00        Compound Not Detected.
   38 1,1,2-Trichloroethane             97      12.533  12.500 (0.906)     1796    0.76042     ~~661.57(aQ)~~
   39 Tetrachloroethene                164      12.533  12.583 (0.906)   346227    127.392       110830 #
   40 1,3-Dichloropropane              76.00        Compound Not Detected.
   41 2-Hexanone                       43.00        Compound Not Detected.
   42 Chlorodibromomethane            129.00        Compound Not Detected.
   43 1,2-Dibromoethane               107.00        Compound Not Detected.
   44 Chlorobenzene (spcc)            112.00        Compound Not Detected.
   45 Ethylbenzene (ccc)              106.00        Compound Not Detected.
   46 1,1,1,2-Tetrachloroethane       131.00        Compound Not Detected.
   47 m&p-Xylene                      106.00        Compound Not Detected.
   48 o-Xylene                        106.00        Compound Not Detected.
 M 49 Xylene (total)                  106.00        Compound Not Detected.
   50 Styrene                         104.00        Compound Not Detected.
   51 Bromoform (spcc)                173.00        Compound Not Detected.
   52 Isopropylbenzene                105.00        Compound Not Detected.
   53 Bromobenzene                    156.00        Compound Not Detected.
   54 1,1,2,2-Tetrachloroethane(sp)    83.00        Compound Not Detected.
   55 n-Propylbenzene                  91.00        Compound Not Detected.
   56 1,2,3-Trichloropropane           75.00        Compound Not Detected.
   57 2-Chlorotoluene                  91.00        Compound Not Detected.
   58 1,3,5-Trimethylbenzene            105      16.183  16.267 (0.929)    11347    1.97959      1722.2(a)
   59 4-Chlorotoluene                  91.00        Compound Not Detected.
   60 tert-Butylbenzene               119.00        Compound Not Detected.
   61 1,2,4-Trimethylbenzene            105      16.783  16.883 (0.964)    25716    4.33953      3775.4(a)
   62 sec-Butylbenzene                105.00        Compound Not Detected.
   63 1,3-Dichlorobenzene             146.00        Compound Not Detected.
   64 p-Isopropyltoluene                119      17.233  17.333 (0.989)     3880    0.56635      492.72(a)
   65 1,4-Dichlorobenzene             146.00        Compound Not Detected.
```

8/4/97

APPENDIX G

Porosity Calculation and NAPLANAL paper (Mariner *et al*, 1997)

POROSITY FROM PERCENT SOIL MOISTURE

Assume pores are fully saturated with water, then:

$\%w = m_p/m_t \times 100$ and

$m_p = V_p\rho_w$ then:

$\%w = (V_p\rho_w/m_t) \times 100$ rearranging

$V_p = \%w\ m_t/100\rho_w$

where:

$\%w$ = percent soil moisture
m_p = mass of water in pores
m_t = total mass of sample
V_p = volume of pores
ρ_w = density of water

$V_t = V_s + V_p$ Then

$V_t = m_s/\rho_s + V_p$ and

$m_s = m_t - m_p$ substituting

$V_t = (m_t - m_p)/\rho_s + V_p$ Finally

$V_t = (m_t - V_p\rho_w)/\rho_s + V_p$

where:

V_T = total volume of sample
V_s = volume of soil
m_s = mass of soil
ρ_s = density of soil

$\eta = V_p/V_t$ Substituting

$\eta = (\%w\ m_t/100\rho_w)/((m_t - V_p\rho_w)/\rho_s + V_p)$ Substitute for V_p

$$\eta = (\%w\ m_t/100\rho_w)/(((m_t - (\%w\ m_t/100\rho_w))/\rho_s + \%w\ m_t/100\rho_w)$$

Divide top and bottom by m_t then:

$$\eta = (\%w\ /100\rho_w)/(((1 - (\%w\ /100\rho_w))/\rho_s + \%w\ /100\rho_w)$$

Multiply top and bottom by $100\rho_w$ then:

$$\eta = \%w\ /((100\rho_w\ - \%w\ )/\rho_s + \%w)$$

where:

η = porosity

For soil correction calculations a value of 1 gm/ml was used for ρ_w and a value of 2.64 gm/ml was used for ρ_s. The above equation then becomes:

$$\eta = \%w\ /((100\ - \%w\ )/2.64 + \%w)$$

Sample Calculation

Assuming soil moisture content of 20%.

$$\eta = 20\ /((100\ - 20\ )/2.64 + 20)$$

$$\eta = 20\ /((80)/2.64 + 20)$$

$$\eta = 20\ /(30.3 + 20)$$

$$\eta = 0.398$$

[redacted]

An Algorithm for the Estimation of NAPL Saturation and Composition from Typical Soil Chemical Analyses

by Paul E. Mariner, Minquan Jin, and Richard E. Jackson

Abstract

An algorithm is presented that allows estimation of the saturation and composition of a single or multicomponent NAPL within a core sample. These estimates are possible because, in addition to distributing the organic chemicals between aqueous, sorbed, air, and NAPL phases according to traditional partitioning equations, the algorithm incorporates equations for the conservation of mass and volume. A unique solution is obtained by solving the set of nonlinear equations implicitly. The algorithm is built into a code called NAPLANAL, which is tested and applied to actual core samples collected in the field.

Pages 122–129

Introduction

It is an extraordinary feature of modern hydrogeological practice that estimating the mass or volume of nonaqueous phase liquid (NAPL) in a soil or rock is not deemed essential to the design of remediation systems. A brief inspection of past issues of this journal will show that NAPL volumes are seldom estimated from field data. Such a volume estimate permits the calculation of an approximate remediation period for the NAPL-contaminated soil or rock. An essential parameter for estimating NAPL volumes in a NAPL-contaminated soil or rock is the NAPL saturation of the porous medium. Mercer and Cohen (1990) have tabulated NAPL saturation data from the literature.

Paraphrasing Bear (1972), when the pore space of an aquifer sediment or fractured rock is contaminated with NAPL, the saturation (or degree of saturation) of NAPL at a particular point is defined as the fraction of pore space occupied by NAPL within a representative elementary volume (REV) around the considered point:

$$S_N = \frac{\text{volume of NAPL within REV}}{\text{total pore volume within REV}} \qquad (1)$$

As pointed out by Corey (1994), "saturation can be conceptualized (but not measured) as a point property varying in space in a manner entirely analogous to porosity." The constraint of being unable to measure the saturation at a point arises from the size of the REV, which

Mayer and Miller (1992) found to vary directly with the nonuniformity of the porous medium such that "the upper range of these REV estimates (i.e., $\sim$10-10^4 cm^3) exceeds the scale of ... field samples typically taken to estimate NAPL residual saturation levels." It is for this reason of scale that Jin et al. (1995) have proposed using a partitioning interwell tracer test for measuring NAPL volume over a large interwell pore volume.

While soil cores cannot provide reliable NAPL saturations over large zones of the subsurface, they can provide information on the approximate volumes of NAPL present in the core samples. Furthermore, continuous coring can indicate the relative NAPL saturations with depth, which may allow an experienced observer to deduce whether pooling of NAPL may be occurring upon some capillary barrier, such as a clay lens. In addition, the analysis and interpretation of soil chemical data from cores indicate the nature of the chemical composition of the NAPL in the source zone. Finally, the chemical analysis of soil cores provides an approximate initial value of NAPL saturation which can be used in multiphase, multicomponent simulators such as UTCHEM for modeling surfactant-enhanced aquifer remediation (e.g., Brown et al. 1994) and the application of partitioning interwell tracer tests (e.g., Jin et al. 1995).

We are not aware of any published method for calculating NAPL saturation from a soil sample chemical analysis when more than one organic compound is identified in the analysis. Feenstra et al. (1991) showed how a measured organic concentration can be used to assess whether a single- or multicomponent NAPL is present in a soil sample, but not how NAPL saturation could be calculated. In addition, the method requires an a priori assumption of the NAPL chemical composition. Mott (1995) improved on the Feenstra et al. (1991) method by presenting a method that can be used to estimate multicomponent NAPL composition from a complete organic chemical soil sample analysis and to determine whether NAPL is present in the sample. The method, which is incorporated in a code called SOILCALC, distributes mass among all phases including the NAPL phase. However, because the method assumes that NAPL occupies no pore space, SOILCALC cannot be used to calculate NAPL saturation. Consequently, its calculations of NAPL composition and the concentrations of organic compounds in each phase are not accurate unless NAPL saturation is approximately two orders of magnitude lower than typical residual NAPL saturations. Typical residual NAPL saturations range from 10 percent to 20 percent in the vadose zone and from 15 percent to 50 percent in the saturated zone (Mercer and Cohen 1990).

In this paper, a model is presented for the implicit calculation of NAPL saturation, NAPL composition, and phase distribution of organic compounds in a core sample of soil or rock. This model was developed in 1993 as an extension of the model presented in Feenstra et al. (1991). In addition to the phase partitioning relationships, the model incorporates equations for the conservation of mass and volume. The algorithm distributes the organic chemicals among aqueous, air, sorbed, and NAPL phases so that both the NAPL saturation and the correct NAPL composition are determined regardless of the amount of NAPL in the sample.

Partitioning Theory

If NAPL exists in a core sample from the unsaturated zone, the NAPL components will be distributed among four physical phases: air, soil, water, and NAPL. Each NAPL component (i.e., each compound in the NAPL) is distributed among the phases according to thermodynamic equilibrium principles and mass transfer kinetic factors. The system reaches equilibrium when the chemical potential of any constituent is equal in all phases. Figure 1 shows a schematic representation of the equilibrium relationship.

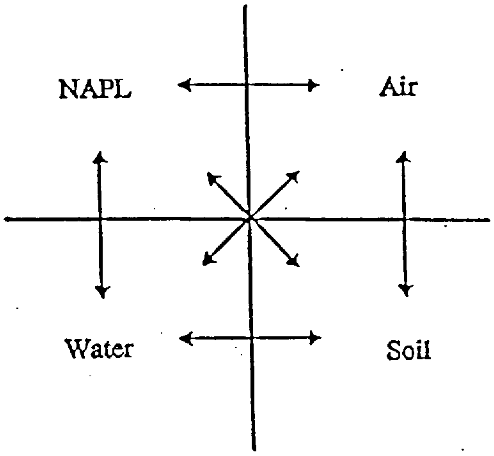

Figure 1. Schematic representation of phase equilibrium and partitioning.

To estimate the distribution of the total mass of a chemical among the phases at equilibrium, the chemical's phase partitioning behavior must be known. All nonaqueous concentrations are defined using traditional equilibrium equations that are functions of aqueous concentrations. These relationships are presented later. In each relationship, at least one chemical property of each organic compound (e.g., aqueous solubility, vapor pressure, and partition coefficient) must be known. In each case, the value of the chemical property is temperature dependent. Consequently, the values used in the model must be representative of the original soil or rock temperature. Values for these properties at specific temperatures can be found in the literature (e.g., Mercer et al. 1990) or estimated (e.g., Lyman et al. 1990; Drefahl and Reinhard 1995).

NAPL-Water Partitioning

NAPL-water partitioning depends on the aqueous solubilities of the NAPL components and the concentrations of the NAPL components in the NAPL. The relationship is analogous to Raoult's law for ideal gas mixtures. For an ideal NAPL in contact with water the aqueous phase concentration of a NAPL component is equal to the pure phase aqueous solubility of the component multiplied by the mole fraction of the component in the NAPL mixture. Mathematically, this relationship is written as:

$$C_w = x_iS_i \qquad (2)$$

where C_w^i is the aqueous phase concentration of component i (mass i in water per volume water); x_i is the mole fraction of the component in the NAPL mixture (mole i in NAPL per mole NAPL); and S_i is the aqueous solubility of pure component i (mass i in water per volume water). Feenstra et al. (1991) refers to C_w^i as the effective aqueous solubility of component i when the aqueous phase is at equilibrium with a NAPL. This general NAPL-water partitioning relationship has been confirmed by Banerjee (1984), Mackay et al. (1991), Cline et al. (1991), Lee et al. (1992a,b), and Broholm and Feenstra (1995) for NAPL mixtures of structurally similar compounds. This relationship is not highly dependent on temperature.

Air-Water Partitioning

The equilibrium concentration of component i in air is related to the aqueous concentration by Henry's law. Henry's law states that equilibrium water-air partitioning is described by a linear relationship. The relationship can be written as:

$$C_a^i = K_H^i C_w^i \qquad (3)$$

where C_a^i is the concentration of i in air (mass i in air per volume air), and K_H^i is the dimensionless Henry's constant. The Henry's constant is often reported in the literature in its dimensional form, $K_H^{i\prime}$ (e.g., atm-L/mol). The dimensional Henry's constant is calculated from the equation:

$$K_H^{i\prime} = \frac{P_{vap}^i}{S_i} MW_i \qquad (4)$$

where P_{vap}^i is the component's vapor pressure (e.g., atm), and MW_i is the component's molecular weight (mass i per mole i), which is needed to convert the previously defined mass-based aqueous solubility S_i to molar units. The two Henry's constants are related through the equation:

$$K_H^i = \frac{K_H^{i\prime}}{RT} \qquad (5)$$

where R is the universal gas constant (0.08206 atm-L/mol-K) and T is temperature in Kelvin. As the equation reveals, air-water partitioning is highly dependent on temperature.

Soil-Water Partitioning

Sorption to soil organic matter can also be described as a linear function of the aqueous organic compound concentration. The relationship can be written as:

$$C_s^i = K_{oc}^i f_{oc} C_w^i \qquad (6)$$

where C_s^i is the sorbed concentration of component i (mass i sorbed per mass soil); K_{oc}^i is the organic carbon to water partition coefficient of component i (mass i sorbed per mass organic carbon divided by mass i in water per volume water); and f_{oc} is the mass fraction of natural organic carbon within the soil matrix (mass natural organic carbon per mass soil).

The mass fraction of natural organic carbon has to be measured for the particular soil to be evaluated. Although the effect of temperature is small, the K_{oc}^i value can be highly sensitive to pH if the organic compound is ionizable (Drefahl and Reinhard 1995).

The linear isotherm model of Equation 6 has been experimentally verified for various organic compounds by Karickhoff et al. (1979), Chiou et al. (1979), Schwarzenbach and Westall (1981), and Chiou et al. (1983). It has been noted, however, that linear sorption is valid only for f_{oc} greater than about 0.001 (Schwarzenbach and Westall 1981) and greater than about 3 to 7 percent of the solid mass fraction of clay (Karickhoff 1984); otherwise, sorption of organic compounds on clays and mineral surfaces can be significant.

Conservation Equations and Relationships

Soil, water, air, and NAPL account for the total volume of a soil sample containing NAPL. The volume conservation equation is:

$$\phi_s + \phi_w + \phi_a + \phi_n = 1 \qquad (7)$$

where ϕ_s is the volumetric soil content (volume soil per total volume); ϕ_w is the volumetric water content (volume water per total volume); ϕ_a is the volumetric air content (volume air per total volume); and ϕ_n is the volumetric NAPL content (volume NAPL per total volume). The soil porosity ϕ (volume void per total volume) is equal to the sum of the volumetric air, water, and NAPL contents:

$$\phi = \phi_a + \phi_w + \phi_n \qquad (8)$$

Thus, the volumetric soil content ϕ_s equals $1 - \phi$.

Each NAPL component in a soil sample is distributed among the phases present. As a result, the total mass of component i in the sample equals the sum of the masses of component i in all phases. The mass conservation equation is:

$$\rho_t C_t^i = \phi_w C_w^i + \phi_a C_a^i + \phi_n C_n^i + \phi_s \rho_s C_s^i \qquad (9)$$

where ρ_t is the total density of the soil sample (mass of sample per volume of sample); C_t^i is the measured total concentration of i in the sample (mass i in sample per mass of sample); C_n^i is the concentration of i in the NAPL (mass i in NAPL per volume NAPL); and ρ_s is the density of the solid (approximately 2.65 kg/L for sand). The total density, ρ_t, is approximately equal to the weighted average of the densities of the four phases:

$$\rho_t = \phi_w\rho_w + \phi_a\rho_a + \phi_n\rho_n + \phi_s\rho_s \qquad (10)$$

where ρ_w is the density of water (approximately 1.0 kg/L); ρ_a is the density of air (approximately 0.0013 kg/L at 20°C); and ρ_n is the density of the NAPL mixture (mass NAPL per volume NAPL). ρ_n can be expressed as:

$$\rho_n = \Sigma C_n^i = \frac{\Sigma x_i MW_i}{\sum \frac{x_i MW_i}{\rho_i}} \qquad (11)$$

where ρ_i is the density of pure component i in liquid form (mass i per volume i). Some components, such as vinyl chloride or anthracene, may not occur as liquid in their pure form under environmental conditions. For these components, hypothetical pure phase liquid densities are computed by extrapolation.

The mole fraction of component i in the NAPL mixture is related to mass concentration by the equation:

$$x_i = \frac{C_n^i MW_n}{\rho_n MW_i} \qquad (12)$$

where MW_n is the equivalent molecular weight of the NAPL mixture (mass NAPL per mole NAPL). MW_n is approximately equal to the weighted average of the molecular weights of the NAPL components:

$$MW_n = \Sigma x_i MW_i \qquad (13)$$

Finally, the sum of the NAPL mole fractions is equal to 1:

$$\Sigma x_i = 1 \qquad (14)$$

Estimation of NAPL Saturation and Composition

A complete chemical analysis of a core sample provides the total mass of each component per unit mass of sample (i.e., the value of C_t^i for each component). To determine the saturation and composition of NAPL in the sample, the total mass of each component in each phase and the total volume of each phase must be determined. The partitioning theory and conservation relationships presented in the previous section can be used for this purpose. The solution allows calculation of the NAPL saturation from the equation:

$$S_N = \frac{\phi_n}{\phi} \qquad (15)$$

The method presented here is a numerical solution of the partitioning and conservation equations. PC software called NAPLANAL was developed to perform the numerical simulation. NAPLANAL can be used to estimate the following: (1) the NAPL saturation and composition in a soil sample containing NAPL; (2) the concentrations of organic compounds in each phase; and (3) the NAPL composition and NAPL volume in samples of NAPL-water emulsions ($\phi_s = 0$). A copy of NAPLANAL is available from the INTERA web site (http://www.intera.com) for a small fee.

The algorithm is first demonstrated by considering a hypothetical soil sample from an unsaturated formation containing NAPL with N chemical components. Calculation of NAPL saturation and composition requires the following measurements or estimates as input: total concentrations of NAPL components in the soil sample (C_t^i), volumetric water content (ϕ_w), soil porosity (ϕ), volumetric soil content ($\phi_s = 1 - \phi$), soil organic carbon content (f_{oc}), organic carbon to water partition coefficients (K_{oc}^i), Henry's law constants in dimensionless form (K_H^i), molecular weight of each component (MW_i), and densities of water, air, soil, and each NAPL component (ρ_w, ρ_a, ρ_s, and ρ_i).

Equations 2, 3, 6, and 8 through 14 provide a total of 5N+5 independent equations that describe partitioning and conservation of organic compounds in a soil sample. Given the measurements and estimates listed in the previous paragraph, there are 5N+5 unknowns. These unknowns are as follows: NAPL component concentrations in water, air, soil, and NAPL (C_w^i, C_a^i, C_s^i, and C_n^i); component mole fractions in the NAPL mixture (x_i); volumetric contents of air and NAPL (ϕ_a and ϕ_n); density of sample (ρ_t); and the equivalent density and molecular weight of the NAPL (ρ_n and MW_n).

An equal number of unknowns and independent equations guarantees a unique solution. NAPLANAL solves the system of equations and unknowns using an algorithm that combines the rapid local convergence of the Newton-Raphson method for a system of nonlinear equations with a globally convergent strategy. For the sample problems tested so far, the computation time for reaching a solution is less than one minute using a 486 DX66 PC.

For core samples from the saturated zone, the air volumetric content (ϕ_a) and air phase concentrations (C_a^i) are equal to zero. Thus, the terms and equations involving the air phase are dropped from the system of equations. As a result, the number of equations reduces to 4N+5, while the number of unknowns reduces to 4N+4. Because there are fewer unknowns than equations, a measurement for either soil porosity (ϕ) or soil volumetric water content (ϕ_w) is sufficient for estimation purposes. Users of NAPLANAL have the choice of treating either ϕ or ϕ_w as an unknown parameter. A gas chromatography method is currently being developed to allow simultaneous measurement of ϕ_w and the concentrations of organic compounds in a soil sample.

The NAPLANAL code begins with the assumption that there is no NAPL present in the sample (i.e., $\phi_n = 0$). The density of the sample can then be calculated from Equation 10 as:

$$\rho_t = \phi_w\rho_w + (\phi - \phi_w)\rho_a + (1 - \phi)\,\rho_s \qquad (16$$

The first approximation of the aqueous concentration can be calculated from Equation 9 by:

$$C_w^i = \frac{C_t^i \rho_t}{\phi_w + K_H^i(\phi - \phi_w) + f_{oc}K_{oc}^i \rho_s (1 - \phi)} \quad (17)$$

shown by Feenstra et al. (1991). If NAPL exists in the sample, then this first approximation of C_w^i should exceed the effective aqueous solubility of component i. Equations 2 and 14 imply that C_w^i equals the effective aqueous solubility when:

$$\sum \frac{C_w^i}{S_i} = 1 \quad (18)$$

Thus, a summation exceeding 1 when Equation 17 is used to estimate C_w^i implies that NAPL is present in the sample and that the NAPL saturation algorithm must be used instead to estimate C_w^i. A summation in Equation 18 equal to or less than one indicates there is no NAPL in the sample (i.e., S_N and ϕ_n equal zero). In this case, Equation 17 provides valid explicit estimates of aqueous concentrations. Air and sorbed concentrations are then calculated directly from Equations 3 and 6. When the summation in Equation 18 is less than 1, C_w^i is less than the effective aqueous solubility and calculation of x_i from Equation 2 is invalid.

Petroleum Hydrocarbon Example

In this example, the petroleum hydrocarbon data from Mott (1995) are used to compare the results of NAPLANAL and SOILCALC. The example problems consider hypothetical soil samples contaminated with C6 through C9 n-aliphatic hydrocarbons. For direct comparison of NAPLANAL and SOILCALC results, the input data are identical. The physical and chemical properties of the soil samples and the petroleum hydrocarbons used in the calculations are summarized in Table 1.

Table 1
Chemical Property Data Used in the Examples by Mott (1995)

Component i	K_{oc}^i (mL/g)	K_H^i	S_i (mg/L)	ρ_i (kg/L)	MW_i (g/mol)
Hexane	6025.60	46.49	12.31	0.66	86.07
Heptane	22908.68	63.59	3.06	0.68	100.20
Octane	77624.71	95.74	0.68	0.70	114.22
Nonane	263026.8	45.80	0.47	0.72	128.26
	f_{oc}		ϕ_w		ϕ
Soil Sample Data	0.01		0.08		0.4

The three soil samples differ only in the total hydrocarbon component concentration. These data are shown in Table 2. The first data set represents a soil sample containing 250 mg/kg of each component. The second data set, which is a borderline case (NAPL may or may not be present based on SOILCALC results), represents a soil sample containing 192 mg/kg each component. The third data set, which is a no NAPL case, represents a soil sample containing 100 mg/kg each component. Results from SOILCALC and NAPLANAL are summarized in Table 2. SOILCALC results are in parentheses.

SOILCALC assumes that NAPL occupies zero void space (i.e., the NAPL saturation is assumed insignificant relative to water and air content). Because of this assumption, SOILCALC does not have NAPL saturation estimation capability. In contrast, NAPLANAL implicitly calculates NAPL saturation. For the first two sets of data, the results indicate NAPL saturations of 0.15 percent and 0.02 percent, respectively. At such low NAPL saturations (i.e., approximately 1 percent or less of typical residual NAPL saturations [Mercer and Cohen 1990]), the pore space occupied by NAPL is indeed insignificant relative to pore space occupied by water and air. As a result, the two models give similar results, as shown in Table 2. However, there are still differences in the component mass distributions, especially for the mass of components in the NAPL phase. Because NAPLANAL calculates NAPL saturation, it should provide more accurate results than SOILCALC, especially at higher NAPL saturations.

Field DNAPL Examples

NAPLANAL was used to calculate the saturations and compositions of DNAPL and the phase distributions of DNAPL components in several core samples collected from a chemical plant on the Gulf Coast. DNAPL is NAPL that is denser than water. The plant has manufactured a variety of chlorinated ethanes and ethenes, such as 1,2-dichloroethane (EDC), trichloroethene (TCE), tetrachlorothene (PCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1,2-trichloroethane (1,1,2-TCA),

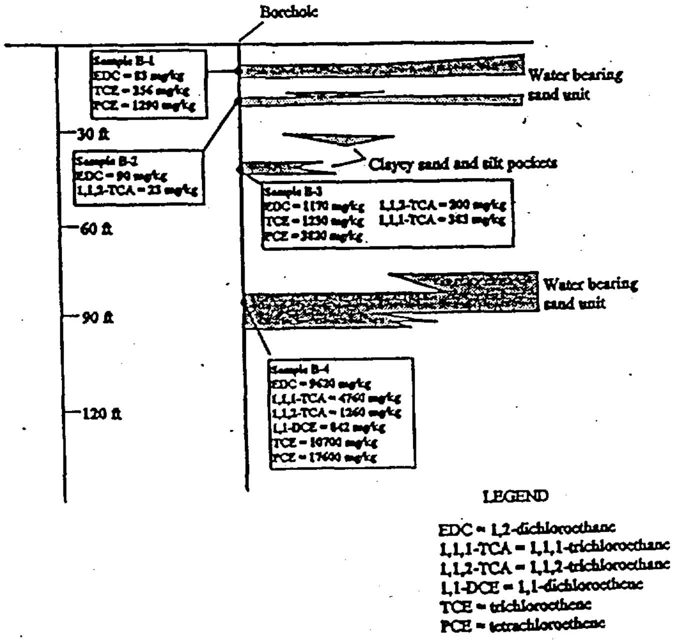

Figure 2. Cross-sectional view of soil sample location and total soil concentration.

Table 2

Comparison of NAPLANAL and SOILCALC Results

SOILCALC Results Are in Parentheses (Mott 1995). Concentrations Are Normalized by Total Sample Mass. For Comparison Purposes, Calculations Are Not Rounded to Reflect Significant Figures.

Component i	Measured Sample Conc. C_t^i (mg/kg)	Sample Conc. in Aq. Phase $C_w^i \phi_w \rho_t^{-1}$ (mg/kg)	Sample Conc. in Air Phase $C_a^i \phi_a \rho_t^{-1}$ (mg/kg)	Sample Conc. Sorbed $C_s^i \phi_s \rho_s \rho_t^{-1}$ (mg/kg)	Sample Conc. in NAPL $C_n^i \phi_n \rho_t^{-1}$ (mg/kg)	Mole Fraction in NAPL x_i
Data Set #1						
Hexane	250	1.467E-01 (1.493E-01)	2.680E+01 (2.795E+01)	1.735E+02 (1.800E+02)	4.953E+01 (4.193E+01)	0.2460 (0.2429)
Heptane	250	3.949E-02 (4.062E-02)	9.871E+00 (1.040E+01)	1.776E+02 (1.861E+02)	6.251E+01 (5.347E+01)	0.2667 (0.2663)
Octane	250	1.055E-02 (1.104E-02)	3.970E+00 (4.258E+00)	1.607E+02 (1.715E+02)	8.530E+01 (7.427E+01)	0.3193 (0.3245)
Nonane	250	3.852E-03 (3.926E-03)	6.936E-01 (6.710E-01)	1.989E+02 (2.065E+02)	5.040E+01 (4.272E+01)	0.1680 (0.1663)
NAPL saturation = 0.15%					$\sum x_i$ =	1.0000 (1.0000)
Data Set #2						
Hexane	192	1.366E-01 (1.378E-01)	2.499E+01 (2.580E+01)	1.615E+02 (1.661E+02)	5.322E+00 (1.060E-02)	0.2290 (0.2241)
Heptane	192	3.894E-02 (3.968E-02)	9.749E+00 (1.016E+01)	1.751E+02 (1.818E+02)	7.114E+00 (1.445E-02)	0.2629 (0.2602)
Octane	192	1.160E-02 (1.207E-02)	4.374E+00 (4.653E+00)	1.768E+02 (1.873E+02)	1.083E+01 (2.224E-02)	0.3511 (0.3546)
Nonane	192	3.601E-03 (3.637E-03)	6.493E-01 (6.710E-01)	1.859E+02 (1.913E+02)	5.438E+00 (1.087E-02)	0.1570 (0.1540)
NAPL saturation = 0.02%					$\sum x_i$ =	1.0000 (0.9929)
Data Set #3						
Hexane	100	7.316E-02 (7.177E-02)	1.339E+01 (1.344E+01)	8.654E+01 (8.648E+01)	(6.720E-15)	(0.1167)
Heptane	100	2.106E-02 (2.067E-02)	5.274E+00 (5.293E+00)	9.471E+01 (9.469E+01)	(8.132E-15)	(0.1355)
Octane	100	6.404E-03 (6.285E-03)	2.415E+00 (2.423E+00)	9.758E+01 (9.757E+01)	(1.364E-15)	(0.1847)
Nonane	100	1.930E-03 (1.894E-03)	3.481E-01 (3.495E-01)	9.965E+01 (9.965E+01)	(7.434E-15)	(0.0802)
No NAPL					$\sum x_i$ =	(0.5171)

1,1-dichloroethane (1,1-DCA), and 1,1-dichloroethene (1,1-DCE). Spillage, waste-disposal operations, and pipeline leakage of these solvents have resulted in ground water contamination at the site. Previous investigations at the site have revealed silty water-bearing sand units separated by fractured clay units. In some areas, the clays are discontinuous and have allowed DNAPL to migrate to a sand unit 80 feet beneath the ground surface. Pumping tests have confirmed hydraulic communication between the sand units.

Total soil chemical concentrations in four core samples from a single borehole were measured to evaluate the suitability of the site for a pilot-scale test of surfactant-enhanced aquifer remediation. The saturation and composition of the DNAPL mixture are important parameters in the decision-making process. The locations of the core samples and the analyzed soil chemical concentrations are shown in Figure 2. The samples are as follows: B-1, located in a sand unit at about 10 feet below ground surface (bgs); B-2, located in a sand unit at about 20 feet bgs; B-3, located in a unit of clayey sand with silt pockets at about 43 feet bgs; and B-4, located in a sand unit at about 80 feet bgs. The volumetric water contents of the core samples were not measured. The porosity and fraction organic carbon content of the sands were assumed

Table 3

Chemical Property Data Used in the Analysis of the Soil Samples

Component i	K_{oc}^i (mL/g)	K_H^i	S_i (mg/L)	ρ_i (kg/L)	MW_i (g/mol)
1,1-dichloroethene	65	0.87	400	1.22	97
1,2-dichloroethane	14	0.038	8690	1.26	99
1,1,1-trichloroethane	152	0.54	720	1.35	133.4
1,1,2-trichloroethane	56	0.031	4500	1.44	133.4
trichloroethene	126	0.3	1100	1.47	131.5
tetrachloroethene	364	0.54	200	1.63	165.8

Table 4
NAPLANAL Calculations from Soil Sample Analyses
Concentrations Are Normalized by Total Sample Mass. Results Are Rounded to Two Significant Figures.

Component i	Measured Sample Conc. C_t^i (mg/kg)	Sample Conc. In Aq. Phase $C_w^i \phi_w \rho_t^{-1}$ (mg/kg)	Sample Conc. Sorbed $C_s^i \phi_s \rho_s \rho_t^{-1}$ (mg/kg)	Sample Conc. In NAPL $C_n^i \phi_n \rho_t^{-1}$ (mg/kg)	Mole Fraction In NAPL x_i
Sample B-1					
1,2-dichloroethane	83	50	0.74	32	0.032
trichloroethene	356	46	6.4	300	0.23
tetrachloroethene	1290	27	11	1300	0.74
NAPL saturation = 0.54%					
Sample B-2					
1,2-dichloroethane	90	89	1.7		
1,1,2-trichloroethane	23	22	1.4		
No NAPL					
Sample B-3					
1,2-dichloroethane	1170	300	4.8	860	0.19
1,1,1-trichloroethane	383	8.2	1.4	370	0.063
1,1,2-trichloroethane	200	24	1.5	170	0.029
trichloroethene	1230	40	5.7	1200	0.20
tetrachloroethene	3820	18	7.6	3800	0.51
NAPL saturation = 2.3%					
Sample B-4					
1,2-dichloroethane	9620	370	6.8	9200	0.28
1,1,1-trichloroethane	4760	12	2.3	4700	0.11
1,1,2-trichloroethane	1260	19	1.4	1200	0.028
1,1-dichloroethene	842	1.6	0.14	840	0.026
trichloroethene	10700	40	6.8	11000	0.24
tetrachloroethene	17600	9.6	4.6	18000	0.32
NAPL saturation = 17%					

to be 0.375 and 0.0015, respectively. These values are equivalent to average values measured by Liljestrand and Charbeneau (1987) in similar shallow sands in the area. Table 3 lists the physical properties attributed to the chlorinated solvents in the core samples.

According to the results of the NAPLANAL calculations, presented in Table 4, only a small amount of DNAPL is present in sample B-1. The ground water in B-2 appears to contain no DNAPL. Samples B-3 and B-4 have calculated NAPL saturations of about 2.3 percent and 17 percent, respectively. The computed NAPL composition in each of these core samples is different. Although PCE appears to be the predominant NAPL component in all samples containing NAPL, the mole fraction of PCE decreases with depth while the TCE and EDC mole fractions increase. This trend suggests historical variations in the composition of infiltrating DNAPL and/or different locations of DNAPL releases having different DNAPL compositions.

In the aforementioned calculations, soil porosity was estimated. Neither porosities nor water contents had been measured for these samples. A graph relating the porosity to the calculated NAPL saturation and compo- tion for samples B-3 and B-4 is shown in Figure 3. Samples B-3 and B-4 represent soil samples having relatively low and high NAPL saturations, respectively. The graph shows that the uncertainty of the porosity value on the calculations of NAPL saturation and composition is small considering the relatively small possible range of soil porosity in sandy sediments.

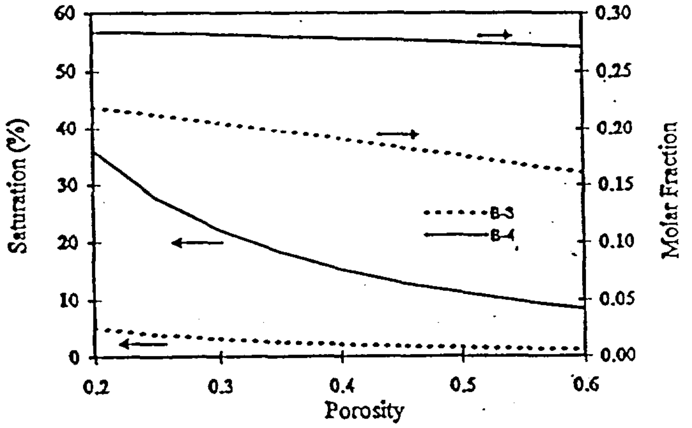

Figure 3. Effect of porosity on NAPL saturation and composition estimation results.

Conclusions

The NAPL saturation algorithm presented in this paper provides a useful tool to investigators involved in site characterization studies at NAPL-contaminated sites. This algorithm allows the quantification of NAPL saturation and NAPL composition in a soil sample from a typical soil chemical analysis. This information is useful in modeling and designing site-specific surfactant-enhanced aquifer remediation strategies (e.g., Brown et al. 1994) and partitioning interwell tracer tests (e.g., Jin et al. 1995). The calculations require only the soil information typically gathered in ground water contamination studies, specifically total chemical concentrations, water moisture content, porosity, natural organic content, and specific physical and chemical properties of the contaminants. A PC software program, NAPLANAL, was developed to perform these calculations.

The accuracy of the calculations depends on the accuracy of the input data. A sample's chemical analysis can be compromised by improper sampling and preservation, failure to identify and quantify all organic contaminants, and incomplete extraction of contaminants. In addition, the values of the physical properties of the soil sample and the chemical properties of the NAPL components affect the results. Thus, sensitivity analyses, such as the example shown for porosity, are strongly encouraged. Such sensitivity analyses can be performed easily using NAPLANAL.

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Biographical Sketches

***Paul Mariner** is a senior hydrogeochemist of the Chemical Hydrogeology Group of INTERA Inc. (9111 Research Blvd., Austin, TX 78759). He has an M.S. in hydrology from the University of Arizona and a B.A. in environmental science from the University of Virginia. His e-mail address is pemarine@dpcmail.dukepower.com.*

***Minquan Jin** is a geosystems engineer of the Chemical Hydrogeology Group of INTERA Inc. (9111 Research Blvd., Austin, TX 78759). He has an M.S. and Ph.D. in petroleum and geosystems engineering from the University of Texas. His e-mail address is mjin@dpcmail.dukepower.com.*

***Dick Jackson** is manager of the Chemical Hydrogeology Group of INTERA Inc. (9111 Research Blvd., Austin, T 78759). He is registered as a professional hydrologist (grou water) by the American Institute of Hydrology and has a Ph.D. in hydrogeology from the University of Waterloo. His e-mail address is rejackso@dpcmail.dukepower.com.*

APPENDIX H

Laboratory Results of Soil Core VOC Analyses

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID:H7G290134 001

Sample WT/Vol: 5 / mL
Work Order: CAXWL202
Dilution factor: 170
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/01/97

QC Batch: 7213114

Client Sample Id: IS01-1 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	850	U
108-86-1	Bromobenzene	850	U
74-97-5	Bromochloromethane	850	U
75-27-4	Bromodichloromethane	850	U
75-25-2	Bromoform	850	U
74-83-9	Bromomethane	1700	U
104-51-8	**n-Butylbenzene**	**240**	**J**
135-98-8	sec-Butylbenzene	850	U
98-06-6	tert-Butylbenzene	850	U
56-23-5	Carbon tetrachloride	850	U
108-90-7	Chlorobenzene	850	U
124-48-1	Chlorodibromomethane	850	U
75-00-3	Chloroethane	1700	U
67-66-3	Chloroform	850	U
74-87-3	Chloromethane	1700	U
95-49-8	2-Chlorotoluene	850	U
106-43-4	4-Chlorotoluene	850	U
96-12-8	1,2-Dibromo-3-chloropropane	1700	U
106-93-4	1,2-Dibromoethane	850	U
74-95-3	Dibromomethane	850	U
95-50-1	1,2-Dichlorobenzene	850	U
541-73-1	1,3-Dichlorobenzene	850	U
106-46-7	1,4-Dichlorobenzene	850	U
75-71-8	Dichlorodifluoromethane	1700	U
75-34-3	1,1-Dichloroethane	850	U
107-06-2	1,2-Dichloroethane	850	U
75-35-4	1,1-Dichloroethene	850	U
156-59-2	**cis-1,2-Dichloroethene**	**12000**	
156-60-5	trans-1,2-Dichloroethene	420	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7G290134 001
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXWL202
Dilution factor: 170
Moisture %:
Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/01/97

QC Batch: 7213114

Client Sample Id: IS01-1 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	850	U
142-28-9	1,3-Dichloropropane	850	U
594-20-7	2,2-Dichloropropane	850	U
563-58-6	1,1-Dichloropropene	850	U
100-41-4	Ethylbenzene	850	U
87-68-3	Hexachlorobutadiene	850	U
98-82-8	Isopropylbenzene	850	U
99-87-6	p-Isopropyltoluene	850	U
75-09-2	Methylene chloride	850	U
91-20-3	Naphthalene	850	U
103-65-1	n-Propylbenzene	850	U
100-42-5	Styrene	850	U
630-20-6	1,1,1,2-Tetrachloroethane	850	U
79-34-5	1,1,2,2-Tetrachloroethane	850	U
127-18-4	Tetrachloroethene	850	U
108-88-3	Toluene	850	U
87-61-6	1,2,3-Trichlorobenzene	850	U
120-82-1	1,2,4-Trichlorobenzene	850	U
71-55-6	1,1,1-Trichloroethane	850	U
79-00-5	1,1,2-Trichloroethane	850	U
79-01-6	Trichloroethene	850	U
75-69-4	Trichlorofluoromethane	1700	U
96-18-4	1,2,3-Trichloropropane	850	U
95-63-6	**1,2,4-Trimethylbenzene**	**1800**	
108-67-8	**1,3,5-Trimethylbenzene**	**890**	
75-01-4	**Vinyl chloride**	**1800**	
95-47-6	o-Xylene	420	U
136777-61-2	m-Xylene & p-Xylene	420	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 002

Sample WT/Vol: 5 / mL

Work Order: CAXWR202

Dilution factor: 210

Moisture %:

Date Received: 07/29/97

Date Extracted:08/01/97

Date Analyzed: 08/01/97

QC Batch: 7213114

Client Sample Id: IS01-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	1000	U
108-86-1	Bromobenzene	1000	U
74-97-5	Bromochloromethane	1000	U
75-27-4	Bromodichloromethane	1000	U
75-25-2	Bromoform	1000	U
74-83-9	Bromomethane	2100	U
104-51-8	**n-Butylbenzene**	**670**	**J**
135-98-8	**sec-Butylbenzene**	**550**	**J**
98-06-6	tert-Butylbenzene	1000	U
56-23-5	Carbon tetrachloride	1000	U
108-90-7	Chlorobenzene	1000	U
124-48-1	Chlorodibromomethane	1000	U
75-00-3	Chloroethane	2100	U
67-66-3	Chloroform	1000	U
74-87-3	Chloromethane	2100	U
95-49-8	2-Chlorotoluene	1000	U
106-43-4	4-Chlorotoluene	1000	U
96-12-8	1,2-Dibromo-3-chloropropane	2100	U
106-93-4	1,2-Dibromoethane	1000	U
74-95-3	Dibromomethane	1000	U
95-50-1	1,2-Dichlorobenzene	1000	U
541-73-1	1,3-Dichlorobenzene	1000	U
106-46-7	1,4-Dichlorobenzene	1000	U
75-71-8	Dichlorodifluoromethane	2100	U
75-34-3	1,1-Dichloroethane	1000	U
107-06-2	1,2-Dichloroethane	1000	U
75-35-4	1,1-Dichloroethene	1000	U
156-59-2	**cis-1,2-Dichloroethene**	**22000**	
156-60-5	trans-1,2-Dichloroethene	520	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 002

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXWR202
Dilution factor: 210
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/01/97

QC Batch: 7213114

Client Sample Id: IS01-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	1000	U
142-28-9	1,3-Dichloropropane	1000	U
594-20-7	2,2-Dichloropropane	1000	U
563-58-6	1,1-Dichloropropene	1000	U
100-41-4	Ethylbenzene	1000	U
87-68-3	Hexachlorobutadiene	1000	U
98-82-8	Isopropylbenzene	1000	U
99-87-6	**p-Isopropyltoluene**	**600**	J
75-09-2	Methylene chloride	1000	U
91-20-3	**Naphthalene**	**410**	J
103-65-1	**n-Propylbenzene**	**990**	J
100-42-5	Styrene	1000	U
630-20-6	1,1,1,2-Tetrachloroethane	1000	U
79-34-5	1,1,2,2-Tetrachloroethane	1000	U
127-18-4	**Tetrachloroethene**	**37000**	
108-88-3	Toluene	1000	U
87-61-6	1,2,3-Trichlorobenzene	1000	U
120-82-1	1,2,4-Trichlorobenzene	1000	U
71-55-6	1,1,1-Trichloroethane	1000	U
79-00-5	1,1,2-Trichloroethane	1000	U
79-01-6	**Trichloroethene**	**3500**	
75-69-4	Trichlorofluoromethane	2100	U
96-18-4	1,2,3-Trichloropropane	1000	U
95-63-6	**1,2,4-Trimethylbenzene**	**9600**	
108-67-8	**1,3,5-Trimethylbenzene**	**4300**	
75-01-4	Vinyl chloride	2100	U
95-47-6	**o-Xylene**	**460**	J
136777-61-2	m-Xylene & p-Xylene	520	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 003

Sample WT/Vol: 5 / mL

Work Order: CAXWT202

Dilution factor: 550

Moisture %:

Date Received: 07/29/97

Date Extracted:08/01/97

Date Analyzed: 08/01/97

QC Batch: 7213114

Client Sample Id: IS01-3 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	2800	U
108-86-1	Bromobenzene	2800	U
74-97-5	Bromochloromethane	2800	U
75-27-4	Bromodichloromethane	2800	U
75-25-2	Bromoform	2800	U
74-83-9	Bromomethane	5500	U
104-51-8	n-Butylbenzene	2800	U
135-98-8	**sec-Butylbenzene**	**2700**	J
98-06-6	tert-Butylbenzene	2800	U
56-23-5	Carbon tetrachloride	2800	U
108-90-7	Chlorobenzene	2800	U
124-48-1	Chlorodibromomethane	2800	U
75-00-3	Chloroethane	5500	U
67-66-3	Chloroform	2800	U
74-87-3	Chloromethane	5500	U
95-49-8	2-Chlorotoluene	2800	U
106-43-4	4-Chlorotoluene	2800	U
96-12-8	1,2-Dibromo-3-chloropropane	5500	U
106-93-4	1,2-Dibromoethane	2800	U
74-95-3	Dibromomethane	2800	U
95-50-1	1,2-Dichlorobenzene	2800	U
541-73-1	1,3-Dichlorobenzene	2800	U
106-46-7	1,4-Dichlorobenzene	2800	U
75-71-8	Dichlorodifluoromethane	5500	U
75-34-3	1,1-Dichloroethane	2800	U
107-06-2	1,2-Dichloroethane	2800	U
75-35-4	1,1-Dichloroethene	2800	U
156-59-2	**cis-1,2-Dichloroethene**	**31000**	
156-60-5	trans-1,2-Dichloroethene	1400	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 003

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXWT202
Dilution factor: 550
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/01/97

QC Batch: 7213114

Client Sample Id: IS01-3 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	2800	U
142-28-9	1,3-Dichloropropane	2800	U
594-20-7	2,2-Dichloropropane	2800	U
563-58-6	1,1-Dichloropropene	2800	U
100-41-4	Ethylbenzene	2800	U
87-68-3	Hexachlorobutadiene	2800	U
98-82-8	**Isopropylbenzene**	**1200**	J
99-87-6	**p-Isopropyltoluene**	**2500**	J
75-09-2	Methylene chloride	2800	U
91-20-3	**Naphthalene**	**1100**	J
103-65-1	**n-Propylbenzene**	**4100**	
100-42-5	Styrene	2800	U
630-20-6	1,1,1,2-Tetrachloroethane	2800	U
79-34-5	1,1,2,2-Tetrachloroethane	2800	U
127-18-4	**Tetrachloroethene**	**63000**	
108-88-3	Toluene	2800	U
87-61-6	1,2,3-Trichlorobenzene	2800	U
120-82-1	1,2,4-Trichlorobenzene	2800	U
71-55-6	1,1,1-Trichloroethane	2800	U
79-00-5	1,1,2-Trichloroethane	2800	U
79-01-6	**Trichloroethene**	**24000**	
75-69-4	Trichlorofluoromethane	5500	U
96-18-4	1,2,3-Trichloropropane	2800	U
95-63-6	**1,2,4-Trimethylbenzene**	**30000**	
108-67-8	**1,3,5-Trimethylbenzene**	**14000**	
75-01-4	Vinyl chloride	5500	U
95-47-6	o-Xylene	1400	U
136777-61-2	m-Xylene & p-Xylene	1400	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 004

Sample WT/Vol: 5 / mL
Work Order: CAXWV302
Dilution factor: 670
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS01-4 -RE 2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	3400	U
108-86-1	Bromobenzene	3400	U
74-97-5	Bromochloromethane	3400	U
75-27-4	Bromodichloromethane	3400	U
75-25-2	Bromoform	3400	U
74-83-9	Bromomethane	6700	U
104-51-8	**n-Butylbenzene**	**950**	**J**
135-98-8	**sec-Butylbenzene**	**860**	**J**
98-06-6	tert-Butylbenzene	3400	U
56-23-5	Carbon tetrachloride	3400	U
108-90-7	Chlorobenzene	3400	U
124-48-1	Chlorodibromomethane	3400	U
75-00-3	Chloroethane	6700	U
67-66-3	Chloroform	3400	U
74-87-3	Chloromethane	6700	U
95-49-8	2-Chlorotoluene	3400	U
106-43-4	4-Chlorotoluene	3400	U
96-12-8	1,2-Dibromo-3-chloropropane	6700	U
106-93-4	1,2-Dibromoethane	3400	U
74-95-3	Dibromomethane	3400	U
95-50-1	1,2-Dichlorobenzene	3400	U
541-73-1	1,3-Dichlorobenzene	3400	U
106-46-7	1,4-Dichlorobenzene	3400	U
75-71-8	Dichlorodifluoromethane	6700	U
75-34-3	1,1-Dichloroethane	3400	U
107-06-2	1,2-Dichloroethane	3400	U
75-35-4	1,1-Dichloroethene	3400	U
156-59-2	**cis-1,2-Dichloroethene**	**20000**	
156-60-5	trans-1,2-Dichloroethene	1700	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 004

Sample WT/Vol: 5 / mL

Work Order: CAXWV302

Dilution factor: 670

Moisture %:

Date Received: 07/29/97

Date Extracted:08/03/97

Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS01-4 -RE 2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	3400	U
142-28-9	1,3-Dichloropropane	3400	U
594-20-7	2,2-Dichloropropane	3400	U
563-58-6	1,1-Dichloropropene	3400	U
100-41-4	Ethylbenzene	3400	U
87-68-3	Hexachlorobutadiene	3400	U
98-82-8	Isopropylbenzene	3400	U
99-87-6	**p-Isopropyltoluene**	**850**	**J**
75-09-2	Methylene chloride	3400	U
91-20-3	Naphthalene	3400	U
103-65-1	**n-Propylbenzene**	**1100**	**J**
100-42-5	Styrene	3400	U
630-20-6	1,1,1,2-Tetrachloroethane	3400	U
79-34-5	1,1,2,2-Tetrachloroethane	3400	U
127-18-4	**Tetrachloroethene**	**65000**	
108-88-3	Toluene	3400	U
87-61-6	1,2,3-Trichlorobenzene	3400	U
120-82-1	1,2,4-Trichlorobenzene	3400	U
71-55-6	1,1,1-Trichloroethane	3400	U
79-00-5	1,1,2-Trichloroethane	3400	U
79-01-6	**Trichloroethene**	**4800**	
75-69-4	Trichlorofluoromethane	6700	U
96-18-4	1,2,3-Trichloropropane	3400	U
95-63-6	**1,2,4-Trimethylbenzene**	**10000**	
108-67-8	**1,3,5-Trimethylbenzene**	**5000**	
75-01-4	Vinyl chloride	6700	U
95-47-6	o-Xylene	1700	U
136777-61-2	m-Xylene & p-Xylene	1700	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 005

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXWX202
Dilution factor: 46
Moisture %:

Date Received: 07/29/97
Date Extracted:08/02/97
Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS02-1 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	230	U
108-86-1	Bromobenzene	230	U
74-97-5	Bromochloromethane	230	U
75-27-4	Bromodichloromethane	230	U
75-25-2	Bromoform	230	U
74-83-9	Bromomethane	460	U
104-51-8	**n-Butylbenzene**	**320**	
135-98-8	**sec-Butylbenzene**	**240**	
98-06-6	**tert-Butylbenzene**	**69**	**J**
56-23-5	Carbon tetrachloride	230	U
108-90-7	Chlorobenzene	230	U
124-48-1	Chlorodibromomethane	230	U
75-00-3	Chloroethane	460	U
67-66-3	Chloroform	230	U
74-87-3	Chloromethane	460	U
95-49-8	2-Chlorotoluene	230	U
106-43-4	4-Chlorotoluene	230	U
96-12-8	1,2-Dibromo-3-chloropropane	460	U
106-93-4	1,2-Dibromoethane	230	U
74-95-3	Dibromomethane	230	U
95-50-1	1,2-Dichlorobenzene	230	U
541-73-1	1,3-Dichlorobenzene	230	U
106-46-7	1,4-Dichlorobenzene	230	U
75-71-8	Dichlorodifluoromethane	460	U
75-34-3	1,1-Dichloroethane	230	U
107-06-2	1,2-Dichloroethane	230	U
75-35-4	1,1-Dichloroethene	230	U
156-59-2	**cis-1,2-Dichloroethene**	**8100**	
156-60-5	trans-1,2-Dichloroethene	120	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 005

Sample WT/Vol: 5 / mL
Work Order: CAXWX202
Dilution factor: 46
Moisture %:

Date Received: 07/29/97
Date Extracted:08/02/97
Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS02-1 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	230	U
142-28-9	1,3-Dichloropropane	230	U
594-20-7	2,2-Dichloropropane	230	U
563-58-6	1,1-Dichloropropene	230	U
100-41-4	Ethylbenzene	230	U
87-68-3	Hexachlorobutadiene	230	U
98-82-8	**Isopropylbenzene**	**120**	**J**
99-87-6	**p-Isopropyltoluene**	**290**	
75-09-2	Methylene chloride	230	U
91-20-3	Naphthalene	230	U
103-65-1	**n-Propylbenzene**	**330**	
100-42-5	Styrene	230	U
630-20-6	1,1,1,2-Tetrachloroethane	230	U
79-34-5	1,1,2,2-Tetrachloroethane	230	U
127-18-4	**Tetrachloroethene**	**7000**	
108-88-3	Toluene	230	U
87-61-6	1,2,3-Trichlorobenzene	230	U
120-82-1	1,2,4-Trichlorobenzene	230	U
71-55-6	1,1,1-Trichloroethane	230	U
79-00-5	1,1,2-Trichloroethane	230	U
79-01-6	**Trichloroethene**	**1100**	
75-69-4	Trichlorofluoromethane	460	U
96-18-4	1,2,3-Trichloropropane	230	U
95-63-6	**1,2,4-Trimethylbenzene**	**3900**	
108-67-8	**1,3,5-Trimethylbenzene**	**1900**	
75-01-4	**Vinyl chloride**	**330**	**J**
95-47-6	**o-Xylene**	**180**	
136777-61-2	**m-Xylene & p-Xylene**	**190**	

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 006

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXX0202
Dilution factor: 225
Moisture %:

Date Received: 07/29/97
Date Extracted:08/02/97
Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS02-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	1100	U
108-86-1	Bromobenzene	1100	U
74-97-5	Bromochloromethane	1100	U
75-27-4	Bromodichloromethane	1100	U
75-25-2	Bromoform	1100	U
74-83-9	Bromomethane	2200	U
104-51-8	**n-Butylbenzene**	**610**	J
135-98-8	**sec-Butylbenzene**	**460**	J
98-06-6	tert-Butylbenzene	1100	U
56-23-5	Carbon tetrachloride	1100	U
108-90-7	Chlorobenzene	1100	U
124-48-1	Chlorodibromomethane	1100	U
75-00-3	Chloroethane	2200	U
67-66-3	Chloroform	1100	U
74-87-3	Chloromethane	2200	U
95-49-8	2-Chlorotoluene	1100	U
106-43-4	4-Chlorotoluene	1100	U
96-12-8	1,2-Dibromo-3-chloropropane	2200	U
106-93-4	1,2-Dibromoethane	1100	U
74-95-3	Dibromomethane	1100	U
95-50-1	1,2-Dichlorobenzene	1100	U
541-73-1	1,3-Dichlorobenzene	1100	U
106-46-7	1,4-Dichlorobenzene	1100	U
75-71-8	Dichlorodifluoromethane	2200	U
75-34-3	1,1-Dichloroethane	1100	U
107-06-2	1,2-Dichloroethane	1100	U
75-35-4	1,1-Dichloroethene	1100	U
156-59-2	**cis-1,2-Dichloroethene**	**17000**	
156-60-5	trans-1,2-Dichloroethene	560	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 006

Sample WT/Vol: 5 / mL

Work Order: CAXX0202

Dilution factor: 225

Moisture %:

Date Received: 07/29/97

Date Extracted:08/02/97

Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS02-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	1100	U
142-28-9	1,3-Dichloropropane	1100	U
594-20-7	2,2-Dichloropropane	1100	U
563-58-6	1,1-Dichloropropene	1100	U
100-41-4	Ethylbenzene	1100	U
87-68-3	Hexachlorobutadiene	1100	U
98-82-8	Isopropylbenzene	1100	U
99-87-6	**p-Isopropyltoluene**	**470**	J
75-09-2	Methylene chloride	1100	U
91-20-3	Naphthalene	1100	U
103-65-1	**n-Propylbenzene**	**810**	J
100-42-5	Styrene	1100	U
630-20-6	1,1,1,2-Tetrachloroethane	1100	U
79-34-5	1,1,2,2-Tetrachloroethane	1100	U
127-18-4	**Tetrachloroethene**	**8900**	
108-88-3	Toluene	1100	U
87-61-6	1,2,3-Trichlorobenzene	1100	U
120-82-1	1,2,4-Trichlorobenzene	1100	U
71-55-6	1,1,1-Trichloroethane	1100	U
79-00-5	1,1,2-Trichloroethane	1100	U
79-01-6	**Trichloroethene**	**1600**	
75-69-4	Trichlorofluoromethane	2200	U
96-18-4	1,2,3-Trichloropropane	1100	U
95-63-6	**1,2,4-Trimethylbenzene**	**7900**	
108-67-8	**1,3,5-Trimethylbenzene**	**3600**	
75-01-4	Vinyl chloride	2200	U
95-47-6	**o-Xylene**	**330**	J
136777-61-2	m-Xylene & p-Xylene	560	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 007

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXX1202
Dilution factor: 370
Moisture %:

Date Received: 07/29/97
Date Extracted:08/02/97
Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS02-3 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	1800	U
108-86-1	Bromobenzene	1800	U
74-97-5	Bromochloromethane	1800	U
75-27-4	Bromodichloromethane	1800	U
75-25-2	Bromoform	1800	U
74-83-9	Bromomethane	3700	U
104-51-8	**n-Butylbenzene**	**2400**	
135-98-8	**sec-Butylbenzene**	**2100**	
98-06-6	tert-Butylbenzene	1800	U
56-23-5	Carbon tetrachloride	1800	U
108-90-7	Chlorobenzene	1800	U
124-48-1	Chlorodibromomethane	1800	U
75-00-3	Chloroethane	3700	U
67-66-3	Chloroform	1800	U
74-87-3	Chloromethane	3700	U
95-49-8	2-Chlorotoluene	1800	U
106-43-4	4-Chlorotoluene	1800	U
96-12-8	1,2-Dibromo-3-chloropropane	3700	U
106-93-4	1,2-Dibromoethane	1800	U
74-95-3	Dibromomethane	1800	U
95-50-1	1,2-Dichlorobenzene	1800	U
541-73-1	1,3-Dichlorobenzene	1800	U
106-46-7	1,4-Dichlorobenzene	1800	U
75-71-8	Dichlorodifluoromethane	3700	U
75-34-3	1,1-Dichloroethane	1800	U
107-06-2	1,2-Dichloroethane	1800	U
75-35-4	1,1-Dichloroethene	1800	U
156-59-2	**cis-1,2-Dichloroethene**	**32000**	
156-60-5	trans-1,2-Dichloroethene	920	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 007

Sample WT/Vol: 5 / mL
Work Order: CAXX1202
Dilution factor: 370
Moisture %:

Date Received: 07/29/97
Date Extracted:08/02/97
Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS02-3 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	1800	U
142-28-9	1,3-Dichloropropane	1800	U
594-20-7	2,2-Dichloropropane	1800	U
563-58-6	1,1-Dichloropropene	1800	U
100-41-4	Ethylbenzene	1800	U
87-68-3	Hexachlorobutadiene	1800	U
98-82-8	**Isopropylbenzene**	**1100**	**J**
99-87-6	**p-Isopropyltoluene**	**2100**	
75-09-2	Methylene chloride	1800	U
91-20-3	Naphthalene	1800	U
103-65-1	**n-Propylbenzene**	**3200**	
100-42-5	Styrene	1800	U
630-20-6	1,1,1,2-Tetrachloroethane	1800	U
79-34-5	1,1,2,2-Tetrachloroethane	1800	U
127-18-4	**Tetrachloroethene**	**7800**	
108-88-3	Toluene	1800	U
87-61-6	1,2,3-Trichlorobenzene	1800	U
120-82-1	1,2,4-Trichlorobenzene	1800	U
71-55-6	1,1,1-Trichloroethane	1800	U
79-00-5	1,1,2-Trichloroethane	1800	U
79-01-6	Trichloroethene	1800	U
75-69-4	Trichlorofluoromethane	3700	U
96-18-4	1,2,3-Trichloropropane	1800	U
95-63-6	**1,2,4-Trimethylbenzene**	**26000**	
108-67-8	**1,3,5-Trimethylbenzene**	**13000**	
75-01-4	**Vinyl chloride**	**980**	**J**
95-47-6	**o-Xylene**	**790**	**J**
136777-61-2	m-Xylene & p-Xylene	920	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID: H7G290134 008

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXX2202
Dilution factor: 5.8
Moisture %:

Date Received: 07/29/97
Date Extracted: 08/02/97
Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS02-4 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	29	U
108-86-1	Bromobenzene	29	U
74-97-5	Bromochloromethane	29	U
75-27-4	Bromodichloromethane	29	U
75-25-2	Bromoform	29	U
74-83-9	Bromomethane	58	U
104-51-8	n-Butylbenzene	29	U
135-98-8	sec-Butylbenzene	29	U
98-06-6	tert-Butylbenzene	29	U
56-23-5	Carbon tetrachloride	29	U
108-90-7	Chlorobenzene	29	U
124-48-1	Chlorodibromomethane	29	U
75-00-3	Chloroethane	58	U
67-66-3	Chloroform	29	U
74-87-3	Chloromethane	58	U
95-49-8	2-Chlorotoluene	29	U
106-43-4	4-Chlorotoluene	29	U
96-12-8	1,2-Dibromo-3-chloropropane	58	U
106-93-4	1,2-Dibromoethane	29	U
74-95-3	Dibromomethane	29	U
95-50-1	1,2-Dichlorobenzene	29	U
541-73-1	1,3-Dichlorobenzene	29	U
106-46-7	1,4-Dichlorobenzene	29	U
75-71-8	Dichlorodifluoromethane	58	U
75-34-3	1,1-Dichloroethane	29	U
107-06-2	1,2-Dichloroethane	29	U
75-35-4	1,1-Dichloroethene	29	U
156-59-2	cis-1,2-Dichloroethene	14	U
156-60-5	trans-1,2-Dichloroethene	14	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7G290134 008
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Date Received: 07/29/97
Work Order: CAXX2202
Date Extracted:08/02/97
Dilution factor: 5.8
Date Analyzed: 08/02/97
Moisture %:
QC Batch: 7214118

Client Sample Id: IS02-4 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	29	U
142-28-9	1,3-Dichloropropane	29	U
594-20-7	2,2-Dichloropropane	29	U
563-58-6	1,1-Dichloropropene	29	U
100-41-4	Ethylbenzene	29	U
87-68-3	Hexachlorobutadiene	29	U
98-82-8	Isopropylbenzene	29	U
99-87-6	p-Isopropyltoluene	29	U
75-09-2	Methylene chloride	29	U
91-20-3	Naphthalene	29	U
103-65-1	n-Propylbenzene	29	U
100-42-5	Styrene	29	U
630-20-6	1,1,1,2-Tetrachloroethane	29	U
79-34-5	1,1,2,2-Tetrachloroethane	29	U
127-18-4	**Tetrachloroethene**	**67**	
108-88-3	Toluene	29	U
87-61-6	1,2,3-Trichlorobenzene	29	U
120-82-1	1,2,4-Trichlorobenzene	29	U
71-55-6	1,1,1-Trichloroethane	29	U
79-00-5	1,1,2-Trichloroethane	29	U
79-01-6	Trichloroethene	29	U
75-69-4	Trichlorofluoromethane	58	U
96-18-4	1,2,3-Trichloropropane	29	U
95-63-6	**1,2,4-Trimethylbenzene**	**11**	J
108-67-8	1,3,5-Trimethylbenzene	29	U
75-01-4	Vinyl chloride	58	U
95-47-6	o-Xylene	14	U
136777-61-2	m-Xylene & p-Xylene	14	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7G290134 009
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXX4102
Dilution factor: 175
Moisture %:
Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/01/97
QC Batch: 7213114

Client Sample Id: IS03-1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	880	U
108-86-1	Bromobenzene	880	U
74-97-5	Bromochloromethane	880	U
75-27-4	Bromodichloromethane	880	U
75-25-2	Bromoform	880	U
74-83-9	Bromomethane	1800	U
104-51-8	n-Butylbenzene	880	U
135-98-8	sec-Butylbenzene	880	U
98-06-6	tert-Butylbenzene	880	U
56-23-5	Carbon tetrachloride	880	U
108-90-7	Chlorobenzene	880	U
124-48-1	Chlorodibromomethane	880	U
75-00-3	Chloroethane	1800	U
67-66-3	Chloroform	880	U
74-87-3	Chloromethane	1800	U
95-49-8	2-Chlorotoluene	880	U
106-43-4	4-Chlorotoluene	880	U
96-12-8	1,2-Dibromo-3-chloropropane	1800	U
106-93-4	1,2-Dibromoethane	880	U
74-95-3	Dibromomethane	880	U
95-50-1	1,2-Dichlorobenzene	880	U
541-73-1	1,3-Dichlorobenzene	880	U
106-46-7	**1,4-Dichlorobenzene**	**250**	**J**
75-71-8	Dichlorodifluoromethane	1800	U
75-34-3	1,1-Dichloroethane	880	U
107-06-2	1,2-Dichloroethane	880	U
75-35-4	1,1-Dichloroethene	880	U
156-59-2	cis-1,2-Dichloroethene	440	U
156-60-5	trans-1,2-Dichloroethene	440	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 009

Sample WT/Vol: 5 / mL
Work Order: CAXX4102
Dilution factor: 175
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/01/97

QC Batch: 7213114

Client Sample Id: IS03-1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	880	U
142-28-9	1,3-Dichloropropane	880	U
594-20-7	2,2-Dichloropropane	880	U
563-58-6	1,1-Dichloropropene	880	U
100-41-4	Ethylbenzene	880	U
87-68-3	Hexachlorobutadiene	880	U
98-82-8	Isopropylbenzene	880	U
99-87-6	p-Isopropyltoluene	880	U
75-09-2	Methylene chloride	880	U
91-20-3	Naphthalene	880	U
103-65-1	n-Propylbenzene	880	U
100-42-5	Styrene	880	U
630-20-6	1,1,1,2-Tetrachloroethane	880	U
79-34-5	1,1,2,2-Tetrachloroethane	880	U
127-18-4	**Tetrachloroethene**	**10000**	
108-88-3	Toluene	880	U
87-61-6	1,2,3-Trichlorobenzene	880	U
120-82-1	**1,2,4-Trichlorobenzene**	**310**	**J**
71-55-6	1,1,1-Trichloroethane	880	U
79-00-5	1,1,2-Trichloroethane	880	U
79-01-6	Trichloroethene	880	U
75-69-4	Trichlorofluoromethane	1800	U
96-18-4	1,2,3-Trichloropropane	880	U
95-63-6	1,2,4-Trimethylbenzene	880	U
108-67-8	1,3,5-Trimethylbenzene	880	U
75-01-4	Vinyl chloride	1800	U
95-47-6	o-Xylene	440	U
136777-61-2	m-Xylene & p-Xylene	440	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 010

Sample WT/Vol: 5 / mL

Work Order: CAXX5102

Dilution factor: 13

Moisture %:

Date Received: 07/29/97

Date Extracted:08/01/97

Date Analyzed: 08/01/97

QC Batch: 7213114

Client Sample Id: IS03-2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	65	U
108-86-1	Bromobenzene	65	U
74-97-5	Bromochloromethane	65	U
75-27-4	Bromodichloromethane	65	U
75-25-2	Bromoform	65	U
74-83-9	Bromomethane	130	U
104-51-8	n-Butylbenzene	65	U
135-98-8	sec-Butylbenzene	65	U
98-06-6	tert-Butylbenzene	65	U
56-23-5	Carbon tetrachloride	65	U
108-90-7	**Chlorobenzene**	**17**	**J**
124-48-1	Chlorodibromomethane	65	U
75-00-3	Chloroethane	130	U
67-66-3	Chloroform	65	U
74-87-3	Chloromethane	130	U
95-49-8	2-Chlorotoluene	65	U
106-43-4	4-Chlorotoluene	65	U
96-12-8	1,2-Dibromo-3-chloropropane	130	U
106-93-4	1,2-Dibromoethane	65	U
74-95-3	Dibromomethane	65	U
95-50-1	1,2-Dichlorobenzene	65	U
541-73-1	1,3-Dichlorobenzene	65	U
106-46-7	**1,4-Dichlorobenzene**	**17**	**J**
75-71-8	Dichlorodifluoromethane	130	U
75-34-3	1,1-Dichloroethane	65	U
107-06-2	1,2-Dichloroethane	65	U
75-35-4	1,1-Dichloroethene	65	U
156-59-2	**cis-1,2-Dichloroethene**	**29**	**J**
156-60-5	trans-1,2-Dichloroethene	32	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 010

Sample WT/Vol: 5 / mL
Work Order: CAXX5102
Dilution factor: 13
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/01/97

QC Batch: 7213114

Client Sample Id: IS03-2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	65	U
142-28-9	1,3-Dichloropropane	65	U
594-20-7	2,2-Dichloropropane	65	U
563-58-6	1,1-Dichloropropene	65	U
100-41-4	Ethylbenzene	65	U
87-68-3	Hexachlorobutadiene	65	U
98-82-8	Isopropylbenzene	65	U
99-87-6	p-Isopropyltoluene	65	U
75-09-2	Methylene chloride	65	U
91-20-3	Naphthalene	65	U
103-65-1	n-Propylbenzene	65	U
100-42-5	Styrene	65	U
630-20-6	1,1,1,2-Tetrachloroethane	65	U
79-34-5	1,1,2,2-Tetrachloroethane	65	U
127-18-4	**Tetrachloroethene**	**780**	
108-88-3	Toluene	65	U
87-61-6	1,2,3-Trichlorobenzene	65	U
120-82-1	**1,2,4-Trichlorobenzene**	**20**	**J**
71-55-6	1,1,1-Trichloroethane	65	U
79-00-5	1,1,2-Trichloroethane	65	U
79-01-6	Trichloroethene	65	U
75-69-4	Trichlorofluoromethane	130	U
96-18-4	1,2,3-Trichloropropane	65	U
95-63-6	1,2,4-Trimethylbenzene	65	U
108-67-8	1,3,5-Trimethylbenzene	65	U
75-01-4	Vinyl chloride	130	U
95-47-6	o-Xylene	32	U
136777-61-2	m-Xylene & p-Xylene	32	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7G290134 011
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXX6102
Dilution factor: 56
Moisture %:
Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/01/97
QC Batch: 7213114

Client Sample Id: IS03-3

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	280	U
108-86-1	Bromobenzene	280	U
74-97-5	Bromochloromethane	280	U
75-27-4	Bromodichloromethane	280	U
75-25-2	Bromoform	280	U
74-83-9	Bromomethane	560	U
104-51-8	n-Butylbenzene	280	U
135-98-8	sec-Butylbenzene	280	U
98-06-6	tert-Butylbenzene	280	U
56-23-5	Carbon tetrachloride	280	U
108-90-7	Chlorobenzene	280	U
124-48-1	Chlorodibromomethane	280	U
75-00-3	Chloroethane	560	U
67-66-3	Chloroform	280	U
74-87-3	Chloromethane	560	U
95-49-8	2-Chlorotoluene	280	U
106-43-4	4-Chlorotoluene	280	U
96-12-8	1,2-Dibromo-3-chloropropane	560	U
106-93-4	1,2-Dibromoethane	280	U
74-95-3	Dibromomethane	280	U
95-50-1	1,2-Dichlorobenzene	280	U
541-73-1	1,3-Dichlorobenzene	280	U
106-46-7	1,4-Dichlorobenzene	280	U
75-71-8	Dichlorodifluoromethane	560	U
75-34-3	1,1-Dichloroethane	280	U
107-06-2	1,2-Dichloroethane	280	U
75-35-4	1,1-Dichloroethene	280	U
156-59-2	**cis-1,2-Dichloroethene**	**100**	**J**
156-60-5	trans-1,2-Dichloroethene	140	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7G290134 011
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXX6102
Dilution factor: 56
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/01/97

QC Batch: 7213114

Client Sample Id: IS03-3

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	280	U
142-28-9	1,3-Dichloropropane	280	U
594-20-7	2,2-Dichloropropane	280	U
563-58-6	1,1-Dichloropropene	280	U
100-41-4	Ethylbenzene	280	U
87-68-3	Hexachlorobutadiene	280	U
98-82-8	Isopropylbenzene	280	U
99-87-6	p-Isopropyltoluene	280	U
75-09-2	Methylene chloride	280	U
91-20-3	Naphthalene	280	U
103-65-1	n-Propylbenzene	280	U
100-42-5	Styrene	280	U
630-20-6	1,1,1,2-Tetrachloroethane	280	U
79-34-5	1,1,2,2-Tetrachloroethane	280	U
127-18-4	**Tetrachloroethene**	**4000**	
108-88-3	Toluene	280	U
87-61-6	1,2,3-Trichlorobenzene	280	U
120-82-1	1,2,4-Trichlorobenzene	280	U
71-55-6	1,1,1-Trichloroethane	280	U
79-00-5	1,1,2-Trichloroethane	280	U
79-01-6	Trichloroethene	280	U
75-69-4	Trichlorofluoromethane	560	U
96-18-4	1,2,3-Trichloropropane	280	U
95-63-6	1,2,4-Trimethylbenzene	280	U
108-67-8	1,3,5-Trimethylbenzene	280	U
75-01-4	Vinyl chloride	560	U
95-47-6	o-Xylene	140	U
136777-61-2	m-Xylene & p-Xylene	140	U

FORM I

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7G290134 012

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXX8102
Dilution factor: 67
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/02/97

QC Batch: 7213114

Client Sample Id: IS04-1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	340	U
108-86-1	Bromobenzene	340	U
74-97-5	Bromochloromethane	340	U
75-27-4	Bromodichloromethane	340	U
75-25-2	Bromoform	340	U
74-83-9	Bromomethane	670	U
104-51-8	n-Butylbenzene	340	U
135-98-8	sec-Butylbenzene	340	U
98-06-6	tert-Butylbenzene	340	U
56-23-5	Carbon tetrachloride	340	U
108-90-7	Chlorobenzene	340	U
124-48-1	Chlorodibromomethane	340	U
75-00-3	Chloroethane	670	U
67-66-3	Chloroform	340	U
74-87-3	Chloromethane	670	U
95-49-8	2-Chlorotoluene	340	U
106-43-4	4-Chlorotoluene	340	U
96-12-8	1,2-Dibromo-3-chloropropane	670	U
106-93-4	1,2-Dibromoethane	340	U
74-95-3	Dibromomethane	340	U
95-50-1	1,2-Dichlorobenzene	340	U
541-73-1	1,3-Dichlorobenzene	340	U
106-46-7	1,4-Dichlorobenzene	340	U
75-71-8	Dichlorodifluoromethane	670	U
75-34-3	1,1-Dichloroethane	340	U
107-06-2	1,2-Dichloroethane	340	U
75-35-4	1,1-Dichloroethene	340	U
156-59-2	cis-1,2-Dichloroethene	170	U
156-60-5	trans-1,2-Dichloroethene	170	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 012

Sample WT/Vol: 5 / mL
Work Order: CAXX8102
Dilution factor: 67
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/02/97

QC Batch: 7213114

Client Sample Id: IS04-1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	340	U
142-28-9	1,3-Dichloropropane	340	U
594-20-7	2,2-Dichloropropane	340	U
563-58-6	1,1-Dichloropropene	340	U
100-41-4	Ethylbenzene	340	U
87-68-3	Hexachlorobutadiene	340	U
98-82-8	Isopropylbenzene	340	U
99-87-6	p-Isopropyltoluene	340	U
75-09-2	Methylene chloride	340	U
91-20-3	Naphthalene	340	U
103-65-1	n-Propylbenzene	340	U
100-42-5	Styrene	340	U
630-20-6	1,1,1,2-Tetrachloroethane	340	U
79-34-5	1,1,2,2-Tetrachloroethane	340	U
127-18-4	**Tetrachloroethene**	**4200**	
108-88-3	Toluene	340	U
87-61-6	1,2,3-Trichlorobenzene	340	U
120-82-1	1,2,4-Trichlorobenzene	340	U
71-55-6	1,1,1-Trichloroethane	340	U
79-00-5	1,1,2-Trichloroethane	340	U
79-01-6	Trichloroethene	340	U
75-69-4	Trichlorofluoromethane	670	U
96-18-4	1,2,3-Trichloropropane	340	U
95-63-6	1,2,4-Trimethylbenzene	340	U
108-67-8	1,3,5-Trimethylbenzene	340	U
75-01-4	Vinyl chloride	670	U
95-47-6	o-Xylene	170	U
136777-61-2	m-Xylene & p-Xylene	170	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 013

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL

Work Order: CAXXA102

Dilution factor: 1650

Moisture %:

Date Received: 07/29/97

Date Extracted:08/01/97

Date Analyzed: 08/02/97

QC Batch: 7213114

Client Sample Id: IS05-1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	8200	U
108-86-1	Bromobenzene	8200	U
74-97-5	Bromochloromethane	8200	U
75-27-4	Bromodichloromethane	8200	U
75-25-2	Bromoform	8200	U
74-83-9	Bromomethane	16000	U
104-51-8	n-Butylbenzene	8200	U
135-98-8	sec-Butylbenzene	8200	U
98-06-6	tert-Butylbenzene	8200	U
56-23-5	Carbon tetrachloride	8200	U
108-90-7	Chlorobenzene	8200	U
124-48-1	Chlorodibromomethane	8200	U
75-00-3	Chloroethane	16000	U
67-66-3	Chloroform	8200	U
74-87-3	Chloromethane	16000	U
95-49-8	2-Chlorotoluene	8200	U
106-43-4	4-Chlorotoluene	8200	U
96-12-8	1,2-Dibromo-3-chloropropane	16000	U
106-93-4	1,2-Dibromoethane	8200	U
74-95-3	Dibromomethane	8200	U
95-50-1	1,2-Dichlorobenzene	8200	U
541-73-1	1,3-Dichlorobenzene	8200	U
106-46-7	1,4-Dichlorobenzene	8200	U
75-71-8	Dichlorodifluoromethane	16000	U
75-34-3	1,1-Dichloroethane	8200	U
107-06-2	1,2-Dichloroethane	8200	U
75-35-4	1,1-Dichloroethene	8200	U
156-59-2	cis-1,2-Dichloroethene	4100	U
156-60-5	trans-1,2-Dichloroethene	4100	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7G290134 013
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXXA102
Dilution factor: 1650
Moisture %:
Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/02/97

QC Batch: 7213114

Client Sample Id: IS05-1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	8200	U
142-28-9	1,3-Dichloropropane	8200	U
594-20-7	2,2-Dichloropropane	8200	U
563-58-6	1,1-Dichloropropene	8200	U
100-41-4	Ethylbenzene	8200	U
87-68-3	Hexachlorobutadiene	8200	U
98-82-8	Isopropylbenzene	8200	U
99-87-6	p-Isopropyltoluene	8200	U
75-09-2	Methylene chloride	8200	U
91-20-3	Naphthalene	8200	U
103-65-1	n-Propylbenzene	8200	U
100-42-5	Styrene	8200	U
630-20-6	1,1,1,2-Tetrachloroethane	8200	U
79-34-5	1,1,2,2-Tetrachloroethane	8200	U
127-18-4	**Tetrachloroethene**	**130000**	
108-88-3	Toluene	8200	U
87-61-6	1,2,3-Trichlorobenzene	8200	U
120-82-1	1,2,4-Trichlorobenzene	8200	U
71-55-6	1,1,1-Trichloroethane	8200	U
79-00-5	1,1,2-Trichloroethane	8200	U
79-01-6	Trichloroethene	8200	U
75-69-4	Trichlorofluoromethane	16000	U
96-18-4	1,2,3-Trichloropropane	8200	U
95-63-6	1,2,4-Trimethylbenzene	8200	U
108-67-8	1,3,5-Trimethylbenzene	8200	U
75-01-4	Vinyl chloride	16000	U
95-47-6	o-Xylene	4100	U
136777-61-2	m-Xylene & p-Xylene	4100	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 014

Sample WT/Vol: 5 / mL

Work Order: CAXXE102

Dilution factor: 2980

Moisture %:

Date Received: 07/29/97

Date Extracted:08/01/97

Date Analyzed: 08/02/97

QC Batch: 7213114

Client Sample Id: IS05-2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	15000	U
108-86-1	Bromobenzene	15000	U
74-97-5	Bromochloromethane	15000	U
75-27-4	Bromodichloromethane	15000	U
75-25-2	Bromoform	15000	U
74-83-9	Bromomethane	30000	U
104-51-8	n-Butylbenzene	15000	U
135-98-8	sec-Butylbenzene	15000	U
98-06-6	tert-Butylbenzene	15000	U
56-23-5	Carbon tetrachloride	15000	U
108-90-7	Chlorobenzene	15000	U
124-48-1	Chlorodibromomethane	15000	U
75-00-3	Chloroethane	30000	U
67-66-3	Chloroform	15000	U
74-87-3	Chloromethane	30000	U
95-49-8	2-Chlorotoluene	15000	U
106-43-4	4-Chlorotoluene	15000	U
96-12-8	1,2-Dibromo-3-chloropropane	30000	U
106-93-4	1,2-Dibromoethane	15000	U
74-95-3	Dibromomethane	15000	U
95-50-1	1,2-Dichlorobenzene	15000	U
541-73-1	1,3-Dichlorobenzene	15000	U
106-46-7	1,4-Dichlorobenzene	15000	U
75-71-8	Dichlorodifluoromethane	30000	U
75-34-3	1,1-Dichloroethane	15000	U
107-06-2	1,2-Dichloroethane	15000	U
75-35-4	1,1-Dichloroethene	15000	U
156-59-2	cis-1,2-Dichloroethene	7400	U
156-60-5	trans-1,2-Dichloroethene	7400	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 014

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXXE102
Dilution factor: 2980
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/02/97

QC Batch: 7213114

Client Sample Id: IS05-2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	15000	U
142-28-9	1,3-Dichloropropane	15000	U
594-20-7	2,2-Dichloropropane	15000	U
563-58-6	1,1-Dichloropropene	15000	U
100-41-4	Ethylbenzene	15000	U
87-68-3	Hexachlorobutadiene	15000	U
98-82-8	Isopropylbenzene	15000	U
99-87-6	p-Isopropyltoluene	15000	U
75-09-2	Methylene chloride	15000	U
91-20-3	Naphthalene	15000	U
103-65-1	n-Propylbenzene	15000	U
100-42-5	Styrene	15000	U
630-20-6	1,1,1,2-Tetrachloroethane	15000	U
79-34-5	1,1,2,2-Tetrachloroethane	15000	U
127-18-4	**Tetrachloroethene**	**390000**	
108-88-3	Toluene	15000	U
87-61-6	1,2,3-Trichlorobenzene	15000	U
120-82-1	1,2,4-Trichlorobenzene	15000	U
71-55-6	1,1,1-Trichloroethane	15000	U
79-00-5	1,1,2-Trichloroethane	15000	U
79-01-6	Trichloroethene	15000	U
75-69-4	Trichlorofluoromethane	30000	U
96-18-4	1,2,3-Trichloropropane	15000	U
95-63-6	1,2,4-Trimethylbenzene	15000	U
108-67-8	1,3,5-Trimethylbenzene	15000	U
75-01-4	Vinyl chloride	30000	U
95-47-6	o-Xylene	7400	U
136777-61-2	m-Xylene & p-Xylene	7400	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 015

Sample WT/Vol: 5 / mL
Work Order: CAXXG102
Dilution factor: 15000
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/02/97

QC Batch: 7213114

Client Sample Id: IS05-3

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	75000	U
108-86-1	Bromobenzene	75000	U
74-97-5	Bromochloromethane	75000	U
75-27-4	Bromodichloromethane	75000	U
75-25-2	Bromoform	75000	U
74-83-9	Bromomethane	150000	U
104-51-8	n-Butylbenzene	75000	U
135-98-8	sec-Butylbenzene	75000	U
98-06-6	tert-Butylbenzene	75000	U
56-23-5	Carbon tetrachloride	75000	U
108-90-7	Chlorobenzene	75000	U
124-48-1	Chlorodibromomethane	75000	U
75-00-3	Chloroethane	150000	U
67-66-3	Chloroform	75000	U
74-87-3	Chloromethane	150000	U
95-49-8	2-Chlorotoluene	75000	U
106-43-4	4-Chlorotoluene	75000	U
96-12-8	1,2-Dibromo-3-chloropropane	150000	U
106-93-4	1,2-Dibromoethane	75000	U
74-95-3	Dibromomethane	75000	U
95-50-1	1,2-Dichlorobenzene	75000	U
541-73-1	1,3-Dichlorobenzene	75000	U
106-46-7	1,4-Dichlorobenzene	75000	U
75-71-8	Dichlorodifluoromethane	150000	U
75-34-3	1,1-Dichloroethane	75000	U
107-06-2	1,2-Dichloroethane	75000	U
75-35-4	1,1-Dichloroethene	75000	U
156-59-2	cis-1,2-Dichloroethene	38000	U
156-60-5	trans-1,2-Dichloroethene	38000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 015

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXXG102
Dilution factor: 15000
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/02/97

QC Batch: 7213114

Client Sample Id: IS05-3

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	75000	U
142-28-9	1,3-Dichloropropane	75000	U
594-20-7	2,2-Dichloropropane	75000	U
563-58-6	1,1-Dichloropropene	75000	U
100-41-4	Ethylbenzene	75000	U
87-68-3	Hexachlorobutadiene	75000	U
98-82-8	Isopropylbenzene	75000	U
99-87-6	p-Isopropyltoluene	75000	U
75-09-2	Methylene chloride	75000	U
91-20-3	Naphthalene	75000	U
103-65-1	n-Propylbenzene	75000	U
100-42-5	Styrene	75000	U
630-20-6	1,1,1,2-Tetrachloroethane	75000	U
79-34-5	1,1,2,2-Tetrachloroethane	75000	U
127-18-4	**Tetrachloroethene**	**2100000**	
108-88-3	Toluene	75000	U
87-61-6	1,2,3-Trichlorobenzene	75000	U
120-82-1	1,2,4-Trichlorobenzene	75000	U
71-55-6	1,1,1-Trichloroethane	75000	U
79-00-5	1,1,2-Trichloroethane	75000	U
79-01-6	Trichloroethene	75000	U
75-69-4	Trichlorofluoromethane	150000	U
96-18-4	1,2,3-Trichloropropane	75000	U
95-63-6	1,2,4-Trimethylbenzene	75000	U
108-67-8	1,3,5-Trimethylbenzene	75000	U
75-01-4	Vinyl chloride	150000	U
95-47-6	o-Xylene	38000	U
136777-61-2	m-Xylene & p-Xylene	38000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 016

Sample WT/Vol: 5 / mL
Work Order: CAXXK402
Dilution factor: 1455
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS05-4 -RE 3

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	7300	U
108-86-1	Bromobenzene	7300	U
74-97-5	Bromochloromethane	7300	U
75-27-4	Bromodichloromethane	7300	U
75-25-2	Bromoform	7300	U
74-83-9	Bromomethane	15000	U
104-51-8	**n-Butylbenzene**	**2300**	J
135-98-8	**sec-Butylbenzene**	**1800**	J
98-06-6	tert-Butylbenzene	7300	U
56-23-5	Carbon tetrachloride	7300	U
108-90-7	Chlorobenzene	7300	U
124-48-1	Chlorodibromomethane	7300	U
75-00-3	Chloroethane	15000	U
67-66-3	Chloroform	7300	U
74-87-3	Chloromethane	15000	U
95-49-8	2-Chlorotoluene	7300	U
106-43-4	4-Chlorotoluene	7300	U
96-12-8	1,2-Dibromo-3-chloropropane	15000	U
106-93-4	1,2-Dibromoethane	7300	U
74-95-3	Dibromomethane	7300	U
95-50-1	1,2-Dichlorobenzene	7300	U
541-73-1	1,3-Dichlorobenzene	7300	U
106-46-7	1,4-Dichlorobenzene	7300	U
75-71-8	Dichlorodifluoromethane	15000	U
75-34-3	1,1-Dichloroethane	7300	U
107-06-2	1,2-Dichloroethane	7300	U
75-35-4	1,1-Dichloroethene	7300	U
156-59-2	cis-1,2-Dichloroethene	3600	U
156-60-5	trans-1,2-Dichloroethene	3600	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 016

Sample WT/Vol: 5 / mL
Work Order: CAXXK402
Dilution factor: 1455
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS05-4 -RE 3

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	7300	U
142-28-9	1,3-Dichloropropane	7300	U
594-20-7	2,2-Dichloropropane	7300	U
563-58-6	1,1-Dichloropropene	7300	U
100-41-4	Ethylbenzene	7300	U
87-68-3	Hexachlorobutadiene	7300	U
98-82-8	Isopropylbenzene	7300	U
99-87-6	**p-Isopropyltoluene**	**1800**	J
75-09-2	Methylene chloride	7300	U
91-20-3	Naphthalene	7300	U
103-65-1	**n-Propylbenzene**	**2800**	J
100-42-5	Styrene	7300	U
630-20-6	1,1,1,2-Tetrachloroethane	7300	U
79-34-5	1,1,2,2-Tetrachloroethane	7300	U
127-18-4	**Tetrachloroethene**	**220000**	
108-88-3	Toluene	7300	U
87-61-6	1,2,3-Trichlorobenzene	7300	U
120-82-1	1,2,4-Trichlorobenzene	7300	U
71-55-6	1,1,1-Trichloroethane	7300	U
79-00-5	1,1,2-Trichloroethane	7300	U
79-01-6	**Trichloroethene**	**15000**	
75-69-4	Trichlorofluoromethane	15000	U
96-18-4	1,2,3-Trichloropropane	7300	U
95-63-6	**1,2,4-Trimethylbenzene**	**26000**	
108-67-8	**1,3,5-Trimethylbenzene**	**13000**	
75-01-4	Vinyl chloride	15000	U
95-47-6	o-Xylene	3600	U
136777-61-2	m-Xylene & p-Xylene	3600	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID: H7G290134 017

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CAXXM302
Dilution factor: 125
Moisture %:

Date Received: 07/29/97
Date Extracted: 08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS06-1 -RE 2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	620	U
108-86-1	Bromobenzene	620	U
74-97-5	Bromochloromethane	620	U
75-27-4	Bromodichloromethane	620	U
75-25-2	Bromoform	620	U
74-83-9	Bromomethane	1200	U
104-51-8	**n-Butylbenzene**	**1000**	
135-98-8	**sec-Butylbenzene**	**480**	**J**
98-06-6	tert-Butylbenzene	620	U
56-23-5	Carbon tetrachloride	620	U
108-90-7	Chlorobenzene	620	U
124-48-1	Chlorodibromomethane	620	U
75-00-3	Chloroethane	1200	U
67-66-3	Chloroform	620	U
74-87-3	Chloromethane	1200	U
95-49-8	2-Chlorotoluene	620	U
106-43-4	4-Chlorotoluene	620	U
96-12-8	1,2-Dibromo-3-chloropropane	1200	U
106-93-4	1,2-Dibromoethane	620	U
74-95-3	Dibromomethane	620	U
95-50-1	1,2-Dichlorobenzene	620	U
541-73-1	1,3-Dichlorobenzene	620	U
106-46-7	1,4-Dichlorobenzene	620	U
75-71-8	Dichlorodifluoromethane	1200	U
75-34-3	1,1-Dichloroethane	620	U
107-06-2	1,2-Dichloroethane	620	U
75-35-4	1,1-Dichloroethene	620	U
156-59-2	cis-1,2-Dichloroethene	310	U
156-60-5	trans-1,2-Dichloroethene	310	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 017

Sample WT/Vol: 5 / mL

Work Order: CAXXM302

Dilution factor: 125

Moisture %:

Date Received: 07/29/97

Date Extracted:08/03/97

Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS06-1 -RE 2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	620	U
142-28-9	1,3-Dichloropropane	620	U
594-20-7	2,2-Dichloropropane	620	U
563-58-6	1,1-Dichloropropene	620	U
100-41-4	Ethylbenzene	620	U
87-68-3	Hexachlorobutadiene	620	U
98-82-8	Isopropylbenzene	620	U
99-87-6	**p-Isopropyltoluene**	**520**	**J**
75-09-2	Methylene chloride	620	U
91-20-3	Naphthalene	620	U
103-65-1	**n-Propylbenzene**	**240**	**J**
100-42-5	Styrene	620	U
630-20-6	1,1,1,2-Tetrachloroethane	620	U
79-34-5	1,1,2,2-Tetrachloroethane	620	U
127-18-4	**Tetrachloroethene**	**1800**	
108-88-3	Toluene	620	U
87-61-6	1,2,3-Trichlorobenzene	620	U
120-82-1	1,2,4-Trichlorobenzene	620	U
71-55-6	1,1,1-Trichloroethane	620	U
79-00-5	1,1,2-Trichloroethane	620	U
79-01-6	Trichloroethene	620	U
75-69-4	Trichlorofluoromethane	1200	U
96-18-4	1,2,3-Trichloropropane	620	U
95-63-6	**1,2,4-Trimethylbenzene**	**2000**	
108-67-8	**1,3,5-Trimethylbenzene**	**1300**	
75-01-4	Vinyl chloride	1200	U
95-47-6	o-Xylene	310	U
136777-61-2	m-Xylene & p-Xylene	310	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 018

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC004102
Dilution factor: 46
Moisture %:

Date Received: 07/29/97
Date Extracted:08/01/97
Date Analyzed: 08/01/97

QC Batch: 7215124

Client Sample Id: IS07-1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	230	U
108-86-1	Bromobenzene	230	U
74-97-5	Bromochloromethane	230	U
75-27-4	Bromodichloromethane	230	U
75-25-2	Bromoform	230	U
74-83-9	Bromomethane	460	U
104-51-8	n-Butylbenzene	230	U
135-98-8	sec-Butylbenzene	230	U
98-06-6	tert-Butylbenzene	230	U
56-23-5	Carbon tetrachloride	230	U
108-90-7	Chlorobenzene	230	U
124-48-1	Chlorodibromomethane	230	U
75-00-3	Chloroethane	460	U
67-66-3	Chloroform	230	U
74-87-3	Chloromethane	460	U
95-49-8	2-Chlorotoluene	230	U
106-43-4	4-Chlorotoluene	230	U
96-12-8	1,2-Dibromo-3-chloropropane	460	U
106-93-4	1,2-Dibromoethane	230	U
74-95-3	Dibromomethane	230	U
95-50-1	1,2-Dichlorobenzene	230	U
541-73-1	1,3-Dichlorobenzene	230	U
106-46-7	1,4-Dichlorobenzene	230	U
75-71-8	Dichlorodifluoromethane	460	U
75-34-3	1,1-Dichloroethane	230	U
107-06-2	1,2-Dichloroethane	230	U
75-35-4	1,1-Dichloroethene	230	U
156-59-2	**cis-1,2-Dichloroethene**	**2100**	
156-60-5	trans-1,2-Dichloroethene	120	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID: H7G290134 018

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC004102
Dilution factor: 46
Moisture %:

Date Received: 07/29/97
Date Extracted: 08/01/97
Date Analyzed: 08/01/97

QC Batch: 7215124

Client Sample Id: IS07-1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	230	U
142-28-9	1,3-Dichloropropane	230	U
594-20-7	2,2-Dichloropropane	230	U
563-58-6	1,1-Dichloropropene	230	U
100-41-4	Ethylbenzene	230	U
87-68-3	Hexachlorobutadiene	230	U
98-82-8	Isopropylbenzene	230	U
99-87-6	p-Isopropyltoluene	230	U
75-09-2	Methylene chloride	230	U
91-20-3	Naphthalene	230	U
103-65-1	n-Propylbenzene	230	U
100-42-5	Styrene	230	U
630-20-6	1,1,1,2-Tetrachloroethane	230	U
79-34-5	1,1,2,2-Tetrachloroethane	230	U
127-18-4	**Tetrachloroethene**	**74**	**J**
108-88-3	Toluene	230	U
87-61-6	1,2,3-Trichlorobenzene	230	U
120-82-1	1,2,4-Trichlorobenzene	230	U
71-55-6	1,1,1-Trichloroethane	230	U
79-00-5	1,1,2-Trichloroethane	230	U
79-01-6	Trichloroethene	230	U
75-69-4	Trichlorofluoromethane	460	U
96-18-4	1,2,3-Trichloropropane	230	U
95-63-6	1,2,4-Trimethylbenzene	230	U
108-67-8	1,3,5-Trimethylbenzene	230	U
75-01-4	**Vinyl chloride**	**3500**	
95-47-6	o-Xylene	120	U
136777-61-2	m-Xylene & p-Xylene	120	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 019

Sample WT/Vol: 5 / mL
Work Order: CC006202
Dilution factor: 870
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS07-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	4400	U
108-86-1	Bromobenzene	4400	U
74-97-5	Bromochloromethane	4400	U
75-27-4	Bromodichloromethane	4400	U
75-25-2	Bromoform	4400	U
74-83-9	Bromomethane	8700	U
104-51-8	n-Butylbenzene	4400	U
135-98-8	sec-Butylbenzene	4400	U
98-06-6	tert-Butylbenzene	4400	U
56-23-5	Carbon tetrachloride	4400	U
108-90-7	Chlorobenzene	4400	U
124-48-1	Chlorodibromomethane	4400	U
75-00-3	Chloroethane	8700	U
67-66-3	Chloroform	4400	U
74-87-3	Chloromethane	8700	U
95-49-8	2-Chlorotoluene	4400	U
106-43-4	4-Chlorotoluene	4400	U
96-12-8	1,2-Dibromo-3-chloropropane	8700	U
106-93-4	1,2-Dibromoethane	4400	U
74-95-3	Dibromomethane	4400	U
95-50-1	1,2-Dichlorobenzene	4400	U
541-73-1	1,3-Dichlorobenzene	4400	U
106-46-7	1,4-Dichlorobenzene	4400	U
75-71-8	Dichlorodifluoromethane	8700	U
75-34-3	1,1-Dichloroethane	4400	U
107-06-2	1,2-Dichloroethane	4400	U
75-35-4	1,1-Dichloroethene	4400	U
156-59-2	**cis-1,2-Dichloroethene**	**46000**	
156-60-5	trans-1,2-Dichloroethene	2200	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 019

Sample WT/Vol: 5 / mL

Work Order: CC006202

Dilution factor: 870

Moisture %:

Date Received: 07/29/97

Date Extracted:08/03/97

Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS07-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	4400	U
142-28-9	1,3-Dichloropropane	4400	U
594-20-7	2,2-Dichloropropane	4400	U
563-58-6	1,1-Dichloropropene	4400	U
100-41-4	Ethylbenzene	4400	U
87-68-3	Hexachlorobutadiene	4400	U
98-82-8	Isopropylbenzene	4400	U
99-87-6	p-Isopropyltoluene	4400	U
75-09-2	Methylene chloride	4400	U
91-20-3	Naphthalene	4400	U
103-65-1	n-Propylbenzene	4400	U
100-42-5	Styrene	4400	U
630-20-6	1,1,1,2-Tetrachloroethane	4400	U
79-34-5	1,1,2,2-Tetrachloroethane	4400	U
127-18-4	**Tetrachloroethene**	**110000**	
108-88-3	Toluene	4400	U
87-61-6	1,2,3-Trichlorobenzene	4400	U
120-82-1	1,2,4-Trichlorobenzene	4400	U
71-55-6	1,1,1-Trichloroethane	4400	U
79-00-5	1,1,2-Trichloroethane	4400	U
79-01-6	**Trichloroethene**	**3900**	**J**
75-69-4	Trichlorofluoromethane	8700	U
96-18-4	1,2,3-Trichloropropane	4400	U
95-63-6	**1,2,4-Trimethylbenzene**	**3800**	**J**
108-67-8	**1,3,5-Trimethylbenzene**	**1700**	**J**
75-01-4	**Vinyl chloride**	**4800**	**J**
95-47-6	o-Xylene	2200	U
136777-61-2	m-Xylene & p-Xylene	2200	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA	SDG Number:
Matrix: (soil/water) SOLID	Lab Sample ID:H7G290134 020
Method: SW846 8260A Volatile Organics, GC/MS (8260A)	
Sample WT/Vol: 5 / mL	Date Received: 07/29/97
Work Order: CC00A202	Date Extracted:08/02/97
Dilution factor: 250	Date Analyzed: 08/02/97
Moisture %:	
	QC Batch: 7214118
Client Sample Id: IS07-3 -RE 1	

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	1200	U
108-86-1	Bromobenzene	1200	U
74-97-5	Bromochloromethane	1200	U
75-27-4	Bromodichloromethane	1200	U
75-25-2	Bromoform	1200	U
74-83-9	Bromomethane	2500	U
104-51-8	n-Butylbenzene	1200	U
135-98-8	sec-Butylbenzene	1200	U
98-06-6	tert-Butylbenzene	1200	U
56-23-5	Carbon tetrachloride	1200	U
108-90-7	Chlorobenzene	1200	U
124-48-1	Chlorodibromomethane	1200	U
75-00-3	Chloroethane	2500	U
67-66-3	Chloroform	1200	U
74-87-3	Chloromethane	2500	U
95-49-8	2-Chlorotoluene	1200	U
106-43-4	4-Chlorotoluene	1200	U
96-12-8	1,2-Dibromo-3-chloropropane	2500	U
106-93-4	1,2-Dibromoethane	1200	U
74-95-3	Dibromomethane	1200	U
95-50-1	1,2-Dichlorobenzene	1200	U
541-73-1	1,3-Dichlorobenzene	1200	U
106-46-7	1,4-Dichlorobenzene	1200	U
75-71-8	Dichlorodifluoromethane	2500	U
75-34-3	1,1-Dichloroethane	1200	U
107-06-2	1,2-Dichloroethane	1200	U
75-35-4	1,1-Dichloroethene	1200	U
156-59-2	**cis-1,2-Dichloroethene**	**18000**	
156-60-5	trans-1,2-Dichloroethene	620	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 020

Sample WT/Vol: 5 / mL

Work Order: CC00A202

Dilution factor: 250

Moisture %:

Date Received: 07/29/97

Date Extracted:08/02/97

Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS07-3 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	1200	U
142-28-9	1,3-Dichloropropane	1200	U
594-20-7	2,2-Dichloropropane	1200	U
563-58-6	1,1-Dichloropropene	1200	U
100-41-4	Ethylbenzene	1200	U
87-68-3	Hexachlorobutadiene	1200	U
98-82-8	Isopropylbenzene	1200	U
99-87-6	p-Isopropyltoluene	1200	U
75-09-2	Methylene chloride	1200	U
91-20-3	Naphthalene	1200	U
103-65-1	n-Propylbenzene	1200	U
100-42-5	Styrene	1200	U
630-20-6	1,1,1,2-Tetrachloroethane	1200	U
79-34-5	1,1,2,2-Tetrachloroethane	1200	U
127-18-4	**Tetrachloroethene**	**32000**	
108-88-3	Toluene	1200	U
87-61-6	1,2,3-Trichlorobenzene	1200	U
120-82-1	1,2,4-Trichlorobenzene	1200	U
71-55-6	1,1,1-Trichloroethane	1200	U
79-00-5	1,1,2-Trichloroethane	1200	U
79-01-6	**Trichloroethene**	**2200**	
75-69-4	Trichlorofluoromethane	2500	U
96-18-4	1,2,3-Trichloropropane	1200	U
95-63-6	**1,2,4-Trimethylbenzene**	**2300**	
108-67-8	**1,3,5-Trimethylbenzene**	**1000**	**J**
75-01-4	Vinyl chloride	2500	U
95-47-6	o-Xylene	620	U
136777-61-2	m-Xylene & p-Xylene	620	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 021

Sample WT/Vol: 5 / mL

Work Order: CC00D202

Dilution factor: 6890

Moisture %:

Date Received: 07/29/97

Date Extracted:08/03/97

Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS07-4 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	34000	U
108-86-1	Bromobenzene	34000	U
74-97-5	Bromochloromethane	34000	U
75-27-4	Bromodichloromethane	34000	U
75-25-2	Bromoform	34000	U
74-83-9	Bromomethane	69000	U
104-51-8	n-Butylbenzene	34000	U
135-98-8	sec-Butylbenzene	34000	U
98-06-6	tert-Butylbenzene	34000	U
56-23-5	Carbon tetrachloride	34000	U
108-90-7	Chlorobenzene	34000	U
124-48-1	Chlorodibromomethane	34000	U
75-00-3	Chloroethane	69000	U
67-66-3	Chloroform	34000	U
74-87-3	Chloromethane	69000	U
95-49-8	2-Chlorotoluene	34000	U
106-43-4	4-Chlorotoluene	34000	U
96-12-8	1,2-Dibromo-3-chloropropane	69000	U
106-93-4	1,2-Dibromoethane	34000	U
74-95-3	Dibromomethane	34000	U
95-50-1	1,2-Dichlorobenzene	34000	U
541-73-1	1,3-Dichlorobenzene	34000	U
106-46-7	1,4-Dichlorobenzene	34000	U
75-71-8	Dichlorodifluoromethane	69000	U
75-34-3	1,1-Dichloroethane	34000	U
107-06-2	1,2-Dichloroethane	34000	U
75-35-4	1,1-Dichloroethene	34000	U
156-59-2	cis-1,2-Dichloroethene	17000	U
156-60-5	trans-1,2-Dichloroethene	17000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 021

Sample WT/Vol: 5 / mL

Work Order: CC00D202

Dilution factor: 6890

Moisture %:

Date Received: 07/29/97

Date Extracted:08/03/97

Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS07-4 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	34000	U
142-28-9	1,3-Dichloropropane	34000	U
594-20-7	2,2-Dichloropropane	34000	U
563-58-6	1,1-Dichloropropene	34000	U
100-41-4	Ethylbenzene	34000	U
87-68-3	Hexachlorobutadiene	34000	U
98-82-8	Isopropylbenzene	34000	U
99-87-6	p-Isopropyltoluene	34000	U
75-09-2	Methylene chloride	34000	U
91-20-3	Naphthalene	34000	U
103-65-1	n-Propylbenzene	34000	U
100-42-5	Styrene	34000	U
630-20-6	1,1,1,2-Tetrachloroethane	34000	U
79-34-5	1,1,2,2-Tetrachloroethane	34000	U
127-18-4	**Tetrachloroethene**	**1200000**	
108-88-3	Toluene	34000	U
87-61-6	1,2,3-Trichlorobenzene	34000	U
120-82-1	1,2,4-Trichlorobenzene	34000	U
71-55-6	1,1,1-Trichloroethane	34000	U
79-00-5	1,1,2-Trichloroethane	34000	U
79-01-6	Trichloroethene	34000	U
75-69-4	Trichlorofluoromethane	69000	U
96-18-4	1,2,3-Trichloropropane	34000	U
95-63-6	1,2,4-Trimethylbenzene	34000	U
108-67-8	1,3,5-Trimethylbenzene	34000	U
75-01-4	Vinyl chloride	69000	U
95-47-6	o-Xylene	17000	U
136777-61-2	m-Xylene & p-Xylene	17000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 022

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC00E202
Dilution factor: 112525
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS08-1 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	560000	U
108-86-1	Bromobenzene	560000	U
74-97-5	Bromochloromethane	560000	U
75-27-4	Bromodichloromethane	560000	U
75-25-2	Bromoform	560000	U
74-83-9	Bromomethane	1100000	U
104-51-8	n-Butylbenzene	560000	U
135-98-8	sec-Butylbenzene	560000	U
98-06-6	tert-Butylbenzene	560000	U
56-23-5	Carbon tetrachloride	560000	U
108-90-7	Chlorobenzene	560000	U
124-48-1	Chlorodibromomethane	560000	U
75-00-3	Chloroethane	1100000	U
67-66-3	Chloroform	560000	U
74-87-3	Chloromethane	1100000	U
95-49-8	2-Chlorotoluene	560000	U
106-43-4	4-Chlorotoluene	560000	U
96-12-8	1,2-Dibromo-3-chloropropane	1100000	U
106-93-4	1,2-Dibromoethane	560000	U
74-95-3	Dibromomethane	560000	U
95-50-1	1,2-Dichlorobenzene	560000	U
541-73-1	1,3-Dichlorobenzene	560000	U
106-46-7	1,4-Dichlorobenzene	560000	U
75-71-8	Dichlorodifluoromethane	1100000	U
75-34-3	1,1-Dichloroethane	560000	U
107-06-2	1,2-Dichloroethane	560000	U
75-35-4	1,1-Dichloroethene	560000	U
156-59-2	cis-1,2-Dichloroethene	280000	U
156-60-5	trans-1,2-Dichloroethene	280000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 022

Sample WT/Vol: 5 / mL

Work Order: CC00E202

Dilution factor: 112525

Moisture %:

Date Received: 07/29/97

Date Extracted:08/03/97

Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS08-1 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	560000	U
142-28-9	1,3-Dichloropropane	560000	U
594-20-7	2,2-Dichloropropane	560000	U
563-58-6	1,1-Dichloropropene	560000	U
100-41-4	Ethylbenzene	560000	U
87-68-3	Hexachlorobutadiene	560000	U
98-82-8	Isopropylbenzene	560000	U
99-87-6	p-Isopropyltoluene	560000	U
75-09-2	Methylene chloride	560000	U
91-20-3	Naphthalene	560000	U
103-65-1	n-Propylbenzene	560000	U
100-42-5	Styrene	560000	U
630-20-6	1,1,1,2-Tetrachloroethane	560000	U
79-34-5	1,1,2,2-Tetrachloroethane	560000	U
127-18-4	**Tetrachloroethene**	**9500000**	
108-88-3	Toluene	560000	U
87-61-6	1,2,3-Trichlorobenzene	560000	U
120-82-1	1,2,4-Trichlorobenzene	560000	U
71-55-6	1,1,1-Trichloroethane	560000	U
79-00-5	1,1,2-Trichloroethane	560000	U
79-01-6	Trichloroethene	560000	U
75-69-4	Trichlorofluoromethane	1100000	U
96-18-4	1,2,3-Trichloropropane	560000	U
95-63-6	1,2,4-Trimethylbenzene	560000	U
108-67-8	1,3,5-Trimethylbenzene	560000	U
75-01-4	Vinyl chloride	1100000	U
95-47-6	o-Xylene	280000	U
136777-61-2	m-Xylene & p-Xylene	280000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 023

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC00G102
Dilution factor: 21750
Moisture %:

Date Received: 07/29/97
Date Extracted:08/02/97
Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS08-2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	110000	U
108-86-1	Bromobenzene	110000	U
74-97-5	Bromochloromethane	110000	U
75-27-4	Bromodichloromethane	110000	U
75-25-2	Bromoform	110000	U
74-83-9	Bromomethane	220000	U
104-51-8	n-Butylbenzene	110000	U
135-98-8	sec-Butylbenzene	110000	U
98-06-6	tert-Butylbenzene	110000	U
56-23-5	Carbon tetrachloride	110000	U
108-90-7	Chlorobenzene	110000	U
124-48-1	Chlorodibromomethane	110000	U
75-00-3	Chloroethane	220000	U
67-66-3	Chloroform	110000	U
74-87-3	Chloromethane	220000	U
95-49-8	2-Chlorotoluene	110000	U
106-43-4	4-Chlorotoluene	110000	U
96-12-8	1,2-Dibromo-3-chloropropane	220000	U
106-93-4	1,2-Dibromoethane	110000	U
74-95-3	Dibromomethane	110000	U
95-50-1	1,2-Dichlorobenzene	110000	U
541-73-1	1,3-Dichlorobenzene	110000	U
106-46-7	1,4-Dichlorobenzene	110000	U
75-71-8	Dichlorodifluoromethane	220000	U
75-34-3	1,1-Dichloroethane	110000	U
107-06-2	1,2-Dichloroethane	110000	U
75-35-4	1,1-Dichloroethene	110000	U
156-59-2	cis-1,2-Dichloroethene	54000	U
156-60-5	trans-1,2-Dichloroethene	54000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 023

Sample WT/Vol: 5 / mL
Work Order: CC00G102
Dilution factor: 21750
Moisture %:

Date Received: 07/29/97
Date Extracted:08/02/97
Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS08-2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	110000	U
142-28-9	1,3-Dichloropropane	110000	U
594-20-7	2,2-Dichloropropane	110000	U
563-58-6	1,1-Dichloropropene	110000	U
100-41-4	Ethylbenzene	110000	U
87-68-3	Hexachlorobutadiene	110000	U
98-82-8	Isopropylbenzene	110000	U
99-87-6	p-Isopropyltoluene	110000	U
75-09-2	Methylene chloride	110000	U
91-20-3	Naphthalene	110000	U
103-65-1	n-Propylbenzene	110000	U
100-42-5	Styrene	110000	U
630-20-6	1,1,1,2-Tetrachloroethane	110000	U
79-34-5	1,1,2,2-Tetrachloroethane	110000	U
127-18-4	**Tetrachloroethene**	**4100000**	
108-88-3	Toluene	110000	U
87-61-6	1,2,3-Trichlorobenzene	110000	U
120-82-1	1,2,4-Trichlorobenzene	110000	U
71-55-6	1,1,1-Trichloroethane	110000	U
79-00-5	1,1,2-Trichloroethane	110000	U
79-01-6	Trichloroethene	110000	U
75-69-4	Trichlorofluoromethane	220000	U
96-18-4	1,2,3-Trichloropropane	110000	U
95-63-6	1,2,4-Trimethylbenzene	110000	U
108-67-8	1,3,5-Trimethylbenzene	110000	U
75-01-4	Vinyl chloride	220000	U
95-47-6	o-Xylene	54000	U
136777-61-2	m-Xylene & p-Xylene	54000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 024

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL

Work Order: CC00J302

Dilution factor: 22175

Moisture %:

Date Received: 07/29/97

Date Extracted:08/03/97

Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS08-3 -RE 2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	110000	U
108-86-1	Bromobenzene	110000	U
74-97-5	Bromochloromethane	110000	U
75-27-4	Bromodichloromethane	110000	U
75-25-2	Bromoform	110000	U
74-83-9	Bromomethane	220000	U
104-51-8	n-Butylbenzene	110000	U
135-98-8	sec-Butylbenzene	110000	U
98-06-6	tert-Butylbenzene	110000	U
56-23-5	Carbon tetrachloride	110000	U
108-90-7	Chlorobenzene	110000	U
124-48-1	Chlorodibromomethane	110000	U
75-00-3	Chloroethane	220000	U
67-66-3	Chloroform	110000	U
74-87-3	Chloromethane	220000	U
95-49-8	2-Chlorotoluene	110000	U
106-43-4	4-Chlorotoluene	110000	U
96-12-8	1,2-Dibromo-3-chloropropane	220000	U
106-93-4	1,2-Dibromoethane	110000	U
74-95-3	Dibromomethane	110000	U
95-50-1	1,2-Dichlorobenzene	110000	U
541-73-1	1,3-Dichlorobenzene	110000	U
106-46-7	1,4-Dichlorobenzene	110000	U
75-71-8	Dichlorodifluoromethane	220000	U
75-34-3	1,1-Dichloroethane	110000	U
107-06-2	1,2-Dichloroethane	110000	U
75-35-4	1,1-Dichloroethene	110000	U
156-59-2	cis-1,2-Dichloroethene	55000	U
156-60-5	trans-1,2-Dichloroethene	55000	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID: H7G290134 024

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC00J302
Dilution factor: 22175
Moisture %:

Date Received: 07/29/97
Date Extracted: 08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS08-3 -RE 2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	110000	U
142-28-9	1,3-Dichloropropane	110000	U
594-20-7	2,2-Dichloropropane	110000	U
563-58-6	1,1-Dichloropropene	110000	U
100-41-4	Ethylbenzene	110000	U
87-68-3	Hexachlorobutadiene	110000	U
98-82-8	Isopropylbenzene	110000	U
99-87-6	p-Isopropyltoluene	110000	U
75-09-2	Methylene chloride	110000	U
91-20-3	Naphthalene	110000	U
103-65-1	n-Propylbenzene	110000	U
100-42-5	Styrene	110000	U
630-20-6	1,1,1,2-Tetrachloroethane	110000	U
79-34-5	1,1,2,2-Tetrachloroethane	110000	U
127-18-4	**Tetrachloroethene**	**1800000**	
108-88-3	Toluene	110000	U
87-61-6	1,2,3-Trichlorobenzene	110000	U
120-82-1	1,2,4-Trichlorobenzene	110000	U
71-55-6	1,1,1-Trichloroethane	110000	U
79-00-5	1,1,2-Trichloroethane	110000	U
79-01-6	Trichloroethene	110000	U
75-69-4	Trichlorofluoromethane	220000	U
96-18-4	1,2,3-Trichloropropane	110000	U
95-63-6	1,2,4-Trimethylbenzene	110000	U
108-67-8	1,3,5-Trimethylbenzene	110000	U
75-01-4	Vinyl chloride	220000	U
95-47-6	o-Xylene	55000	U
136777-61-2	m-Xylene & p-Xylene	55000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 025

Sample WT/Vol: 5 / mL

Work Order: CC00L102

Dilution factor: 17205

Moisture %:

Date Received: 07/29/97

Date Extracted:08/02/97

Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS08-4

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	86000	U
108-86-1	Bromobenzene	86000	U
74-97-5	Bromochloromethane	86000	U
75-27-4	Bromodichloromethane	86000	U
75-25-2	Bromoform	86000	U
74-83-9	Bromomethane	170000	U
104-51-8	n-Butylbenzene	86000	U
135-98-8	sec-Butylbenzene	86000	U
98-06-6	tert-Butylbenzene	86000	U
56-23-5	Carbon tetrachloride	86000	U
108-90-7	Chlorobenzene	86000	U
124-48-1	Chlorodibromomethane	86000	U
75-00-3	Chloroethane	170000	U
67-66-3	Chloroform	86000	U
74-87-3	Chloromethane	170000	U
95-49-8	2-Chlorotoluene	86000	U
106-43-4	4-Chlorotoluene	86000	U
96-12-8	1,2-Dibromo-3-chloropropane	170000	U
106-93-4	1,2-Dibromoethane	86000	U
74-95-3	Dibromomethane	86000	U
95-50-1	1,2-Dichlorobenzene	86000	U
541-73-1	1,3-Dichlorobenzene	86000	U
106-46-7	1,4-Dichlorobenzene	86000	U
75-71-8	Dichlorodifluoromethane	170000	U
75-34-3	1,1-Dichloroethane	86000	U
107-06-2	1,2-Dichloroethane	86000	U
75-35-4	1,1-Dichloroethene	86000	U
156-59-2	cis-1,2-Dichloroethene	43000	U
156-60-5	trans-1,2-Dichloroethene	43000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 025

Sample WT/Vol: 5 / mL
Work Order: CC00L102
Dilution factor: 17205
Moisture %:

Date Received: 07/29/97
Date Extracted:08/02/97
Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS08-4

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	86000	U
142-28-9	1,3-Dichloropropane	86000	U
594-20-7	2,2-Dichloropropane	86000	U
563-58-6	1,1-Dichloropropene	86000	U
100-41-4	Ethylbenzene	86000	U
87-68-3	Hexachlorobutadiene	86000	U
98-82-8	Isopropylbenzene	86000	U
99-87-6	p-Isopropyltoluene	86000	U
75-09-2	Methylene chloride	86000	U
91-20-3	Naphthalene	86000	U
103-65-1	n-Propylbenzene	86000	U
100-42-5	Styrene	86000	U
630-20-6	1,1,1,2-Tetrachloroethane	86000	U
79-34-5	1,1,2,2-Tetrachloroethane	86000	U
127-18-4	**Tetrachloroethene**	**800000**	
108-88-3	Toluene	86000	U
87-61-6	1,2,3-Trichlorobenzene	86000	U
120-82-1	1,2,4-Trichlorobenzene	86000	U
71-55-6	1,1,1-Trichloroethane	86000	U
79-00-5	1,1,2-Trichloroethane	86000	U
79-01-6	**Trichloroethene**	**84000**	**J**
75-69-4	Trichlorofluoromethane	170000	U
96-18-4	1,2,3-Trichloropropane	86000	U
95-63-6	**1,2,4-Trimethylbenzene**	**82000**	**J**
108-67-8	**1,3,5-Trimethylbenzene**	**41000**	**J**
75-01-4	Vinyl chloride	170000	U
95-47-6	o-Xylene	43000	U
136777-61-2	m-Xylene & p-Xylene	43000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7G290134 026
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC00P102
Dilution factor: 23200
Moisture %:
Date Received: 07/29/97
Date Extracted:08/02/97
Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS08-5

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	120000	U
108-86-1	Bromobenzene	120000	U
74-97-5	Bromochloromethane	120000	U
75-27-4	Bromodichloromethane	120000	U
75-25-2	Bromoform	120000	U
74-83-9	Bromomethane	230000	U
104-51-8	n-Butylbenzene	120000	U
135-98-8	sec-Butylbenzene	120000	U
98-06-6	tert-Butylbenzene	120000	U
56-23-5	Carbon tetrachloride	120000	U
108-90-7	Chlorobenzene	120000	U
124-48-1	Chlorodibromomethane	120000	U
75-00-3	Chloroethane	230000	U
67-66-3	Chloroform	120000	U
74-87-3	Chloromethane	230000	U
95-49-8	2-Chlorotoluene	120000	U
106-43-4	4-Chlorotoluene	120000	U
96-12-8	1,2-Dibromo-3-chloropropane	230000	U
106-93-4	1,2-Dibromoethane	120000	U
74-95-3	Dibromomethane	120000	U
95-50-1	1,2-Dichlorobenzene	120000	U
541-73-1	1,3-Dichlorobenzene	120000	U
106-46-7	1,4-Dichlorobenzene	120000	U
75-71-8	Dichlorodifluoromethane	230000	U
75-34-3	1,1-Dichloroethane	120000	U
107-06-2	1,2-Dichloroethane	120000	U
75-35-4	1,1-Dichloroethene	120000	U
156-59-2	cis-1,2-Dichloroethene	58000	U
156-60-5	trans-1,2-Dichloroethene	58000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 026

Sample WT/Vol: 5 / mL

Work Order: CC00P102

Dilution factor: 23200

Moisture %:

Date Received: 07/29/97

Date Extracted:08/02/97

Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS08-5

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	120000	U
142-28-9	1,3-Dichloropropane	120000	U
594-20-7	2,2-Dichloropropane	120000	U
563-58-6	1,1-Dichloropropene	120000	U
100-41-4	Ethylbenzene	120000	U
87-68-3	Hexachlorobutadiene	120000	U
98-82-8	Isopropylbenzene	120000	U
99-87-6	p-Isopropyltoluene	120000	U
75-09-2	Methylene chloride	120000	U
91-20-3	Naphthalene	120000	U
103-65-1	n-Propylbenzene	120000	U
100-42-5	Styrene	120000	U
630-20-6	1,1,1,2-Tetrachloroethane	120000	U
79-34-5	1,1,2,2-Tetrachloroethane	120000	U
127-18-4	**Tetrachloroethene**	**1100000**	
108-88-3	Toluene	120000	U
87-61-6	1,2,3-Trichlorobenzene	120000	U
120-82-1	1,2,4-Trichlorobenzene	120000	U
71-55-6	1,1,1-Trichloroethane	120000	U
79-00-5	1,1,2-Trichloroethane	120000	U
79-01-6	**Trichloroethene**	**180000**	
75-69-4	Trichlorofluoromethane	230000	U
96-18-4	1,2,3-Trichloropropane	120000	U
95-63-6	**1,2,4-Trimethylbenzene**	**160000**	
108-67-8	**1,3,5-Trimethylbenzene**	**81000**	J
75-01-4	Vinyl chloride	230000	U
95-47-6	o-Xylene	58000	U
136777-61-2	m-Xylene & p-Xylene	58000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 029

Sample WT/Vol: 5 / mL

Work Order: CC00T202

Dilution factor: 2920

Moisture %:

Date Received: 07/29/97

Date Extracted:08/03/97

Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS09-1 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	15000	U
108-86-1	Bromobenzene	15000	U
74-97-5	Bromochloromethane	15000	U
75-27-4	Bromodichloromethane	15000	U
75-25-2	Bromoform	15000	U
74-83-9	Bromomethane	29000	U
104-51-8	n-Butylbenzene	15000	U
135-98-8	sec-Butylbenzene	15000	U
98-06-6	tert-Butylbenzene	15000	U
56-23-5	Carbon tetrachloride	15000	U
108-90-7	Chlorobenzene	15000	U
124-48-1	Chlorodibromomethane	15000	U
75-00-3	Chloroethane	29000	U
67-66-3	Chloroform	15000	U
74-87-3	Chloromethane	29000	U
95-49-8	2-Chlorotoluene	15000	U
106-43-4	4-Chlorotoluene	15000	U
96-12-8	1,2-Dibromo-3-chloropropane	29000	U
106-93-4	1,2-Dibromoethane	15000	U
74-95-3	Dibromomethane	15000	U
95-50-1	1,2-Dichlorobenzene	15000	U
541-73-1	1,3-Dichlorobenzene	15000	U
106-46-7	1,4-Dichlorobenzene	15000	U
75-71-8	Dichlorodifluoromethane	29000	U
75-34-3	1,1-Dichloroethane	15000	U
107-06-2	1,2-Dichloroethane	15000	U
75-35-4	1,1-Dichloroethene	15000	U
156-59-2	cis-1,2-Dichloroethene	7300	U
156-60-5	trans-1,2-Dichloroethene	7300	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 029

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC00T202
Dilution factor: 2920
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS09-1 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	15000	U
142-28-9	1,3-Dichloropropane	15000	U
594-20-7	2,2-Dichloropropane	15000	U
563-58-6	1,1-Dichloropropene	15000	U
100-41-4	Ethylbenzene	15000	U
87-68-3	Hexachlorobutadiene	15000	U
98-82-8	Isopropylbenzene	15000	U
99-87-6	p-Isopropyltoluene	15000	U
75-09-2	Methylene chloride	15000	U
91-20-3	Naphthalene	15000	U
103-65-1	n-Propylbenzene	15000	U
100-42-5	Styrene	15000	U
630-20-6	1,1,1,2-Tetrachloroethane	15000	U
79-34-5	1,1,2,2-Tetrachloroethane	15000	U
127-18-4	**Tetrachloroethene**	**110000**	
108-88-3	Toluene	15000	U
87-61-6	1,2,3-Trichlorobenzene	15000	U
120-82-1	1,2,4-Trichlorobenzene	15000	U
71-55-6	1,1,1-Trichloroethane	15000	U
79-00-5	1,1,2-Trichloroethane	15000	U
79-01-6	Trichloroethene	15000	U
75-69-4	Trichlorofluoromethane	29000	U
96-18-4	1,2,3-Trichloropropane	15000	U
95-63-6	1,2,4-Trimethylbenzene	15000	U
108-67-8	1,3,5-Trimethylbenzene	15000	U
75-01-4	Vinyl chloride	29000	U
95-47-6	o-Xylene	7300	U
136777-61-2	m-Xylene & p-Xylene	7300	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 030

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC00V202
Dilution factor: 175
Moisture %:

Date Received: 07/29/97
Date Extracted:08/02/97
Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS09-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	880	U
108-86-1	Bromobenzene	880	U
74-97-5	Bromochloromethane	880	U
75-27-4	Bromodichloromethane	880	U
75-25-2	Bromoform	880	U
74-83-9	Bromomethane	1800	U
104-51-8	n-Butylbenzene	880	U
135-98-8	sec-Butylbenzene	880	U
98-06-6	tert-Butylbenzene	880	U
56-23-5	Carbon tetrachloride	880	U
108-90-7	Chlorobenzene	880	U
124-48-1	Chlorodibromomethane	880	U
75-00-3	Chloroethane	1800	U
67-66-3	Chloroform	880	U
74-87-3	Chloromethane	1800	U
95-49-8	2-Chlorotoluene	880	U
106-43-4	4-Chlorotoluene	880	U
96-12-8	1,2-Dibromo-3-chloropropane	1800	U
106-93-4	1,2-Dibromoethane	880	U
74-95-3	Dibromomethane	880	U
95-50-1	1,2-Dichlorobenzene	880	U
541-73-1	1,3-Dichlorobenzene	880	U
106-46-7	1,4-Dichlorobenzene	880	U
75-71-8	Dichlorodifluoromethane	1800	U
75-34-3	1,1-Dichloroethane	880	U
107-06-2	1,2-Dichloroethane	880	U
75-35-4	1,1-Dichloroethene	880	U
156-59-2	cis-1,2-Dichloroethene	440	U
156-60-5	trans-1,2-Dichloroethene	440	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 030

Sample WT/Vol: 5 / mL

Work Order: CC00V202

Dilution factor: 175

Moisture %:

Date Received: 07/29/97

Date Extracted:08/02/97

Date Analyzed: 08/02/97

QC Batch: 7214118

Client Sample Id: IS09-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	880	U
142-28-9	1,3-Dichloropropane	880	U
594-20-7	2,2-Dichloropropane	880	U
563-58-6	1,1-Dichloropropene	880	U
100-41-4	Ethylbenzene	880	U
87-68-3	Hexachlorobutadiene	880	U
98-82-8	Isopropylbenzene	880	U
99-87-6	p-Isopropyltoluene	880	U
75-09-2	Methylene chloride	880	U
91-20-3	Naphthalene	880	U
103-65-1	n-Propylbenzene	880	U
100-42-5	Styrene	880	U
630-20-6	1,1,1,2-Tetrachloroethane	880	U
79-34-5	1,1,2,2-Tetrachloroethane	880	U
127-18-4	**Tetrachloroethene**	**15000**	
108-88-3	Toluene	880	U
87-61-6	1,2,3-Trichlorobenzene	880	U
120-82-1	1,2,4-Trichlorobenzene	880	U
71-55-6	1,1,1-Trichloroethane	880	U
79-00-5	1,1,2-Trichloroethane	880	U
79-01-6	Trichloroethene	880	U
75-69-4	Trichlorofluoromethane	1800	U
96-18-4	1,2,3-Trichloropropane	880	U
95-63-6	1,2,4-Trimethylbenzene	880	U
108-67-8	1,3,5-Trimethylbenzene	880	U
75-01-4	Vinyl chloride	1800	U
95-47-6	o-Xylene	440	U
136777-61-2	m-Xylene & p-Xylene	440	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 031

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC00W202
Dilution factor: 325
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS10-1 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	1600	U
108-86-1	Bromobenzene	1600	U
74-97-5	Bromochloromethane	1600	U
75-27-4	Bromodichloromethane	1600	U
75-25-2	Bromoform	1600	U
74-83-9	Bromomethane	3200	U
104-51-8	n-Butylbenzene	1600	U
135-98-8	sec-Butylbenzene	1600	U
98-06-6	tert-Butylbenzene	1600	U
56-23-5	Carbon tetrachloride	1600	U
108-90-7	Chlorobenzene	1600	U
124-48-1	Chlorodibromomethane	1600	U
75-00-3	Chloroethane	3200	U
67-66-3	Chloroform	1600	U
74-87-3	Chloromethane	3200	U
95-49-8	2-Chlorotoluene	1600	U
106-43-4	4-Chlorotoluene	1600	U
96-12-8	1,2-Dibromo-3-chloropropane	3200	U
106-93-4	1,2-Dibromoethane	1600	U
74-95-3	Dibromomethane	1600	U
95-50-1	1,2-Dichlorobenzene	1600	U
541-73-1	1,3-Dichlorobenzene	1600	U
106-46-7	1,4-Dichlorobenzene	1600	U
75-71-8	Dichlorodifluoromethane	3200	U
75-34-3	1,1-Dichloroethane	1600	U
107-06-2	1,2-Dichloroethane	1600	U
75-35-4	1,1-Dichloroethene	1600	U
156-59-2	**cis-1,2-Dichloroethene**	**2200**	
156-60-5	trans-1,2-Dichloroethene	810	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 031

Sample WT/Vol: 5 / mL
Work Order: CC00W202
Dilution factor: 325
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS10-1 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	1600	U
142-28-9	1,3-Dichloropropane	1600	U
594-20-7	2,2-Dichloropropane	1600	U
563-58-6	1,1-Dichloropropene	1600	U
100-41-4	Ethylbenzene	1600	U
87-68-3	Hexachlorobutadiene	1600	U
98-82-8	Isopropylbenzene	1600	U
99-87-6	p-Isopropyltoluene	1600	U
75-09-2	Methylene chloride	1600	U
91-20-3	**Naphthalene**	**440**	J B
103-65-1	n-Propylbenzene	1600	U
100-42-5	Styrene	1600	U
630-20-6	1,1,1,2-Tetrachloroethane	1600	U
79-34-5	1,1,2,2-Tetrachloroethane	1600	U
127-18-4	**Tetrachloroethene**	**48000**	
108-88-3	Toluene	1600	U
87-61-6	1,2,3-Trichlorobenzene	1600	U
120-82-1	1,2,4-Trichlorobenzene	1600	U
71-55-6	1,1,1-Trichloroethane	1600	U
79-00-5	1,1,2-Trichloroethane	1600	U
79-01-6	**Trichloroethene**	**2200**	
75-69-4	Trichlorofluoromethane	3200	U
96-18-4	1,2,3-Trichloropropane	1600	U
95-63-6	1,2,4-Trimethylbenzene	1600	U
108-67-8	1,3,5-Trimethylbenzene	1600	U
75-01-4	Vinyl chloride	3200	U
95-47-6	o-Xylene	810	U
136777-61-2	m-Xylene & p-Xylene	810	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 032

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC00X202
Dilution factor: 130
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS10-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	650	U
108-86-1	Bromobenzene	650	U
74-97-5	Bromochloromethane	650	U
75-27-4	Bromodichloromethane	650	U
75-25-2	Bromoform	650	U
74-83-9	Bromomethane	1300	U
104-51-8	n-Butylbenzene	650	U
135-98-8	sec-Butylbenzene	650	U
98-06-6	tert-Butylbenzene	650	U
56-23-5	Carbon tetrachloride	650	U
108-90-7	Chlorobenzene	650	U
124-48-1	Chlorodibromomethane	650	U
75-00-3	Chloroethane	1300	U
67-66-3	Chloroform	650	U
74-87-3	Chloromethane	1300	U
95-49-8	2-Chlorotoluene	650	U
106-43-4	4-Chlorotoluene	650	U
96-12-8	1,2-Dibromo-3-chloropropane	1300	U
106-93-4	1,2-Dibromoethane	650	U
74-95-3	Dibromomethane	650	U
95-50-1	1,2-Dichlorobenzene	650	U
541-73-1	1,3-Dichlorobenzene	650	U
106-46-7	1,4-Dichlorobenzene	650	U
75-71-8	Dichlorodifluoromethane	1300	U
75-34-3	1,1-Dichloroethane	650	U
107-06-2	1,2-Dichloroethane	650	U
75-35-4	1,1-Dichloroethene	650	U
156-59-2	**cis-1,2-Dichloroethene**	**600**	
156-60-5	trans-1,2-Dichloroethene	320	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 032

Sample WT/Vol: 5 / mL
Work Order: CC00X202
Dilution factor: 130
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS10-2 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	650	U
142-28-9	1,3-Dichloropropane	650	U
594-20-7	2,2-Dichloropropane	650	U
563-58-6	1,1-Dichloropropene	650	U
100-41-4	Ethylbenzene	650	U
87-68-3	Hexachlorobutadiene	650	U
98-82-8	Isopropylbenzene	650	U
99-87-6	p-Isopropyltoluene	650	U
75-09-2	Methylene chloride	650	U
91-20-3	Naphthalene	650	U
103-65-1	n-Propylbenzene	650	U
100-42-5	Styrene	650	U
630-20-6	1,1,1,2-Tetrachloroethane	650	U
79-34-5	1,1,2,2-Tetrachloroethane	650	U
127-18-4	**Tetrachloroethene**	**16000**	
108-88-3	Toluene	650	U
87-61-6	1,2,3-Trichlorobenzene	650	U
120-82-1	1,2,4-Trichlorobenzene	650	U
71-55-6	1,1,1-Trichloroethane	650	U
79-00-5	1,1,2-Trichloroethane	650	U
79-01-6	**Trichloroethene**	**500**	J
75-69-4	Trichlorofluoromethane	1300	U
96-18-4	1,2,3-Trichloropropane	650	U
95-63-6	1,2,4-Trimethylbenzene	650	U
108-67-8	1,3,5-Trimethylbenzene	650	U
75-01-4	Vinyl chloride	1300	U
95-47-6	o-Xylene	320	U
136777-61-2	m-Xylene & p-Xylene	320	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 033

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL

Date Received: 07/29/97

Work Order: CC010202

Date Extracted:08/03/97

Dilution factor: 279950

Date Analyzed: 08/03/97

Moisture %:

QC Batch: 7215125

Client Sample Id: IS10-3 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	1400000	U
108-86-1	Bromobenzene	1400000	U
74-97-5	Bromochloromethane	1400000	U
75-27-4	Bromodichloromethane	1400000	U
75-25-2	Bromoform	1400000	U
74-83-9	Bromomethane	2800000	U
104-51-8	n-Butylbenzene	1400000	U
135-98-8	sec-Butylbenzene	1400000	U
98-06-6	tert-Butylbenzene	1400000	U
56-23-5	Carbon tetrachloride	1400000	U
108-90-7	Chlorobenzene	1400000	U
124-48-1	Chlorodibromomethane	1400000	U
75-00-3	Chloroethane	2800000	U
67-66-3	Chloroform	1400000	U
74-87-3	Chloromethane	2800000	U
95-49-8	2-Chlorotoluene	1400000	U
106-43-4	4-Chlorotoluene	1400000	U
96-12-8	1,2-Dibromo-3-chloropropane	2800000	U
106-93-4	1,2-Dibromoethane	1400000	U
74-95-3	Dibromomethane	1400000	U
95-50-1	1,2-Dichlorobenzene	1400000	U
541-73-1	1,3-Dichlorobenzene	1400000	U
106-46-7	1,4-Dichlorobenzene	1400000	U
75-71-8	Dichlorodifluoromethane	2800000	U
75-34-3	1,1-Dichloroethane	1400000	U
107-06-2	1,2-Dichloroethane	1400000	U
75-35-4	1,1-Dichloroethene	1400000	U
156-59-2	cis-1,2-Dichloroethene	700000	U
156-60-5	trans-1,2-Dichloroethene	700000	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID: H7G290134 033

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC010202
Dilution factor: 279950
Moisture %:

Date Received: 07/29/97
Date Extracted: 08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS10-3 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	1400000	U
142-28-9	1,3-Dichloropropane	1400000	U
594-20-7	2,2-Dichloropropane	1400000	U
563-58-6	1,1-Dichloropropene	1400000	U
100-41-4	Ethylbenzene	1400000	U
87-68-3	Hexachlorobutadiene	1400000	U
98-82-8	Isopropylbenzene	1400000	U
99-87-6	p-Isopropyltoluene	1400000	U
75-09-2	Methylene chloride	1400000	U
91-20-3	Naphthalene	1400000	U
103-65-1	n-Propylbenzene	1400000	U
100-42-5	Styrene	1400000	U
630-20-6	1,1,1,2-Tetrachloroethane	1400000	U
79-34-5	1,1,2,2-Tetrachloroethane	1400000	U
127-18-4	**Tetrachloroethene**	**19000000**	
108-88-3	Toluene	1400000	U
87-61-6	1,2,3-Trichlorobenzene	1400000	U
120-82-1	1,2,4-Trichlorobenzene	1400000	U
71-55-6	1,1,1-Trichloroethane	1400000	U
79-00-5	1,1,2-Trichloroethane	1400000	U
79-01-6	Trichloroethene	1400000	U
75-69-4	Trichlorofluoromethane	2800000	U
96-18-4	1,2,3-Trichloropropane	1400000	U
95-63-6	1,2,4-Trimethylbenzene	1400000	U
108-67-8	1,3,5-Trimethylbenzene	1400000	U
75-01-4	Vinyl chloride	2800000	U
95-47-6	o-Xylene	700000	U
136777-61-2	m-Xylene & p-Xylene	700000	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA	SDG Number:
Matrix: (soil/water) SOLID	Lab Sample ID: H7G290134 034
Method: SW846 8260A Volatile Organics, GC/MS (8260A)	
Sample WT/Vol: 5 / mL	Date Received: 07/29/97
Work Order: CC011202	Date Extracted: 08/03/97
Dilution factor: 30995	Date Analyzed: 08/03/97
Moisture %:	
	QC Batch: 7215125
Client Sample Id: IS10-4 -RE 1	

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	150000	U
108-86-1	Bromobenzene	150000	U
74-97-5	Bromochloromethane	150000	U
75-27-4	Bromodichloromethane	150000	U
75-25-2	Bromoform	150000	U
74-83-9	Bromomethane	310000	U
104-51-8	n-Butylbenzene	150000	U
135-98-8	sec-Butylbenzene	150000	U
98-06-6	tert-Butylbenzene	150000	U
56-23-5	Carbon tetrachloride	150000	U
108-90-7	Chlorobenzene	150000	U
124-48-1	Chlorodibromomethane	150000	U
75-00-3	Chloroethane	310000	U
67-66-3	Chloroform	150000	U
74-87-3	Chloromethane	310000	U
95-49-8	2-Chlorotoluene	150000	U
106-43-4	4-Chlorotoluene	150000	U
96-12-8	1,2-Dibromo-3-chloropropane	310000	U
106-93-4	1,2-Dibromoethane	150000	U
74-95-3	Dibromomethane	150000	U
95-50-1	1,2-Dichlorobenzene	150000	U
541-73-1	1,3-Dichlorobenzene	150000	U
106-46-7	1,4-Dichlorobenzene	150000	U
75-71-8	Dichlorodifluoromethane	310000	U
75-34-3	1,1-Dichloroethane	150000	U
107-06-2	1,2-Dichloroethane	150000	U
75-35-4	1,1-Dichloroethene	150000	U
156-59-2	cis-1,2-Dichloroethene	77000	U
156-60-5	trans-1,2-Dichloroethene	77000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7G290134 034

Sample WT/Vol: 5 / mL
Work Order: CC011202
Dilution factor: 30995
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS10-4 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	150000	U
142-28-9	1,3-Dichloropropane	150000	U
594-20-7	2,2-Dichloropropane	150000	U
563-58-6	1,1-Dichloropropene	150000	U
100-41-4	Ethylbenzene	150000	U
87-68-3	Hexachlorobutadiene	150000	U
98-82-8	Isopropylbenzene	150000	U
99-87-6	p-Isopropyltoluene	150000	U
75-09-2	Methylene chloride	150000	U
91-20-3	Naphthalene	150000	U
103-65-1	n-Propylbenzene	150000	U
100-42-5	Styrene	150000	U
630-20-6	1,1,1,2-Tetrachloroethane	150000	U
79-34-5	1,1,2,2-Tetrachloroethane	150000	U
127-18-4	**Tetrachloroethene**	**2900000**	
108-88-3	Toluene	150000	U
87-61-6	1,2,3-Trichlorobenzene	150000	U
120-82-1	1,2,4-Trichlorobenzene	150000	U
71-55-6	1,1,1-Trichloroethane	150000	U
79-00-5	1,1,2-Trichloroethane	150000	U
79-01-6	Trichloroethene	150000	U
75-69-4	Trichlorofluoromethane	310000	U
96-18-4	1,2,3-Trichloropropane	150000	U
95-63-6	1,2,4-Trimethylbenzene	150000	U
108-67-8	1,3,5-Trimethylbenzene	150000	U
75-01-4	Vinyl chloride	310000	U
95-47-6	o-Xylene	77000	U
136777-61-2	m-Xylene & p-Xylene	77000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7G290134 035
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Date Received: 07/29/97
Work Order: CC012302
Date Extracted:08/03/97
Dilution factor: 71620
Date Analyzed: 08/03/97
Moisture %:

QC Batch: 7215125

Client Sample Id: IS11-1 -RE 2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	360000	U
108-86-1	Bromobenzene	360000	U
74-97-5	Bromochloromethane	360000	U
75-27-4	Bromodichloromethane	360000	U
75-25-2	Bromoform	360000	U
74-83-9	Bromomethane	720000	U
104-51-8	n-Butylbenzene	360000	U
135-98-8	sec-Butylbenzene	360000	U
98-06-6	tert-Butylbenzene	360000	U
56-23-5	Carbon tetrachloride	360000	U
108-90-7	Chlorobenzene	360000	U
124-48-1	Chlorodibromomethane	360000	U
75-00-3	Chloroethane	720000	U
67-66-3	Chloroform	360000	U
74-87-3	Chloromethane	720000	U
95-49-8	2-Chlorotoluene	360000	U
106-43-4	4-Chlorotoluene	360000	U
96-12-8	1,2-Dibromo-3-chloropropane	720000	U
106-93-4	1,2-Dibromoethane	360000	U
74-95-3	Dibromomethane	360000	U
95-50-1	1,2-Dichlorobenzene	360000	U
541-73-1	1,3-Dichlorobenzene	360000	U
106-46-7	1,4-Dichlorobenzene	360000	U
75-71-8	Dichlorodifluoromethane	720000	U
75-34-3	1,1-Dichloroethane	360000	U
107-06-2	1,2-Dichloroethane	360000	U
75-35-4	1,1-Dichloroethene	360000	U
156-59-2	cis-1,2-Dichloroethene	180000	U
156-60-5	trans-1,2-Dichloroethene	180000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7G290134 035

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 5 / mL
Work Order: CC012302
Dilution factor: 71620
Moisture %:

Date Received: 07/29/97
Date Extracted:08/03/97
Date Analyzed: 08/03/97

QC Batch: 7215125

Client Sample Id: IS11-1 -RE 2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	360000	U
142-28-9	1,3-Dichloropropane	360000	U
594-20-7	2,2-Dichloropropane	360000	U
563-58-6	1,1-Dichloropropene	360000	U
100-41-4	Ethylbenzene	360000	U
87-68-3	Hexachlorobutadiene	360000	U
98-82-8	Isopropylbenzene	360000	U
99-87-6	p-Isopropyltoluene	360000	U
75-09-2	**Methylene chloride**	**190000**	**J**
91-20-3	Naphthalene	360000	U
103-65-1	n-Propylbenzene	360000	U
100-42-5	Styrene	360000	U
630-20-6	1,1,1,2-Tetrachloroethane	360000	U
79-34-5	1,1,2,2-Tetrachloroethane	360000	U
127-18-4	**Tetrachloroethene**	**9500000**	
108-88-3	Toluene	360000	U
87-61-6	1,2,3-Trichlorobenzene	360000	U
120-82-1	1,2,4-Trichlorobenzene	360000	U
71-55-6	1,1,1-Trichloroethane	360000	U
79-00-5	1,1,2-Trichloroethane	360000	U
79-01-6	Trichloroethene	360000	U
75-69-4	Trichlorofluoromethane	720000	U
96-18-4	1,2,3-Trichloropropane	360000	U
95-63-6	1,2,4-Trimethylbenzene	360000	U
108-67-8	1,3,5-Trimethylbenzene	360000	U
75-01-4	Vinyl chloride	720000	U
95-47-6	o-Xylene	180000	U
136777-61-2	m-Xylene & p-Xylene	180000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7H220203 001

Sample WT/Vol: 21.3 / g
Work Order: CCF0C101
Dilution factor: 360
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/27/97

QC Batch: 7239123

Client Sample Id: IR88IS12-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	1800	U
108-86-1	Bromobenzene	1800	U
74-97-5	Bromochloromethane	1800	U
75-27-4	Bromodichloromethane	1800	U
75-25-2	Bromoform	1800	U
74-83-9	Bromomethane	3600	U
104-51-8	n-Butylbenzene	1800	U
135-98-8	sec-Butylbenzene	1800	U
98-06-6	tert-Butylbenzene	1800	U
56-23-5	Carbon tetrachloride	1800	U
108-90-7	Chlorobenzene	1800	U
124-48-1	Chlorodibromomethane	1800	U
75-00-3	Chloroethane	3600	U
67-66-3	Chloroform	1800	U
74-87-3	Chloromethane	3600	U
95-49-8	2-Chlorotoluene	1800	U
106-43-4	4-Chlorotoluene	1800	U
96-12-8	1,2-Dibromo-3-chloropropane	3600	U
106-93-4	1,2-Dibromoethane	1800	U
74-95-3	Dibromomethane	1800	U
95-50-1	1,2-Dichlorobenzene	1800	U
541-73-1	1,3-Dichlorobenzene	1800	U
106-46-7	1,4-Dichlorobenzene	1800	U
75-71-8	Dichlorodifluoromethane	3600	U
75-34-3	1,1-Dichloroethane	1800	U
107-06-2	1,2-Dichloroethane	1800	U
75-35-4	1,1-Dichloroethene	1800	U
156-59-2	cis-1,2-Dichloroethene	900	U
156-60-5	trans-1,2-Dichloroethene	900	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID: H7H220203 001

Sample WT/Vol: 21.3 / g
Work Order: CCF0C101
Dilution factor: 360
Moisture %:
Date Received: 08/22/97
Date Extracted: 08/27/97
Date Analyzed: 08/27/97

QC Batch: 7239123

Client Sample Id: IR88IS12-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	1800	U
142-28-9	1,3-Dichloropropane	1800	U
594-20-7	2,2-Dichloropropane	1800	U
563-58-6	1,1-Dichloropropene	1800	U
100-41-4	Ethylbenzene	1800	U
87-68-3	Hexachlorobutadiene	1800	U
98-82-8	Isopropylbenzene	1800	U
99-87-6	p-Isopropyltoluene	1800	U
75-09-2	**Methylene chloride**	**1000**	**J B**
91-20-3	Naphthalene	1800	U
103-65-1	n-Propylbenzene	1800	U
100-42-5	Styrene	1800	U
630-20-6	1,1,1,2-Tetrachloroethane	1800	U
79-34-5	1,1,2,2-Tetrachloroethane	1800	U
127-18-4	**Tetrachloroethene**	**37000**	
108-88-3	Toluene	1800	U
87-61-6	1,2,3-Trichlorobenzene	1800	U
120-82-1	1,2,4-Trichlorobenzene	1800	U
71-55-6	1,1,1-Trichloroethane	1800	U
79-00-5	1,1,2-Trichloroethane	1800	U
79-01-6	Trichloroethene	1800	U
75-69-4	Trichlorofluoromethane	3600	U
96-18-4	1,2,3-Trichloropropane	1800	U
95-63-6	1,2,4-Trimethylbenzene	1800	U
108-67-8	1,3,5-Trimethylbenzene	1800	U
75-01-4	Vinyl chloride	3600	U
95-47-6	o-Xylene	900	U
136777-61-2	m-Xylene & p-Xylene	900	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number: ·

Matrix: (soil/water) SOLID

Lab Sample ID:H7H220203 002

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 14.1 / g
Work Order: CCF0M101
Dilution factor: 208
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/27/97

QC Batch: 7239123

Client Sample Id: IR88IS12-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	1000	U
108-86-1	Bromobenzene	1000	U
74-97-5	Bromochloromethane	1000	U
75-27-4	Bromodichloromethane	1000	U
75-25-2	Bromoform	1000	U
74-83-9	Bromomethane	2100	U
104-51-8	n-Butylbenzene	1000	U
135-98-8	sec-Butylbenzene	1000	U
98-06-6	tert-Butylbenzene	1000	U
56-23-5	Carbon tetrachloride	1000	U
108-90-7	Chlorobenzene	1000	U
124-48-1	Chlorodibromomethane	1000	U
75-00-3	Chloroethane	2100	U
67-66-3	Chloroform	1000	U
74-87-3	Chloromethane	2100	U
95-49-8	2-Chlorotoluene	1000	U
106-43-4	4-Chlorotoluene	1000	U
96-12-8	1,2-Dibromo-3-chloropropane	2100	U
106-93-4	1,2-Dibromoethane	1000	U
74-95-3	Dibromomethane	1000	U
95-50-1	1,2-Dichlorobenzene	1000	U
541-73-1	1,3-Dichlorobenzene	1000	U
106-46-7	1,4-Dichlorobenzene	1000	U
75-71-8	Dichlorodifluoromethane	2100	U
75-34-3	1,1-Dichloroethane	1000	U
107-06-2	1,2-Dichloroethane	1000	U
75-35-4	1,1-Dichloroethene	1000	U
156-59-2	cis-1,2-Dichloroethene	520	U
156-60-5	trans-1,2-Dichloroethene	520	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID: H7H220203 002

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 14.1 / g
Work Order: CCF0M101
Dilution factor: 208
Moisture %:

Date Received: 08/22/97
Date Extracted: 08/27/97
Date Analyzed: 08/27/97

QC Batch: 7239123

Client Sample Id: IR88IS12-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	1000	U
142-28-9	1,3-Dichloropropane	1000	U
594-20-7	2,2-Dichloropropane	1000	U
563-58-6	1,1-Dichloropropene	1000	U
100-41-4	Ethylbenzene	1000	U
87-68-3	Hexachlorobutadiene	1000	U
98-82-8	Isopropylbenzene	1000	U
99-87-6	p-Isopropyltoluene	1000	U
75-09-2	**Methylene chloride**	**520**	**J B**
91-20-3	Naphthalene	1000	U
103-65-1	n-Propylbenzene	1000	U
100-42-5	Styrene	1000	U
630-20-6	1,1,1,2-Tetrachloroethane	1000	U
79-34-5	1,1,2,2-Tetrachloroethane	1000	U
127-18-4	**Tetrachloroethene**	**20000**	
108-88-3	Toluene	1000	U
87-61-6	1,2,3-Trichlorobenzene	1000	U
120-82-1	1,2,4-Trichlorobenzene	1000	U
71-55-6	1,1,1-Trichloroethane	1000	U
79-00-5	1,1,2-Trichloroethane	1000	U
79-01-6	**Trichloroethene**	**160**	
75-69-4	Trichlorofluoromethane	2100	U
96-18-4	1,2,3-Trichloropropane	1000	U
95-63-6	1,2,4-Trimethylbenzene	1000	U
108-67-8	1,3,5-Trimethylbenzene	1000	U
75-01-4	Vinyl chloride	2100	U
95-47-6	o-Xylene	520	U
136777-61-2	m-Xylene & p-Xylene	520	U

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID: H7H220203 003

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 17.9 / g
Work Order: CCF0N101
Dilution factor: 171.2
Moisture %:

Date Received: 08/22/97
Date Extracted: 08/27/97
Date Analyzed: 08/27/97

QC Batch: 7239123

Client Sample Id: IR88IS12-03

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	860	U
108-86-1	Bromobenzene	860	U
74-97-5	Bromochloromethane	860	U
75-27-4	Bromodichloromethane	860	U
75-25-2	Bromoform	860	U
74-83-9	Bromomethane	1700	U
104-51-8	n-Butylbenzene	860	U
135-98-8	sec-Butylbenzene	860	U
98-06-6	tert-Butylbenzene	860	U
56-23-5	Carbon tetrachloride	860	U
108-90-7	Chlorobenzene	860	U
124-48-1	Chlorodibromomethane	860	U
75-00-3	Chloroethane	1700	U
67-66-3	Chloroform	860	U
74-87-3	Chloromethane	1700	U
95-49-8	2-Chlorotoluene	860	U
106-43-4	4-Chlorotoluene	860	U
96-12-8	1,2-Dibromo-3-chloropropane	1700	U
106-93-4	1,2-Dibromoethane	860	U
74-95-3	Dibromomethane	860	U
95-50-1	1,2-Dichlorobenzene	860	U
541-73-1	1,3-Dichlorobenzene	860	U
106-46-7	1,4-Dichlorobenzene	860	U
75-71-8	Dichlorodifluoromethane	1700	U
75-34-3	1,1-Dichloroethane	860	U
107-06-2	1,2-Dichloroethane	860	U
75-35-4	1,1-Dichloroethene	860	U
156-59-2	cis-1,2-Dichloroethene	430	U
156-60-5	trans-1,2-Dichloroethene	430	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID:H7H220203 003

Sample WT/Vol: 17.9 / g
Work Order: CCF0N101
Dilution factor: 171.2
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/27/97

QC Batch: 7239123

Client Sample Id: IR88IS12-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	860	U
142-28-9	1,3-Dichloropropane	860	U
594-20-7	2,2-Dichloropropane	860	U
563-58-6	1,1-Dichloropropene	860	U
100-41-4	Ethylbenzene	860	U
87-68-3	Hexachlorobutadiene	860	U
98-82-8	Isopropylbenzene	860	U
99-87-6	p-Isopropyltoluene	860	U
75-09-2	**Methylene chloride**	**510**	**J B**
91-20-3	Naphthalene	860	U
103-65-1	n-Propylbenzene	860	U
100-42-5	Styrene	860	U
630-20-6	1,1,1,2-Tetrachloroethane	860	U
79-34-5	1,1,2,2-Tetrachloroethane	860	U
127-18-4	**Tetrachloroethene**	**25000**	
108-88-3	Toluene	860	U
87-61-6	1,2,3-Trichlorobenzene	860	U
120-82-1	1,2,4-Trichlorobenzene	860	U
71-55-6	1,1,1-Trichloroethane	860	U
79-00-5	1,1,2-Trichloroethane	860	U
79-01-6	Trichloroethene	860	U
75-69-4	Trichlorofluoromethane	1700	U
96-18-4	1,2,3-Trichloropropane	860	U
95-63-6	1,2,4-Trimethylbenzene	860	U
108-67-8	1,3,5-Trimethylbenzene	860	U
75-01-4	Vinyl chloride	1700	U
95-47-6	o-Xylene	430	U
136777-61-2	m-Xylene & p-Xylene	430	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA
SDG Number: ·

Matrix: (soil/water) SOLID
Lab Sample ID: H7H220203 004
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 22.7 / g
Work Order: CCF0P201
Dilution factor: 48979
Moisture %:

Date Received: 08/22/97
Date Extracted: 08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IS13-01 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	240000	U
108-86-1	Bromobenzene	240000	U
74-97-5	Bromochloromethane	240000	U
75-27-4	Bromodichloromethane	240000	U
75-25-2	Bromoform	240000	U
74-83-9	Bromomethane	490000	U
104-51-8	n-Butylbenzene	240000	U
135-98-8	sec-Butylbenzene	240000	U
98-06-6	tert-Butylbenzene	240000	U
56-23-5	Carbon tetrachloride	240000	U
108-90-7	Chlorobenzene	240000	U
124-48-1	Chlorodibromomethane	240000	U
75-00-3	Chloroethane	490000	U
67-66-3	Chloroform	240000	U
74-87-3	Chloromethane	490000	U
95-49-8	2-Chlorotoluene	240000	U
106-43-4	4-Chlorotoluene	240000	U
96-12-8	1,2-Dibromo-3-chloropropane	490000	U
106-93-4	1,2-Dibromoethane	240000	U
74-95-3	Dibromomethane	240000	U
95-50-1	1,2-Dichlorobenzene	240000	U
541-73-1	1,3-Dichlorobenzene	240000	U
106-46-7	1,4-Dichlorobenzene	240000	U
75-71-8	Dichlorodifluoromethane	490000	U
75-34-3	1,1-Dichloroethane	240000	U
107-06-2	1,2-Dichloroethane	240000	U
75-35-4	1,1-Dichloroethene	240000	U
156-59-2	cis-1,2-Dichloroethene	120000	U
156-60-5	trans-1,2-Dichloroethene	120000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7H220203 004
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 22.7 / g
Work Order: CCF0P201
Dilution factor: 48979
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IS13-01 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	240000	U
142-28-9	1,3-Dichloropropane	240000	U
594-20-7	2,2-Dichloropropane	240000	U
563-58-6	1,1-Dichloropropene	240000	U
100-41-4	Ethylbenzene	240000	U
87-68-3	Hexachlorobutadiene	240000	U
98-82-8	Isopropylbenzene	240000	U
99-87-6	p-Isopropyltoluene	240000	U
75-09-2	Methylene chloride	240000	U
91-20-3	Naphthalene	240000	U
103-65-1	n-Propylbenzene	240000	U
100-42-5	Styrene	240000	U
630-20-6	1,1,1,2-Tetrachloroethane	240000	U
79-34-5	1,1,2,2-Tetrachloroethane	240000	U
127-18-4	**Tetrachloroethene**	**5500000**	
108-88-3	Toluene	240000	U
87-61-6	1,2,3-Trichlorobenzene	240000	U
120-82-1	1,2,4-Trichlorobenzene	240000	U
71-55-6	1,1,1-Trichloroethane	240000	U
79-00-5	1,1,2-Trichloroethane	240000	U
79-01-6	Trichloroethene	240000	U
75-69-4	Trichlorofluoromethane	490000	U
96-18-4	1,2,3-Trichloropropane	240000	U
95-63-6	1,2,4-Trimethylbenzene	240000	U
108-67-8	1,3,5-Trimethylbenzene	240000	U
75-01-4	Vinyl chloride	490000	U
95-47-6	o-Xylene	120000	U
136777-61-2	m-Xylene & p-Xylene	120000	U

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7H220203 005

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 24.3 / g

Work Order: CCF0R201

Dilution factor: 244366

Moisture %:

Date Received: 08/22/97

Date Extracted:08/27/97

Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IS13-02 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	1200000	U
108-86-1	Bromobenzene	1200000	U
74-97-5	Bromochloromethane	1200000	U
75-27-4	Bromodichloromethane	1200000	U
75-25-2	Bromoform	1200000	U
74-83-9	Bromomethane	2400000	U
104-51-8	n-Butylbenzene	1200000	U
135-98-8	sec-Butylbenzene	1200000	U
98-06-6	tert-Butylbenzene	1200000	U
56-23-5	Carbon tetrachloride	1200000	U
108-90-7	Chlorobenzene	1200000	U
124-48-1	Chlorodibromomethane	1200000	U
75-00-3	Chloroethane	2400000	U
67-66-3	Chloroform	1200000	U
74-87-3	Chloromethane	2400000	U
95-49-8	2-Chlorotoluene	1200000	U
106-43-4	4-Chlorotoluene	1200000	U
96-12-8	1,2-Dibromo-3-chloropropane	2400000	U
106-93-4	1,2-Dibromoethane	1200000	U
74-95-3	Dibromomethane	1200000	U
95-50-1	1,2-Dichlorobenzene	1200000	U
541-73-1	1,3-Dichlorobenzene	1200000	U
106-46-7	1,4-Dichlorobenzene	1200000	U
75-71-8	Dichlorodifluoromethane	2400000	U
75-34-3	1,1-Dichloroethane	1200000	U
107-06-2	1,2-Dichloroethane	1200000	U
75-35-4	1,1-Dichloroethene	1200000	U
156-59-2	cis-1,2-Dichloroethene	610000	U
156-60-5	trans-1,2-Dichloroethene	610000	U

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID: H7H220203 005

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 24.3 / g
Work Order: CCF0R201
Dilution factor: 244366
Moisture %:

Date Received: 08/22/97
Date Extracted: 08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IS13-02 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	1200000	U
142-28-9	1,3-Dichloropropane	1200000	U
594-20-7	2,2-Dichloropropane	1200000	U
563-58-6	1,1-Dichloropropene	1200000	U
100-41-4	Ethylbenzene	1200000	U
87-68-3	Hexachlorobutadiene	1200000	U
98-82-8	Isopropylbenzene	1200000	U
99-87-6	p-Isopropyltoluene	1200000	U
75-09-2	Methylene chloride	1200000	U
91-20-3	Naphthalene	1200000	U
103-65-1	n-Propylbenzene	1200000	U
100-42-5	Styrene	1200000	U
630-20-6	1,1,1,2-Tetrachloroethane	1200000	U
79-34-5	1,1,2,2-Tetrachloroethane	1200000	U
127-18-4	**Tetrachloroethene**	**18000000**	
108-88-3	Toluene	1200000	U
87-61-6	1,2,3-Trichlorobenzene	1200000	U
120-82-1	1,2,4-Trichlorobenzene	1200000	U
71-55-6	1,1,1-Trichloroethane	1200000	U
79-00-5	1,1,2-Trichloroethane	1200000	U
79-01-6	Trichloroethene	1200000	U
75-69-4	Trichlorofluoromethane	2400000	U
96-18-4	1,2,3-Trichloropropane	1200000	U
95-63-6	1,2,4-Trimethylbenzene	1200000	U
108-67-8	1,3,5-Trimethylbenzene	1200000	U
75-01-4	Vinyl chloride	2400000	U
95-47-6	o-Xylene	610000	U
136777-61-2	m-Xylene & p-Xylene	610000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID:H7H220203 006

Sample WT/Vol: 15.3 / g
Work Order: CCF0T201
Dilution factor: 67713
Moisture %:
Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IS13-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	340000	U
108-86-1	Bromobenzene	340000	U
74-97-5	Bromochloromethane	340000	U
75-27-4	Bromodichloromethane	340000	U
75-25-2	Bromoform	340000	U
74-83-9	Bromomethane	680000	U
104-51-8	n-Butylbenzene	340000	U
135-98-8	sec-Butylbenzene	340000	U
98-06-6	tert-Butylbenzene	340000	U
56-23-5	Carbon tetrachloride	340000	U
108-90-7	Chlorobenzene	340000	U
124-48-1	Chlorodibromomethane	340000	U
75-00-3	Chloroethane	680000	U
67-66-3	Chloroform	340000	U
74-87-3	Chloromethane	680000	U
95-49-8	2-Chlorotoluene	340000	U
106-43-4	4-Chlorotoluene	340000	U
96-12-8	1,2-Dibromo-3-chloropropane	680000	U
106-93-4	1,2-Dibromoethane	340000	U
74-95-3	Dibromomethane	340000	U
95-50-1	1,2-Dichlorobenzene	340000	U
541-73-1	1,3-Dichlorobenzene	340000	U
106-46-7	1,4-Dichlorobenzene	340000	U
75-71-8	Dichlorodifluoromethane	680000	U
75-34-3	1,1-Dichloroethane	340000	U
107-06-2	1,2-Dichloroethane	340000	U
75-35-4	1,1-Dichloroethene	340000	U
156-59-2	cis-1,2-Dichloroethene	170000	U
156-60-5	trans-1,2-Dichloroethene	170000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7H220203 006
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 15.3 / g
Work Order: CCF0T201
Dilution factor: 67713
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IS13-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	340000	U
142-28-9	1,3-Dichloropropane	340000	U
594-20-7	2,2-Dichloropropane	340000	U
563-58-6	1,1-Dichloropropene	340000	U
100-41-4	Ethylbenzene	340000	U
87-68-3	Hexachlorobutadiene	340000	U
98-82-8	Isopropylbenzene	340000	U
99-87-6	p-Isopropyltoluene	340000	U
75-09-2	Methylene chloride	340000	U
91-20-3	Naphthalene	340000	U
103-65-1	n-Propylbenzene	340000	U
100-42-5	Styrene	340000	U
630-20-6	1,1,1,2-Tetrachloroethane	340000	U
79-34-5	1,1,2,2-Tetrachloroethane	340000	U
127-18-4	**Tetrachloroethene**	**4800000**	
108-88-3	Toluene	340000	U
87-61-6	1,2,3-Trichlorobenzene	340000	U
120-82-1	1,2,4-Trichlorobenzene	340000	U
71-55-6	1,1,1-Trichloroethane	340000	U
79-00-5	1,1,2-Trichloroethane	340000	U
79-01-6	Trichloroethene	340000	U
75-69-4	Trichlorofluoromethane	680000	U
96-18-4	1,2,3-Trichloropropane	340000	U
95-63-6	1,2,4-Trimethylbenzene	340000	U
108-67-8	1,3,5-Trimethylbenzene	340000	U
75-01-4	Vinyl chloride	680000	U
95-47-6	o-Xylene	170000	U
136777-61-2	m-Xylene & p-Xylene	170000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7H220203 007

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 26.8 / g
Work Order: CCF0W101
Dilution factor: 122.6
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/27/97

QC Batch: 7239123

Client Sample Id: IR88RW01-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	610	U
108-86-1	Bromobenzene	610	U
74-97-5	Bromochloromethane	610	U
75-27-4	Bromodichloromethane	610	U
75-25-2	Bromoform	610	U
74-83-9	Bromomethane	1200	U
104-51-8	n-Butylbenzene	610	U
135-98-8	sec-Butylbenzene	610	U
98-06-6	tert-Butylbenzene	610	U
56-23-5	Carbon tetrachloride	610	U
108-90-7	Chlorobenzene	610	U
124-48-1	Chlorodibromomethane	610	U
75-00-3	Chloroethane	1200	U
67-66-3	Chloroform	610	U
74-87-3	Chloromethane	1200	U
95-49-8	2-Chlorotoluene	610	U
106-43-4	4-Chlorotoluene	610	U
96-12-8	1,2-Dibromo-3-chloropropane	1200	U
106-93-4	1,2-Dibromoethane	610	U
74-95-3	Dibromomethane	610	U
95-50-1	1,2-Dichlorobenzene	610	U
541-73-1	1,3-Dichlorobenzene	610	U
106-46-7	1,4-Dichlorobenzene	610	U
75-71-8	Dichlorodifluoromethane	1200	U
75-34-3	1,1-Dichloroethane	610	U
107-06-2	1,2-Dichloroethane	610	U
75-35-4	1,1-Dichloroethene	610	U
156-59-2	cis-1,2-Dichloroethene	310	U
156-60-5	trans-1,2-Dichloroethene	310	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7H220203 007

Sample WT/Vol: 26.8 / g
Work Order: CCF0W101
Dilution factor: 122.6
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/27/97

QC Batch: 7239123

Client Sample Id: IR88RW01-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	610	U
142-28-9	1,3-Dichloropropane	610	U
594-20-7	2,2-Dichloropropane	610	U
563-58-6	1,1-Dichloropropene	610	U
100-41-4	Ethylbenzene	610	U
87-68-3	Hexachlorobutadiene	610	U
98-82-8	Isopropylbenzene	610	U
99-87-6	p-Isopropyltoluene	610	U
75-09-2	**Methylene chloride**	**350**	J B
91-20-3	Naphthalene	610	U
103-65-1	n-Propylbenzene	610	U
100-42-5	Styrene	610	U
630-20-6	1,1,1,2-Tetrachloroethane	610	U
79-34-5	1,1,2,2-Tetrachloroethane	610	U
127-18-4	**Tetrachloroethene**	**22000**	
108-88-3	Toluene	610	U
87-61-6	1,2,3-Trichlorobenzene	610	U
120-82-1	1,2,4-Trichlorobenzene	610	U
71-55-6	1,1,1-Trichloroethane	610	U
79-00-5	1,1,2-Trichloroethane	610	U
79-01-6	Trichloroethene	610	U
75-69-4	Trichlorofluoromethane	1200	U
96-18-4	1,2,3-Trichloropropane	610	U
95-63-6	1,2,4-Trimethylbenzene	610	U
108-67-8	1,3,5-Trimethylbenzene	610	U
75-01-4	Vinyl chloride	1200	U
95-47-6	o-Xylene	310	U
136777-61-2	m-Xylene & p-Xylene	310	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7H220203 008

Sample WT/Vol: 25.4 / g

Work Order: CCF11201

Dilution factor: 77098

Moisture %:

Date Received: 08/22/97

Date Extracted:08/27/97

Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88RW01-02 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	390000	U
108-86-1	Bromobenzene	390000	U
74-97-5	Bromochloromethane	390000	U
75-27-4	Bromodichloromethane	390000	U
75-25-2	Bromoform	390000	U
74-83-9	Bromomethane	770000	U
104-51-8	n-Butylbenzene	390000	U
135-98-8	sec-Butylbenzene	390000	U
98-06-6	tert-Butylbenzene	390000	U
56-23-5	Carbon tetrachloride	390000	U
108-90-7	Chlorobenzene	390000	U
124-48-1	Chlorodibromomethane	390000	U
75-00-3	Chloroethane	770000	U
67-66-3	Chloroform	390000	U
74-87-3	Chloromethane	770000	U
95-49-8	2-Chlorotoluene	390000	U
106-43-4	4-Chlorotoluene	390000	U
96-12-8	1,2-Dibromo-3-chloropropane	770000	U
106-93-4	1,2-Dibromoethane	390000	U
74-95-3	Dibromomethane	390000	U
95-50-1	1,2-Dichlorobenzene	390000	U
541-73-1	1,3-Dichlorobenzene	390000	U
106-46-7	1,4-Dichlorobenzene	390000	U
75-71-8	Dichlorodifluoromethane	770000	U
75-34-3	1,1-Dichloroethane	390000	U
107-06-2	1,2-Dichloroethane	390000	U
75-35-4	1,1-Dichloroethene	390000	U
156-59-2	cis-1,2-Dichloroethene	190000	U
156-60-5	trans-1,2-Dichloroethene	190000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7H220203 008
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 25.4 / g
Work Order: CCF11201
Dilution factor: 77098
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88RW01-02 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	390000	U
142-28-9	1,3-Dichloropropane	390000	U
594-20-7	2,2-Dichloropropane	390000	U
563-58-6	1,1-Dichloropropene	390000	U
100-41-4	Ethylbenzene	390000	U
87-68-3	Hexachlorobutadiene	390000	U
98-82-8	Isopropylbenzene	390000	U
99-87-6	p-Isopropyltoluene	390000	U
75-09-2	**Methylene chloride**	**140000**	**J B**
91-20-3	Naphthalene	390000	U
103-65-1	n-Propylbenzene	390000	U
100-42-5	Styrene	390000	U
630-20-6	1,1,1,2-Tetrachloroethane	390000	U
79-34-5	1,1,2,2-Tetrachloroethane	390000	U
127-18-4	**Tetrachloroethene**	**7900000**	
108-88-3	Toluene	390000	U
87-61-6	1,2,3-Trichlorobenzene	390000	U
120-82-1	1,2,4-Trichlorobenzene	390000	U
71-55-6	1,1,1-Trichloroethane	390000	U
79-00-5	1,1,2-Trichloroethane	390000	U
79-01-6	Trichloroethene	390000	U
75-69-4	Trichlorofluoromethane	770000	U
96-18-4	1,2,3-Trichloropropane	390000	U
95-63-6	1,2,4-Trimethylbenzene	390000	U
108-67-8	1,3,5-Trimethylbenzene	390000	U
75-01-4	Vinyl chloride	770000	U
95-47-6	o-Xylene	190000	U
136777-61-2	m-Xylene & p-Xylene	190000	U

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7H220203 009

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 11.2 / g
Work Order: CCF13201
Dilution factor: 10229
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88RW01-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	51000	U
108-86-1	Bromobenzene	51000	U
74-97-5	Bromochloromethane	51000	U
75-27-4	Bromodichloromethane	51000	U
75-25-2	Bromoform	51000	U
74-83-9	Bromomethane	100000	U
104-51-8	n-Butylbenzene	51000	U
135-98-8	sec-Butylbenzene	51000	U
98-06-6	tert-Butylbenzene	51000	U
56-23-5	Carbon tetrachloride	51000	U
108-90-7	Chlorobenzene	51000	U
124-48-1	Chlorodibromomethane	51000	U
75-00-3	Chloroethane	100000	U
67-66-3	Chloroform	51000	U
74-87-3	Chloromethane	100000	U
95-49-8	2-Chlorotoluene	51000	U
106-43-4	4-Chlorotoluene	51000	U
96-12-8	1,2-Dibromo-3-chloropropane	100000	U
106-93-4	1,2-Dibromoethane	51000	U
74-95-3	Dibromomethane	51000	U
95-50-1	1,2-Dichlorobenzene	51000	U
541-73-1	1,3-Dichlorobenzene	51000	U
106-46-7	1,4-Dichlorobenzene	51000	U
75-71-8	Dichlorodifluoromethane	100000	U
75-34-3	1,1-Dichloroethane	51000	U
107-06-2	1,2-Dichloroethane	51000	U
75-35-4	1,1-Dichloroethene	51000	U
156-59-2	cis-1,2-Dichloroethene	26000	U
156-60-5	trans-1,2-Dichloroethene	26000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7H220203 009

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 11.2 / g
Work Order: CCF13201
Dilution factor: 10229
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88RW01-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	51000	U
142-28-9	1,3-Dichloropropane	51000	U
594-20-7	2,2-Dichloropropane	51000	U
563-58-6	1,1-Dichloropropene	51000	U
100-41-4	Ethylbenzene	51000	U
87-68-3	Hexachlorobutadiene	51000	U
98-82-8	Isopropylbenzene	51000	U
99-87-6	p-Isopropyltoluene	51000	U
75-09-2	Methylene chloride	51000	U
91-20-3	Naphthalene	51000	U
103-65-1	n-Propylbenzene	51000	U
100-42-5	Styrene	51000	U
630-20-6	1,1,1,2-Tetrachloroethane	51000	U
79-34-5	1,1,2,2-Tetrachloroethane	51000	U
127-18-4	**Tetrachloroethene**	**1300000**	
108-88-3	Toluene	51000	U
87-61-6	1,2,3-Trichlorobenzene	51000	U
120-82-1	1,2,4-Trichlorobenzene	51000	U
71-55-6	1,1,1-Trichloroethane	51000	U
79-00-5	1,1,2-Trichloroethane	51000	U
79-01-6	Trichloroethene	51000	U
75-69-4	Trichlorofluoromethane	100000	U
96-18-4	1,2,3-Trichloropropane	51000	U
95-63-6	1,2,4-Trimethylbenzene	51000	U
108-67-8	1,3,5-Trimethylbenzene	51000	U
75-01-4	Vinyl chloride	100000	U
95-47-6	o-Xylene	26000	U
136777-61-2	m-Xylene & p-Xylene	26000	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID: H7H220203 010

Sample WT/Vol: 22.1 / g
Work Order: CCF14201
Dilution factor: 165.8
Moisture %:

Date Received: 08/22/97
Date Extracted: 08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88RW02-01 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	830	U
108-86-1	Bromobenzene	830	U
74-97-5	Bromochloromethane	830	U
75-27-4	Bromodichloromethane	830	U
75-25-2	Bromoform	830	U
74-83-9	Bromomethane	1700	U
104-51-8	n-Butylbenzene	830	U
135-98-8	sec-Butylbenzene	830	U
98-06-6	tert-Butylbenzene	830	U
56-23-5	Carbon tetrachloride	830	U
108-90-7	Chlorobenzene	830	U
124-48-1	Chlorodibromomethane	830	U
75-00-3	Chloroethane	1700	U
67-66-3	Chloroform	830	U
74-87-3	Chloromethane	1700	U
95-49-8	2-Chlorotoluene	830	U
106-43-4	4-Chlorotoluene	830	U
96-12-8	1,2-Dibromo-3-chloropropane	1700	U
106-93-4	1,2-Dibromoethane	830	U
74-95-3	Dibromomethane	830	U
95-50-1	1,2-Dichlorobenzene	830	U
541-73-1	1,3-Dichlorobenzene	830	U
106-46-7	1,4-Dichlorobenzene	830	U
75-71-8	Dichlorodifluoromethane	1700	U
75-34-3	1,1-Dichloroethane	830	U
107-06-2	1,2-Dichloroethane	830	U
75-35-4	1,1-Dichloroethene	830	U
156-59-2	cis-1,2-Dichloroethene	410	U
156-60-5	trans-1,2-Dichloroethene	410	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID: H7H220203 010
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 22.1 / g
Work Order: CCF14201
Dilution factor: 165.8
Moisture %:
Date Received: 08/22/97
Date Extracted: 08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88RW02-01 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	830	U
142-28-9	1,3-Dichloropropane	830	U
594-20-7	2,2-Dichloropropane	830	U
563-58-6	1,1-Dichloropropene	830	U
100-41-4	Ethylbenzene	830	U
87-68-3	Hexachlorobutadiene	830	U
98-82-8	Isopropylbenzene	830	U
99-87-6	p-Isopropyltoluene	830	U
75-09-2	**Methylene chloride**	**270**	**J B**
91-20-3	Naphthalene	830	U
103-65-1	n-Propylbenzene	830	U
100-42-5	Styrene	830	U
630-20-6	1,1,1,2-Tetrachloroethane	830	U
79-34-5	1,1,2,2-Tetrachloroethane	830	U
127-18-4	**Tetrachloroethene**	**12000**	
108-88-3	Toluene	830	U
87-61-6	1,2,3-Trichlorobenzene	830	U
120-82-1	1,2,4-Trichlorobenzene	830	U
71-55-6	1,1,1-Trichloroethane	830	U
79-00-5	1,1,2-Trichloroethane	830	U
79-01-6	Trichloroethene	830	U
75-69-4	Trichlorofluoromethane	1700	U
96-18-4	1,2,3-Trichloropropane	830	U
95-63-6	1,2,4-Trimethylbenzene	830	U
108-67-8	1,3,5-Trimethylbenzene	830	U
75-01-4	Vinyl chloride	1700	U
95-47-6	o-Xylene	410	U
136777-61-2	m-Xylene & p-Xylene	410	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 25.2 / g
Work Order: CCF16101
Dilution factor: 4612.5
Moisture %:

Client Sample Id: IR88RW02-02

SDG Number:

Lab Sample ID: H7H220203 011

Date Received: 08/22/97
Date Extracted: 08/27/97
Date Analyzed: 08/27/97

QC Batch: 7239123

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	23000	U
108-86-1	Bromobenzene	23000	U
74-97-5	Bromochloromethane	23000	U
75-27-4	Bromodichloromethane	23000	U
75-25-2	Bromoform	23000	U
74-83-9	Bromomethane	46000	U
104-51-8	n-Butylbenzene	23000	U
135-98-8	sec-Butylbenzene	23000	U
98-06-6	tert-Butylbenzene	23000	U
56-23-5	Carbon tetrachloride	23000	U
108-90-7	Chlorobenzene	23000	U
124-48-1	Chlorodibromomethane	23000	U
75-00-3	Chloroethane	46000	U
67-66-3	Chloroform	23000	U
74-87-3	Chloromethane	46000	U
95-49-8	2-Chlorotoluene	23000	U
106-43-4	4-Chlorotoluene	23000	U
96-12-8	1,2-Dibromo-3-chloropropane	46000	U
106-93-4	1,2-Dibromoethane	23000	U
74-95-3	Dibromomethane	23000	U
95-50-1	1,2-Dichlorobenzene	23000	U
541-73-1	1,3-Dichlorobenzene	23000	U
106-46-7	1,4-Dichlorobenzene	23000	U
75-71-8	Dichlorodifluoromethane	46000	U
75-34-3	1,1-Dichloroethane	23000	U
107-06-2	1,2-Dichloroethane	23000	U
75-35-4	1,1-Dichloroethene	23000	U
156-59-2	cis-1,2-Dichloroethene	12000	U
156-60-5	trans-1,2-Dichloroethene	12000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7H220203 011

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 25.2 / g

Date Received: 08/22/97

Work Order: CCF16101

Date Extracted:08/27/97

Dilution factor: 4612.5

Date Analyzed: 08/27/97

Moisture %:

QC Batch: 7239123

Client Sample Id: IR88RW02-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	23000	U
142-28-9	1,3-Dichloropropane	23000	U
594-20-7	2,2-Dichloropropane	23000	U
563-58-6	1,1-Dichloropropene	23000	U
100-41-4	Ethylbenzene	23000	U
87-68-3	Hexachlorobutadiene	23000	U
98-82-8	Isopropylbenzene	23000	U
99-87-6	p-Isopropyltoluene	23000	U
75-09-2	Methylene chloride	23000	U
91-20-3	Naphthalene	23000	U
103-65-1	n-Propylbenzene	23000	U
100-42-5	Styrene	23000	U
630-20-6	1,1,1,2-Tetrachloroethane	23000	U
79-34-5	1,1,2,2-Tetrachloroethane	23000	U
127-18-4	**Tetrachloroethene**	**730000**	
108-88-3	Toluene	23000	U
87-61-6	1,2,3-Trichlorobenzene	23000	U
120-82-1	1,2,4-Trichlorobenzene	23000	U
71-55-6	1,1,1-Trichloroethane	23000	U
79-00-5	1,1,2-Trichloroethane	23000	U
79-01-6	Trichloroethene	23000	U
75-69-4	Trichlorofluoromethane	46000	U
96-18-4	1,2,3-Trichloropropane	23000	U
95-63-6	1,2,4-Trimethylbenzene	23000	U
108-67-8	1,3,5-Trimethylbenzene	23000	U
75-01-4	Vinyl chloride	46000	U
95-47-6	o-Xylene	12000	U
136777-61-2	m-Xylene & p-Xylene	12000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7H220203 012

Sample WT/Vol: 25.6 / g
Work Order: CCF17201
Dilution factor: 35040
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88RW02-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	180000	U
108-86-1	Bromobenzene	180000	U
74-97-5	Bromochloromethane	180000	U
75-27-4	Bromodichloromethane	180000	U
75-25-2	Bromoform	180000	U
74-83-9	Bromomethane	350000	U
104-51-8	n-Butylbenzene	180000	U
135-98-8	sec-Butylbenzene	180000	U
98-06-6	tert-Butylbenzene	180000	U
56-23-5	Carbon tetrachloride	180000	U
108-90-7	Chlorobenzene	180000	U
124-48-1	Chlorodibromomethane	180000	U
75-00-3	Chloroethane	350000	U
67-66-3	Chloroform	180000	U
74-87-3	Chloromethane	350000	U
95-49-8	2-Chlorotoluene	180000	U
106-43-4	4-Chlorotoluene	180000	U
96-12-8	1,2-Dibromo-3-chloropropane	350000	U
106-93-4	1,2-Dibromoethane	180000	U
74-95-3	Dibromomethane	180000	U
95-50-1	1,2-Dichlorobenzene	180000	U
541-73-1	1,3-Dichlorobenzene	180000	U
106-46-7	1,4-Dichlorobenzene	180000	U
75-71-8	Dichlorodifluoromethane	350000	U
75-34-3	1,1-Dichloroethane	180000	U
107-06-2	1,2-Dichloroethane	180000	U
75-35-4	1,1-Dichloroethene	180000	U
156-59-2	cis-1,2-Dichloroethene	88000	U
156-60-5	trans-1,2-Dichloroethene	88000	U

FORM I

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7H220203 012

Sample WT/Vol: 25.6 / g
Work Order: CCF17201
Dilution factor: 35040
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88RW02-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	180000	U
142-28-9	1,3-Dichloropropane	180000	U
594-20-7	2,2-Dichloropropane	180000	U
563-58-6	1,1-Dichloropropene	180000	U
100-41-4	Ethylbenzene	180000	U
87-68-3	Hexachlorobutadiene	180000	U
98-82-8	Isopropylbenzene	180000	U
99-87-6	p-Isopropyltoluene	180000	U
75-09-2	Methylene chloride	180000	U
91-20-3	Naphthalene	180000	U
103-65-1	n-Propylbenzene	180000	U
100-42-5	Styrene	180000	U
630-20-6	1,1,1,2-Tetrachloroethane	180000	U
79-34-5	1,1,2,2-Tetrachloroethane	180000	U
127-18-4	**Tetrachloroethene**	**3600000**	
108-88-3	Toluene	180000	U
87-61-6	1,2,3-Trichlorobenzene	180000	U
120-82-1	1,2,4-Trichlorobenzene	180000	U
71-55-6	1,1,1-Trichloroethane	180000	U
79-00-5	1,1,2-Trichloroethane	180000	U
79-01-6	Trichloroethene	180000	U
75-69-4	Trichlorofluoromethane	350000	U
96-18-4	1,2,3-Trichloropropane	180000	U
95-63-6	1,2,4-Trimethylbenzene	180000	U
108-67-8	1,3,5-Trimethylbenzene	180000	U
75-01-4	Vinyl chloride	350000	U
95-47-6	o-Xylene	88000	U
136777-61-2	m-Xylene & p-Xylene	88000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 014

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 58 / g
Work Order: CEG4A101
Dilution factor: 1328.77
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-RW03-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	13000	U
74-83-9	Bromomethane	13000	U
75-01-4	Vinyl chloride	13000	U
75-00-3	Chloroethane	13000	U
75-09-2	Methylene chloride	6600	U
67-64-1	Acetone	27000	U
75-15-0	Carbon disulfide	6600	U
75-35-4	1,1-Dichloroethene	6600	U
75-34-3	1,1-Dichloroethane	6600	U
540-59-0	1,2-Dichloroethene (total)	6600	U
67-66-3	Chloroform	6600	U
107-06-2	1,2-Dichloroethane	6600	U
78-93-3	2-Butanone	27000	U
71-55-6	1,1,1-Trichloroethane	6600	U
56-23-5	Carbon tetrachloride	6600	U
75-27-4	Bromodichloromethane	6600	U
78-87-5	1,2-Dichloropropane	6600	U
10061-01-5	cis-1,3-Dichloropropene	6600	U
79-01-6	**Trichloroethene**	**1300**	
124-48-1	Dibromochloromethane	6600	U
79-00-5	1,1,2-Trichloroethane	6600	U
71-43-2	Benzene	6600	U
10061-02-6	trans-1,3-Dichloropropene	6600	U
75-25-2	Bromoform	6600	U
108-10-1	4-Methyl-2-pentanone	27000	U
591-78-6	2-Hexanone	27000	U
127-18-4	**Tetrachloroethene**	**220000**	
79-34-5	1,1,2,2-Tetrachloroethane	6600	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L100182 014

Sample WT/Vol: 58 / g

Work Order: CEG4A101

Dilution factor: 1328.77

Moisture %:

Date Received: 12/10/97

Date Extracted:12/12/97

Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-RW03-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	6600	U
108-90-7	Chlorobenzene	6600	U
100-41-4	Ethylbenzene	6600	U
100-42-5	Styrene	6600	U
1330-20-7	Xylenes (total)	6600	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 015

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 90.5 / g
Work Order: CEG4C101
Dilution factor: 127.4
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-RW04-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	1300	U
74-83-9	Bromomethane	1300	U
75-01-4	Vinyl chloride	1300	U
75-00-3	Chloroethane	1300	U
75-09-2	Methylene chloride	640	U
67-64-1	Acetone	2500	U
75-15-0	Carbon disulfide	640	U
75-35-4	1,1-Dichloroethene	640	U
75-34-3	1,1-Dichloroethane	640	U
540-59-0	1,2-Dichloroethene (total)	640	U
67-66-3	Chloroform	640	U
107-06-2	1,2-Dichloroethane	640	U
78-93-3	**2-Butanone**	**960**	**J**
71-55-6	1,1,1-Trichloroethane	640	U
56-23-5	Carbon tetrachloride	640	U
75-27-4	Bromodichloromethane	640	U
78-87-5	1,2-Dichloropropane	640	U
10061-01-5	cis-1,3-Dichloropropene	640	U
79-01-6	Trichloroethene	640	U
124-48-1	Dibromochloromethane	640	U
79-00-5	1,1,2-Trichloroethane	640	U
71-43-2	Benzene	640	U
10061-02-6	trans-1,3-Dichloropropene	640	U
75-25-2	Bromoform	640	U
108-10-1	4-Methyl-2-pentanone	2500	U
591-78-6	2-Hexanone	2500	U
127-18-4	**Tetrachloroethene**	**18000**	
79-34-5	1,1,2,2-Tetrachloroethane	640	U

BAKER ENVIRONMENTAL, INC.

Lab Name: QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID: H7L100182 015
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 90.5 / g
Work Order: CEG4C101
Dilution factor: 127.4
Moisture %:

Date Received: 12/10/97
Date Extracted: 12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-RW04-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	640	U
108-90-7	Chlorobenzene	640	U
100-41-4	Ethylbenzene	640	U
100-42-5	Styrene	640	U
1330-20-7	Xylenes (total)	640	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 016

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 78.3 / g
Work Order: CEG4D101
Dilution factor: 141187.22
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-RW04-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	1400000	U
74-83-9	Bromomethane	1400000	U
75-01-4	Vinyl chloride	1400000	U
75-00-3	Chloroethane	1400000	U
75-09-2	Methylene chloride	710000	U
67-64-1	Acetone	2800000	U
75-15-0	Carbon disulfide	710000	U
75-35-4	1,1-Dichloroethene	710000	U
75-34-3	1,1-Dichloroethane	710000	U
540-59-0	1,2-Dichloroethene (total)	710000	U
67-66-3	Chloroform	710000	U
107-06-2	1,2-Dichloroethane	710000	U
78-93-3	2-Butanone	2800000	U
71-55-6	1,1,1-Trichloroethane	710000	U
56-23-5	Carbon tetrachloride	710000	U
75-27-4	Bromodichloromethane	710000	U
78-87-5	1,2-Dichloropropane	710000	U
10061-01-5	cis-1,3-Dichloropropene	710000	U
79-01-6	Trichloroethene	710000	U
124-48-1	Dibromochloromethane	710000	U
79-00-5	1,1,2-Trichloroethane	710000	U
71-43-2	Benzene	710000	U
10061-02-6	trans-1,3-Dichloropropene	710000	U
75-25-2	Bromoform	710000	U
108-10-1	4-Methyl-2-pentanone	2800000	U
591-78-6	2-Hexanone	2800000	U
127-18-4	Tetrachloroethene	17000000	
79-34-5	1,1,2,2-Tetrachloroethane	710000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 016

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 78.3 / g
Work Order: CEG4D101
Dilution factor: 141187.22
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-RW04-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	710000	U
108-90-7	Chlorobenzene	710000	U
100-41-4	Ethylbenzene	710000	U
100-42-5	Styrene	710000	U
1330-20-7	Xylenes (total)	710000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA SDG Number:

Matrix: (soil/water) SOLID Lab Sample ID:H7L100182 017
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 62.1 / g Date Received: 12/10/97
Work Order: CEG4E101 Date Extracted:12/12/97
Dilution factor: 1805.62 Date Analyzed: 12/12/97
Moisture %:
QC Batch: 7346142
Client Sample Id: IR88-RW04-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	18000	U
74-83-9	Bromomethane	18000	U
75-01-4	Vinyl chloride	18000	U
75-00-3	Chloroethane	18000	U
75-09-2	Methylene chloride	9000	U
67-64-1	Acetone	36000	U
75-15-0	Carbon disulfide	9000	U
75-35-4	1,1-Dichloroethene	9000	U
75-34-3	1,1-Dichloroethane	9000	U
540-59-0	1,2-Dichloroethene (total)	9000	U
67-66-3	Chloroform	9000	U
107-06-2	1,2-Dichloroethane	9000	U
78-93-3	2-Butanone	36000	U
71-55-6	1,1,1-Trichloroethane	9000	U
56-23-5	Carbon tetrachloride	9000	U
75-27-4	Bromodichloromethane	9000	U
78-87-5	1,2-Dichloropropane	9000	U
10061-01-5	cis-1,3-Dichloropropene	9000	U
79-01-6	Trichloroethene	9000	U
124-48-1	Dibromochloromethane	9000	U
79-00-5	1,1,2-Trichloroethane	9000	U
71-43-2	Benzene	9000	U
10061-02-6	trans-1,3-Dichloropropene	9000	U
75-25-2	Bromoform	9000	U
108-10-1	4-Methyl-2-pentanone	36000	U
591-78-6	2-Hexanone	36000	U
127-18-4	Tetrachloroethene	350000	
79-34-5	1,1,2,2-Tetrachloroethane	9000	U

FORM I

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 017

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 62.1 / g
Work Order: CEG4E101
Dilution factor: 1805.62
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-RW04-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	9000	U
108-90-7	Chlorobenzene	9000	U
100-41-4	Ethylbenzene	9000	U
100-42-5	Styrene	9000	U
1330-20-7	Xylenes (total)	9000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number: •

Matrix: (soil/water) SOLID

Lab Sample ID:H7H220203 013

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 23.4 / g

Work Order: CCF18201

Dilution factor: 891.1

Moisture %:

Date Received: 08/22/97

Date Extracted:08/27/97

Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IW01-01 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	4500	U
108-86-1	Bromobenzene	4500	U
74-97-5	Bromochloromethane	4500	U
75-27-4	Bromodichloromethane	4500	U
75-25-2	Bromoform	4500	U
74-83-9	Bromomethane	8900	U
104-51-8	n-Butylbenzene	4500	U
135-98-8	sec-Butylbenzene	4500	U
98-06-6	tert-Butylbenzene	4500	U
56-23-5	Carbon tetrachloride	4500	U
108-90-7	Chlorobenzene	4500	U
124-48-1	Chlorodibromomethane	4500	U
75-00-3	Chloroethane	8900	U
67-66-3	Chloroform	4500	U
74-87-3	Chloromethane	8900	U
95-49-8	2-Chlorotoluene	4500	U
106-43-4	4-Chlorotoluene	4500	U
96-12-8	1,2-Dibromo-3-chloropropane	8900	U
106-93-4	1,2-Dibromoethane	4500	U
74-95-3	Dibromomethane	4500	U
95-50-1	1,2-Dichlorobenzene	4500	U
541-73-1	1,3-Dichlorobenzene	4500	U
106-46-7	1,4-Dichlorobenzene	4500	U
75-71-8	Dichlorodifluoromethane	8900	U
75-34-3	1,1-Dichloroethane	4500	U
107-06-2	1,2-Dichloroethane	4500	U
75-35-4	1,1-Dichloroethene	4500	U
156-59-2	cis-1,2-Dichloroethene	2200	U
156-60-5	trans-1,2-Dichloroethene	2200	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA
SDG Number: ·

Matrix: (soil/water) SOLID
Lab Sample ID: H7H220203 013
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 23.4 / g
Work Order: CCF18201
Dilution factor: 891.1
Moisture %:

Date Received: 08/22/97
Date Extracted: 08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IW01-01 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg		Q
78-87-5	1,2-Dichloropropane	4500		U
142-28-9	1,3-Dichloropropane	4500		U
594-20-7	2,2-Dichloropropane	4500		U
563-58-6	1,1-Dichloropropene	4500		U
100-41-4	Ethylbenzene	4500		U
87-68-3	Hexachlorobutadiene	4500		U
98-82-8	Isopropylbenzene	4500		U
99-87-6	p-Isopropyltoluene	4500		U
75-09-2	Methylene chloride	4500		U
91-20-3	Naphthalene	4500		U
103-65-1	n-Propylbenzene	4500		U
100-42-5	Styrene	4500		U
630-20-6	1,1,1,2-Tetrachloroethane	4500		U
79-34-5	1,1,2,2-Tetrachloroethane	4500		U
127-18-4	**Tetrachloroethene**	**100000**		
108-88-3	Toluene	4500		U
87-61-6	1,2,3-Trichlorobenzene	4500		U
120-82-1	1,2,4-Trichlorobenzene	4500		U
71-55-6	1,1,1-Trichloroethane	4500		U
79-00-5	1,1,2-Trichloroethane	4500		U
79-01-6	Trichloroethene	4500		U
75-69-4	Trichlorofluoromethane	8900		U
96-18-4	1,2,3-Trichloropropane	4500		U
95-63-6	1,2,4-Trimethylbenzene	4500		U
108-67-8	1,3,5-Trimethylbenzene	4500		U
75-01-4	Vinyl chloride	8900		U
95-47-6	o-Xylene	2200		U
136777-61-2	m-Xylene & p-Xylene	2200		U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA
SDG Number: .

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID: H7H220203 014

Sample WT/Vol: 19.2 / g
Work Order: CCF19201
Dilution factor: 230311
Moisture %:
Date Received: 08/22/97
Date Extracted: 08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IW01-02 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	1200000	U
108-86-1	Bromobenzene	1200000	U
74-97-5	Bromochloromethane	1200000	U
75-27-4	Bromodichloromethane	1200000	U
75-25-2	Bromoform	1200000	U
74-83-9	Bromomethane	2300000	U
104-51-8	n-Butylbenzene	1200000	U
135-98-8	sec-Butylbenzene	1200000	U
98-06-6	tert-Butylbenzene	1200000	U
56-23-5	Carbon tetrachloride	1200000	U
108-90-7	Chlorobenzene	1200000	U
124-48-1	Chlorodibromomethane	1200000	U
75-00-3	Chloroethane	2300000	U
67-66-3	Chloroform	1200000	U
74-87-3	Chloromethane	2300000	U
95-49-8	2-Chlorotoluene	1200000	U
106-43-4	4-Chlorotoluene	1200000	U
96-12-8	1,2-Dibromo-3-chloropropane	2300000	U
106-93-4	1,2-Dibromoethane	1200000	U
74-95-3	Dibromomethane	1200000	U
95-50-1	1,2-Dichlorobenzene	1200000	U
541-73-1	1,3-Dichlorobenzene	1200000	U
106-46-7	1,4-Dichlorobenzene	1200000	U
75-71-8	Dichlorodifluoromethane	2300000	U
75-34-3	1,1-Dichloroethane	1200000	U
107-06-2	1,2-Dichloroethane	1200000	U
75-35-4	1,1-Dichloroethene	1200000	U
156-59-2	cis-1,2-Dichloroethene	580000	U
156-60-5	trans-1,2-Dichloroethene	580000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number: .

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID:H7H220203 014

Sample WT/Vol: 19.2 / g
Work Order: CCF19201
Dilution factor: 230311
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IW01-02 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	1200000	U
142-28-9	1,3-Dichloropropane	1200000	U
594-20-7	2,2-Dichloropropane	1200000	U
563-58-6	1,1-Dichloropropene	1200000	U
100-41-4	Ethylbenzene	1200000	U
87-68-3	Hexachlorobutadiene	1200000	U
98-82-8	Isopropylbenzene	1200000	U
99-87-6	p-Isopropyltoluene	1200000	U
75-09-2	Methylene chloride	1200000	U
91-20-3	Naphthalene	1200000	U
103-65-1	n-Propylbenzene	1200000	U
100-42-5	Styrene	1200000	U
630-20-6	1,1,1,2-Tetrachloroethane	1200000	U
79-34-5	1,1,2,2-Tetrachloroethane	1200000	U
127-18-4	**Tetrachloroethene**	**26000000**	
108-88-3	Toluene	1200000	U
87-61-6	1,2,3-Trichlorobenzene	1200000	U
120-82-1	1,2,4-Trichlorobenzene	1200000	U
71-55-6	1,1,1-Trichloroethane	1200000	U
79-00-5	1,1,2-Trichloroethane	1200000	U
79-01-6	Trichloroethene	1200000	U
75-69-4	Trichlorofluoromethane	2300000	U
96-18-4	1,2,3-Trichloropropane	1200000	U
95-63-6	1,2,4-Trimethylbenzene	1200000	U
108-67-8	1,3,5-Trimethylbenzene	1200000	U
75-01-4	Vinyl chloride	2300000	U
95-47-6	o-Xylene	580000	U
136777-61-2	m-Xylene & p-Xylene	580000	U

FORM I

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number: .

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7H220203 015

Sample WT/Vol: 17 / g

Work Order: CCF1A201

Dilution factor: 44963

Moisture %:

Date Received: 08/22/97

Date Extracted:08/27/97

Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IW01-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	220000	U
108-86-1	Bromobenzene	220000	U
74-97-5	Bromochloromethane	220000	U
75-27-4	Bromodichloromethane	220000	U
75-25-2	Bromoform	220000	U
74-83-9	Bromomethane	450000	U
104-51-8	n-Butylbenzene	220000	U
135-98-8	sec-Butylbenzene	220000	U
98-06-6	tert-Butylbenzene	220000	U
56-23-5	Carbon tetrachloride	220000	U
108-90-7	Chlorobenzene	220000	U
124-48-1	Chlorodibromomethane	220000	U
75-00-3	Chloroethane	450000	U
67-66-3	Chloroform	220000	U
74-87-3	Chloromethane	450000	U
95-49-8	2-Chlorotoluene	220000	U
106-43-4	4-Chlorotoluene	220000	U
96-12-8	1,2-Dibromo-3-chloropropane	450000	U
106-93-4	1,2-Dibromoethane	220000	U
74-95-3	Dibromomethane	220000	U
95-50-1	1,2-Dichlorobenzene	220000	U
541-73-1	1,3-Dichlorobenzene	220000	U
106-46-7	1,4-Dichlorobenzene	220000	U
75-71-8	Dichlorodifluoromethane	450000	U
75-34-3	1,1-Dichloroethane	220000	U
107-06-2	1,2-Dichloroethane	220000	U
75-35-4	1,1-Dichloroethene	220000	U
156-59-2	cis-1,2-Dichloroethene	110000	U
156-60-5	trans-1,2-Dichloroethene	110000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number: .

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7H220203 015

Sample WT/Vol: 17 / g

Work Order: CCF1A201

Dilution factor: 44963

Moisture %:

Date Received: 08/22/97

Date Extracted:08/27/97

Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IW01-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	220000	U
142-28-9	1,3-Dichloropropane	220000	U
594-20-7	2,2-Dichloropropane	220000	U
563-58-6	1,1-Dichloropropene	220000	U
100-41-4	Ethylbenzene	220000	U
87-68-3	Hexachlorobutadiene	220000	U
98-82-8	Isopropylbenzene	220000	U
99-87-6	p-Isopropyltoluene	220000	U
75-09-2	Methylene chloride	220000	U
91-20-3	Naphthalene	220000	U
103-65-1	n-Propylbenzene	220000	U
100-42-5	Styrene	220000	U
630-20-6	1,1,1,2-Tetrachloroethane	220000	U
79-34-5	1,1,2,2-Tetrachloroethane	220000	U
127-18-4	**Tetrachloroethene**	**4200000**	
108-88-3	Toluene	220000	U
87-61-6	1,2,3-Trichlorobenzene	220000	U
120-82-1	1,2,4-Trichlorobenzene	220000	U
71-55-6	1,1,1-Trichloroethane	220000	U
79-00-5	1,1,2-Trichloroethane	220000	U
79-01-6	Trichloroethene	220000	U
75-69-4	Trichlorofluoromethane	450000	U
96-18-4	1,2,3-Trichloropropane	220000	U
95-63-6	1,2,4-Trimethylbenzene	220000	U
108-67-8	1,3,5-Trimethylbenzene	220000	U
75-01-4	Vinyl chloride	450000	U
95-47-6	o-Xylene	110000	U
136777-61-2	m-Xylene & p-Xylene	110000	U

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID:H7H220203 016

Sample WT/Vol: 18.9 / g
Work Order: CCF1C201
Dilution factor: 202.2
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IW01-06 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
71-43-2	Benzene	1000	U
108-86-1	Bromobenzene	1000	U
74-97-5	Bromochloromethane	1000	U
75-27-4	Bromodichloromethane	1000	U
75-25-2	Bromoform	1000	U
74-83-9	Bromomethane	2000	U
104-51-8	n-Butylbenzene	1000	U
135-98-8	sec-Butylbenzene	1000	U
98-06-6	tert-Butylbenzene	1000	U
56-23-5	Carbon tetrachloride	1000	U
108-90-7	Chlorobenzene	1000	U
124-48-1	Chlorodibromomethane	1000	U
75-00-3	Chloroethane	2000	U
67-66-3	Chloroform	1000	U
74-87-3	Chloromethane	2000	U
95-49-8	2-Chlorotoluene	1000	U
106-43-4	4-Chlorotoluene	1000	U
96-12-8	1,2-Dibromo-3-chloropropane	2000	U
106-93-4	1,2-Dibromoethane	1000	U
74-95-3	Dibromomethane	1000	U
95-50-1	1,2-Dichlorobenzene	1000	U
541-73-1	1,3-Dichlorobenzene	1000	U
106-46-7	1,4-Dichlorobenzene	1000	U
75-71-8	Dichlorodifluoromethane	2000	U
75-34-3	1,1-Dichloroethane	1000	U
107-06-2	1,2-Dichloroethane	1000	U
75-35-4	1,1-Dichloroethene	1000	U
156-59-2	**cis-1,2-Dichloroethene**	**27000**	
156-60-5	trans-1,2-Dichloroethene	510	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7H220203 016

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 18.9 / g
Work Order: CCF1C201
Dilution factor: 202.2
Moisture %:

Date Received: 08/22/97
Date Extracted:08/27/97
Date Analyzed: 08/28/97

QC Batch: 7239123

Client Sample Id: IR88IW01-06 -RE 1

		CONCENTRATION UNITS:	
CAS NO.	COMPOUND	(ug/L or ug/kg) ug/kg	Q
78-87-5	1,2-Dichloropropane	1000	U
142-28-9	1,3-Dichloropropane	1000	U
594-20-7	2,2-Dichloropropane	1000	U
563-58-6	1,1-Dichloropropene	1000	U
100-41-4	Ethylbenzene	1000	U
87-68-3	Hexachlorobutadiene	1000	U
98-82-8	Isopropylbenzene	1000	U
99-87-6	**p-Isopropyltoluene**	**450**	**J**
75-09-2	**Methylene chloride**	**350**	**J B**
91-20-3	Naphthalene	1000	U
103-65-1	**n-Propylbenzene**	**260**	**J**
100-42-5	Styrene	1000	U
630-20-6	1,1,1,2-Tetrachloroethane	1000	U
79-34-5	1,1,2,2-Tetrachloroethane	1000	U
127-18-4	**Tetrachloroethene**	**1400**	
108-88-3	Toluene	1000	U
87-61-6	1,2,3-Trichlorobenzene	1000	U
120-82-1	1,2,4-Trichlorobenzene	1000	U
71-55-6	1,1,1-Trichloroethane	1000	U
79-00-5	1,1,2-Trichloroethane	1000	U
79-01-6	Trichloroethene	1000	U
75-69-4	Trichlorofluoromethane	2000	U
96-18-4	1,2,3-Trichloropropane	1000	U
95-63-6	**1,2,4-Trimethylbenzene**	**3000**	
108-67-8	**1,3,5-Trimethylbenzene**	**1400**	
75-01-4	**Vinyl chloride**	**18000**	
95-47-6	o-Xylene	510	U
136777-61-2	m-Xylene & p-Xylene	510	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 001

Sample WT/Vol: 70.2 / g

Work Order: CE3G2101

Dilution factor: 25.83

Date Received: 11/18/97

Date Extracted:11/19/97

Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT01-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	260	U
74-83-9	Bromomethane	260	U
75-01-4	Vinyl chloride	260	U
75-00-3	Chloroethane	260	U
75-09-2	Methylene chloride	130	U
67-64-1	Acetone	520	U
75-15-0	Carbon disulfide	130	U
75-35-4	1,1-Dichloroethene	130	U
75-34-3	1,1-Dichloroethane	130	U
540-59-0	1,2-Dichloroethene (total)	130	U
67-66-3	Chloroform	130	U
107-06-2	1,2-Dichloroethane	130	U
78-93-3	**2-Butanone**	**800**	
71-55-6	1,1,1-Trichloroethane	130	U
56-23-5	Carbon tetrachloride	130	U
75-27-4	Bromodichloromethane	130	U
78-87-5	1,2-Dichloropropane	130	U
10061-01-5	cis-1,3-Dichloropropene	130	U
79-01-6	Trichloroethene	130	U
124-48-1	Dibromochloromethane	130	U
79-00-5	**1,1,2-Trichloroethane**	**50**	**J**
71-43-2	Benzene	130	U
10061-02-6	trans-1,3-Dichloropropene	130	U
75-25-2	**Bromoform**	**38**	**J**
108-10-1	4-Methyl-2-pentanone	520	U
591-78-6	2-Hexanone	520	U
127-18-4	Tetrachloroethene	130	U
79-34-5	1,1,2,2-Tetrachloroethane	130	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 001

Sample WT/Vol: 70.2 / g

Work Order: CE3G2101

Dilution factor: 25.83

Date Received: 11/18/97

Date Extracted:11/19/97

Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT01-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	130	U
108-90-7	Chlorobenzene	130	U
100-41-4	Ethylbenzene	130	U
100-42-5	Styrene	130	U
1330-20-7	Xylenes (total)	130	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID: H7K180125 002

Sample WT/Vol: 84.6 / g

Work Order: CE3GA101

Dilution factor: 22.55

Date Received: 11/18/97

Date Extracted: 11/19/97

Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT02-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	230	U
74-83-9	Bromomethane	230	U
75-01-4	Vinyl chloride	230	U
75-00-3	Chloroethane	230	U
75-09-2	Methylene chloride	110	U
67-64-1	Acetone	450	U
75-15-0	Carbon disulfide	110	U
75-35-4	1,1-Dichloroethene	110	U
75-34-3	1,1-Dichloroethane	110	U
540-59-0	1,2-Dichloroethene (total)	110	U
67-66-3	Chloroform	110	U
107-06-2	1,2-Dichloroethane	110	U
78-93-3	**2-Butanone**	**790**	
71-55-6	1,1,1-Trichloroethane	110	U
56-23-5	Carbon tetrachloride	110	U
75-27-4	Bromodichloromethane	110	U
78-87-5	1,2-Dichloropropane	110	U
10061-01-5	cis-1,3-Dichloropropene	110	U
79-01-6	Trichloroethene	110	U
124-48-1	Dibromochloromethane	110	U
79-00-5	1,1,2-Trichloroethane	110	U
71-43-2	Benzene	110	U
10061-02-6	trans-1,3-Dichloropropene	110	U
75-25-2	Bromoform	110	U
108-10-1	4-Methyl-2-pentanone	450	U
591-78-6	2-Hexanone	450	U
127-18-4	Tetrachloroethene	110	U
79-34-5	1,1,2,2-Tetrachloroethane	110	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 002

Sample WT/Vol: 84.6 / g

Work Order: CE3GA101

Dilution factor: 22.55

Date Received: 11/18/97

Date Extracted:11/19/97

Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT02-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	110	U
108-90-7	Chlorobenzene	110	U
100-41-4	Ethylbenzene	110	U
100-42-5	Styrene	110	U
1330-20-7	Xylenes (total)	110	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 003

Sample WT/Vol: 143.7 / g
Work Order: CE3GD101
Dilution factor: 133.5

Date Received: 11/18/97
Date Extracted:11/19/97
Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT03-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	1300	U
74-83-9	Bromomethane	1300	U
75-01-4	Vinyl chloride	1300	U
75-00-3	Chloroethane	1300	U
75-09-2	Methylene chloride	670	U
67-64-1	Acetone	2700	U
75-15-0	Carbon disulfide	670	U
75-35-4	1,1-Dichloroethene	670	U
75-34-3	1,1-Dichloroethane	670	U
540-59-0	1,2-Dichloroethene (total)	670	U
67-66-3	Chloroform	670	U
107-06-2	1,2-Dichloroethane	670	U
78-93-3	**2-Butanone**	**470**	**J**
71-55-6	1,1,1-Trichloroethane	670	U
56-23-5	Carbon tetrachloride	670	U
75-27-4	Bromodichloromethane	670	U
78-87-5	1,2-Dichloropropane	670	U
10061-01-5	cis-1,3-Dichloropropene	670	U
79-01-6	Trichloroethene	670	U
124-48-1	Dibromochloromethane	670	U
79-00-5	1,1,2-Trichloroethane	670	U
71-43-2	Benzene	670	U
10061-02-6	trans-1,3-Dichloropropene	670	U
75-25-2	Bromoform	670	U
108-10-1	4-Methyl-2-pentanone	2700	U
591-78-6	2-Hexanone	2700	U
127-18-4	**Tetrachloroethene**	**18000**	
79-34-5	1,1,2,2-Tetrachloroethane	670	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K180125 003

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 143.7 / g
Work Order: CE3GD101
Dilution factor: 133.5

Date Received: 11/18/97
Date Extracted:11/19/97
Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT03-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	670	U
108-90-7	Chlorobenzene	670	U
100-41-4	Ethylbenzene	670	U
100-42-5	Styrene	670	U
1330-20-7	Xylenes (total)	670	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 004

Sample WT/Vol: 88.4 / g

Work Order: CE3GE101

Dilution factor: 211

Date Received: 11/18/97

Date Extracted:11/19/97

Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT04-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	2100	U
74-83-9	Bromomethane	2100	U
75-01-4	Vinyl chloride	2100	U
75-00-3	Chloroethane	2100	U
75-09-2	Methylene chloride	1100	U
67-64-1	Acetone	4200	U
75-15-0	Carbon disulfide	1100	U
75-35-4	1,1-Dichloroethene	1100	U
75-34-3	1,1-Dichloroethane	1100	U
540-59-0	1,2-Dichloroethene (total)	1100	U
67-66-3	Chloroform	1100	U
107-06-2	1,2-Dichloroethane	1100	U
78-93-3	**2-Butanone**	**820**	**J**
71-55-6	1,1,1-Trichloroethane	1100	U
56-23-5	Carbon tetrachloride	1100	U
75-27-4	Bromodichloromethane	1100	U
78-87-5	1,2-Dichloropropane	1100	U
10061-01-5	cis-1,3-Dichloropropene	1100	U
79-01-6	Trichloroethene	1100	U
124-48-1	Dibromochloromethane	1100	U
79-00-5	1,1,2-Trichloroethane	1100	U
71-43-2	Benzene	1100	U
10061-02-6	trans-1,3-Dichloropropene	1100	U
75-25-2	Bromoform	1100	U
108-10-1	4-Methyl-2-pentanone	4200	U
591-78-6	2-Hexanone	4200	U
127-18-4	**Tetrachloroethene**	**41000**	
79-34-5	1,1,2,2-Tetrachloroethane	1100	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 004

Sample WT/Vol: 88.4 / g

Work Order: CE3GE101

Dilution factor: 211

Date Received: 11/18/97

Date Extracted:11/19/97

Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT04-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	1100	U
108-90-7	Chlorobenzene	1100	U
100-41-4	Ethylbenzene	1100	U
100-42-5	Styrene	1100	U
1330-20-7	Xylenes (total)	1100	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K180125 005

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 129.8 / g
Work Order: CE3GG101
Dilution factor: 14.16

Date Received: 11/18/97
Date Extracted:11/19/97
Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT05-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	140	U
74-83-9	Bromomethane	140	U
75-01-4	Vinyl chloride	140	U
75-00-3	Chloroethane	140	U
75-09-2	Methylene chloride	71	U
67-64-1	Acetone	280	U
75-15-0	Carbon disulfide	71	U
75-35-4	1,1-Dichloroethene	71	U
75-34-3	1,1-Dichloroethane	71	U
540-59-0	1,2-Dichloroethene (total)	71	U
67-66-3	Chloroform	71	U
107-06-2	1,2-Dichloroethane	71	U
78-93-3	**2-Butanone**	**390**	
71-55-6	1,1,1-Trichloroethane	71	U
56-23-5	Carbon tetrachloride	71	U
75-27-4	Bromodichloromethane	71	U
78-87-5	1,2-Dichloropropane	71	U
10061-01-5	cis-1,3-Dichloropropene	71	U
79-01-6	**Trichloroethene**	**55**	J
124-48-1	Dibromochloromethane	71	U
79-00-5	1,1,2-Trichloroethane	71	U
71-43-2	Benzene	71	U
10061-02-6	trans-1,3-Dichloropropene	71	U
75-25-2	Bromoform	71	U
108-10-1	4-Methyl-2-pentanone	280	U
591-78-6	2-Hexanone	280	U
127-18-4	**Tetrachloroethene**	**770**	
79-34-5	1,1,2,2-Tetrachloroethane	71	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 005

Sample WT/Vol: 129.8 / g

Work Order: CE3GG101

Dilution factor: 14.16

Date Received: 11/18/97

Date Extracted:11/19/97

Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT05-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	71	U
108-90-7	Chlorobenzene	71	U
100-41-4	Ethylbenzene	71	U
100-42-5	Styrene	71	U
1330-20-7	Xylenes (total)	71	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 007

Sample WT/Vol: 116.7 / g

Work Order: CE3J4101

Dilution factor: 17.37

Date Received: 11/18/97

Date Extracted:11/19/97

Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT07-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	170	U
74-83-9	Bromomethane	170	U
75-01-4	Vinyl chloride	170	U
75-00-3	Chloroethane	170	U
75-09-2	Methylene chloride	87	U
67-64-1	Acetone	350	U
75-15-0	Carbon disulfide	87	U
75-35-4	1,1-Dichloroethene	87	U
75-34-3	1,1-Dichloroethane	87	U
540-59-0	**1,2-Dichloroethene (total)**	**210**	
67-66-3	Chloroform	87	U
107-06-2	1,2-Dichloroethane	87	U
78-93-3	**2-Butanone**	**400**	
71-55-6	1,1,1-Trichloroethane	87	U
56-23-5	Carbon tetrachloride	87	U
75-27-4	Bromodichloromethane	87	U
78-87-5	1,2-Dichloropropane	87	U
10061-01-5	cis-1,3-Dichloropropene	87	U
79-01-6	**Trichloroethene**	**160**	
124-48-1	Dibromochloromethane	87	U
79-00-5	1,1,2-Trichloroethane	87	U
71-43-2	Benzene	87	U
10061-02-6	trans-1,3-Dichloropropene	87	U
75-25-2	Bromoform	87	U
108-10-1	4-Methyl-2-pentanone	350	U
591-78-6	2-Hexanone	350	U
127-18-4	**Tetrachloroethene**	**2500**	
79-34-5	1,1,2,2-Tetrachloroethane	87	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 007

Sample WT/Vol: 116.7 / g
Work Order: CE3J4101
Dilution factor: 17.37

Date Received: 11/18/97
Date Extracted:11/19/97
Date Analyzed: 11/19/97

QC Batch: 7323121

Client Sample Id: IR88-CPT07-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	87	U
108-90-7	Chlorobenzene	87	U
100-41-4	Ethylbenzene	87	U
100-42-5	Styrene	87	U
1330-20-7	Xylenes (total)	87	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K180125 008

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 67.8 / g
Work Order: CE3J6101
Dilution factor: 57.58

Date Received: 11/18/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-CPT08-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	580	U
74-83-9	Bromomethane	580	U
75-01-4	Vinyl chloride	580	U
75-00-3	Chloroethane	580	U
75-09-2	Methylene chloride	290	U
67-64-1	Acetone	1200	U
75-15-0	Carbon disulfide	290	U
75-35-4	1,1-Dichloroethene	290	U
75-34-3	1,1-Dichloroethane	290	U
540-59-0	1,2-Dichloroethene (total)	290	U
67-66-3	Chloroform	290	U
107-06-2	1,2-Dichloroethane	290	U
78-93-3	**2-Butanone**	**710**	**J**
71-55-6	1,1,1-Trichloroethane	290	U
56-23-5	Carbon tetrachloride	290	U
75-27-4	Bromodichloromethane	290	U
78-87-5	1,2-Dichloropropane	290	U
10061-01-5	cis-1,3-Dichloropropene	290	U
79-01-6	**Trichloroethene**	**230**	**J**
124-48-1	Dibromochloromethane	290	U
79-00-5	1,1,2-Trichloroethane	290	U
71-43-2	Benzene	290	U
10061-02-6	trans-1,3-Dichloropropene	290	U
75-25-2	Bromoform	290	U
108-10-1	4-Methyl-2-pentanone	1200	U
591-78-6	2-Hexanone	1200	U
127-18-4	**Tetrachloroethene**	**5900**	
79-34-5	1,1,2,2-Tetrachloroethane	290	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 008

Sample WT/Vol: 67.8 / g

Work Order: CE3J6101

Dilution factor: 57.58

Date Received: 11/18/97

Date Extracted:11/20/97

Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-CPT08-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	290	U
108-90-7	Chlorobenzene	290	U
100-41-4	Ethylbenzene	290	U
100-42-5	Styrene	290	U
1330-20-7	Xylenes (total)	290	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 009

Sample WT/Vol: 78.8 / g
Work Order: CE3JC101
Dilution factor: 23.88

Date Received: 11/18/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-CPT09-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	240	U
74-83-9	Bromomethane	240	U
75-01-4	Vinyl chloride	240	U
75-00-3	Chloroethane	240	U
75-09-2	Methylene chloride	120	U
67-64-1	Acetone	480	U
75-15-0	Carbon disulfide	120	U
75-35-4	1,1-Dichloroethene	120	U
75-34-3	1,1-Dichloroethane	120	U
540-59-0	1,2-Dichloroethene (total)	120	U
67-66-3	Chloroform	120	U
107-06-2	1,2-Dichloroethane	120	U
78-93-3	**2-Butanone**	**610**	
71-55-6	1,1,1-Trichloroethane	120	U
56-23-5	Carbon tetrachloride	120	U
75-27-4	Bromodichloromethane	120	U
78-87-5	1,2-Dichloropropane	120	U
10061-01-5	cis-1,3-Dichloropropene	120	U
79-01-6	Trichloroethene	120	U
124-48-1	Dibromochloromethane	120	U
79-00-5	1,1,2-Trichloroethane	120	U
71-43-2	Benzene	120	U
10061-02-6	trans-1,3-Dichloropropene	120	U
75-25-2	Bromoform	120	U
108-10-1	4-Methyl-2-pentanone	480	U
591-78-6	2-Hexanone	480	U
127-18-4	**Tetrachloroethene**	**2100**	
79-34-5	1,1,2,2-Tetrachloroethane	120	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K180125 009

Sample WT/Vol: 78.8 / g

Work Order: CE3JC101

Dilution factor: 23.88

Date Received: 11/18/97

Date Extracted:11/20/97

Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-CPT09-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	120	U
108-90-7	Chlorobenzene	120	U
100-41-4	Ethylbenzene	120	U
100-42-5	Styrene	120	U
1330-20-7	Xylenes (total)	120	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K180125 010

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 107.2 / g
Work Order: CE3JD101
Dilution factor: 18.2

Date Received: 11/18/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-CPT10-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	180	U
74-83-9	Bromomethane	180	U
75-01-4	Vinyl chloride	180	U
75-00-3	Chloroethane	180	U
75-09-2	Methylene chloride	91	U
67-64-1	Acetone	360	U
75-15-0	Carbon disulfide	91	U
75-35-4	1,1-Dichloroethene	91	U
75-34-3	1,1-Dichloroethane	91	U
540-59-0	1,2-Dichloroethene (total)	91	U
67-66-3	Chloroform	91	U
107-06-2	1,2-Dichloroethane	91	U
78-93-3	**2-Butanone**	**390**	
71-55-6	1,1,1-Trichloroethane	91	U
56-23-5	Carbon tetrachloride	91	U
75-27-4	Bromodichloromethane	91	U
78-87-5	1,2-Dichloropropane	91	U
10061-01-5	cis-1,3-Dichloropropene	91	U
79-01-6	Trichloroethene	91	U
124-48-1	Dibromochloromethane	91	U
79-00-5	1,1,2-Trichloroethane	91	U
71-43-2	Benzene	91	U
10061-02-6	trans-1,3-Dichloropropene	91	U
75-25-2	Bromoform	91	U
108-10-1	4-Methyl-2-pentanone	360	U
591-78-6	2-Hexanone	360	U
127-18-4	**Tetrachloroethene**	**320**	
79-34-5	1,1,2,2-Tetrachloroethane	91	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K180125 010

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 107.2 / g
Work Order: CE3JD101
Dilution factor: 18.2

Date Received: 11/18/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-CPT10-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	91	U
108-90-7	Chlorobenzene	91	U
100-41-4	Ethylbenzene	91	U
100-42-5	Styrene	91	U
1330-20-7	Xylenes (total)	91	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K200104 001

Sample WT/Vol: 119.6 / g
Work Order: CE4FL101
Dilution factor: 16.8
Moisture %:

Date Received: 11/20/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS14-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	170	U
74-83-9	Bromomethane	170	U
75-01-4	Vinyl chloride	170	U
75-00-3	Chloroethane	170	U
75-09-2	Methylene chloride	84	U
67-64-1	Acetone	340	U
75-15-0	Carbon disulfide	84	U
75-35-4	1,1-Dichloroethene	84	U
75-34-3	1,1-Dichloroethane	84	U
540-59-0	1,2-Dichloroethene (total)	84	U
67-66-3	Chloroform	84	U
107-06-2	1,2-Dichloroethane	84	U
78-93-3	**2-Butanone**	**440**	
71-55-6	1,1,1-Trichloroethane	84	U
56-23-5	Carbon tetrachloride	84	U
75-27-4	Bromodichloromethane	84	U
78-87-5	1,2-Dichloropropane	84	U
10061-01-5	cis-1,3-Dichloropropene	84	U
79-01-6	Trichloroethene	84	U
124-48-1	Dibromochloromethane	84	U
79-00-5	1,1,2-Trichloroethane	84	U
71-43-2	Benzene	84	U
10061-02-6	trans-1,3-Dichloropropene	84	U
75-25-2	Bromoform	84	U
108-10-1	4-Methyl-2-pentanone	340	U
591-78-6	2-Hexanone	340	U
127-18-4	**Tetrachloroethene**	**28**	**J**
79-34-5	1,1,2,2-Tetrachloroethane	84	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K200104 001

Sample WT/Vol: 119.6 / g
Work Order: CE4FL101
Dilution factor: 16.8
Moisture %:

Date Received: 11/20/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS14-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	84	U
108-90-7	Chlorobenzene	84	U
100-41-4	Ethylbenzene	84	U
100-42-5	Styrene	84	U
1330-20-7	Xylenes (total)	84	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID:H7K200104 002

Sample WT/Vol: 151.3 / g
Work Order: CE4FT101
Dilution factor: 12.5
Moisture %:
Date Received: 11/20/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS15-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	120	U
74-83-9	Bromomethane	120	U
75-01-4	Vinyl chloride	120	U
75-00-3	Chloroethane	120	U
75-09-2	Methylene chloride	62	U
67-64-1	Acetone	250	U
75-15-0	Carbon disulfide	62	U
75-35-4	1,1-Dichloroethene	62	U
75-34-3	1,1-Dichloroethane	62	U
540-59-0	1,2-Dichloroethene (total)	62	U
67-66-3	Chloroform	62	U
107-06-2	1,2-Dichloroethane	62	U
78-93-3	**2-Butanone**	**300**	
71-55-6	1,1,1-Trichloroethane	62	U
56-23-5	Carbon tetrachloride	62	U
75-27-4	Bromodichloromethane	62	U
78-87-5	1,2-Dichloropropane	62	U
10061-01-5	cis-1,3-Dichloropropene	62	U
79-01-6	**Trichloroethene**	**29**	J
124-48-1	Dibromochloromethane	62	U
79-00-5	1,1,2-Trichloroethane	62	U
71-43-2	Benzene	62	U
10061-02-6	trans-1,3-Dichloropropene	62	U
75-25-2	Bromoform	62	U
108-10-1	4-Methyl-2-pentanone	250	U
591-78-6	2-Hexanone	250	U
127-18-4	**Tetrachloroethene**	**1900**	
79-34-5	1,1,2,2-Tetrachloroethane	62	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K200104 002

Sample WT/Vol: 151.3 / g

Work Order: CE4FT101

Dilution factor: 12.5

Moisture %:

Date Received: 11/20/97

Date Extracted:11/20/97

Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS15-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	62	U
108-90-7	Chlorobenzene	62	U
100-41-4	Ethylbenzene	62	U
100-42-5	Styrene	62	U
1330-20-7	Xylenes (total)	62	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K200104 003

Sample WT/Vol: 143.7 / g
Work Order: CE4FV101
Dilution factor: 12400
Moisture %:

Date Received: 11/20/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS16-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	120000	U
74-83-9	Bromomethane	120000	U
75-01-4	Vinyl chloride	120000	U
75-00-3	Chloroethane	120000	U
75-09-2	Methylene chloride	62000	U
67-64-1	Acetone	250000	U
75-15-0	Carbon disulfide	62000	U
75-35-4	1,1-Dichloroethene	62000	U
75-34-3	1,1-Dichloroethane	62000	U
540-59-0	1,2-Dichloroethene (total)	62000	U
67-66-3	Chloroform	62000	U
107-06-2	1,2-Dichloroethane	62000	U
78-93-3	2-Butanone	250000	U
71-55-6	1,1,1-Trichloroethane	62000	U
56-23-5	Carbon tetrachloride	62000	U
75-27-4	Bromodichloromethane	62000	U
78-87-5	1,2-Dichloropropane	62000	U
10061-01-5	cis-1,3-Dichloropropene	62000	U
79-01-6	Trichloroethene	62000	U
124-48-1	Dibromochloromethane	62000	U
79-00-5	1,1,2-Trichloroethane	62000	U
71-43-2	Benzene	62000	U
10061-02-6	trans-1,3-Dichloropropene	62000	U
75-25-2	Bromoform	62000	U
108-10-1	4-Methyl-2-pentanone	250000	U
591-78-6	2-Hexanone	250000	U
127-18-4	**Tetrachloroethene**	**1800000**	
79-34-5	1,1,2,2-Tetrachloroethane	62000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K200104 003

Sample WT/Vol: 143.7 / g

Work Order: CE4FV101

Dilution factor: 12400

Moisture %:

Date Received: 11/20/97

Date Extracted:11/20/97

Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS16-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	62000	U
108-90-7	Chlorobenzene	62000	U
100-41-4	Ethylbenzene	62000	U
100-42-5	Styrene	62000	U
1330-20-7	Xylenes (total)	62000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K200104 004

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 125.6 / g
Work Order: CE4FW101
Dilution factor: 16700
Moisture %:

Date Received: 11/20/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS17-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	170000	U
74-83-9	Bromomethane	170000	U
75-01-4	Vinyl chloride	170000	U
75-00-3	Chloroethane	170000	U
75-09-2	Methylene chloride	84000	U
67-64-1	Acetone	330000	U
75-15-0	Carbon disulfide	84000	U
75-35-4	1,1-Dichloroethene	84000	U
75-34-3	1,1-Dichloroethane	84000	U
540-59-0	1,2-Dichloroethene (total)	84000	U
67-66-3	Chloroform	84000	U
107-06-2	1,2-Dichloroethane	84000	U
78-93-3	2-Butanone	330000	U
71-55-6	1,1,1-Trichloroethane	84000	U
56-23-5	Carbon tetrachloride	84000	U
75-27-4	Bromodichloromethane	84000	U
78-87-5	1,2-Dichloropropane	84000	U
10061-01-5	cis-1,3-Dichloropropene	84000	U
79-01-6	Trichloroethene	84000	U
124-48-1	Dibromochloromethane	84000	U
79-00-5	1,1,2-Trichloroethane	84000	U
71-43-2	Benzene	84000	U
10061-02-6	trans-1,3-Dichloropropene	84000	U
75-25-2	Bromoform	84000	U
108-10-1	4-Methyl-2-pentanone	330000	U
591-78-6	2-Hexanone	330000	U
127-18-4	**Tetrachloroethene**	**3700000**	**E**
79-34-5	1,1,2,2-Tetrachloroethane	84000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7K200104 004
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 125.6 / g
Work Order: CE4FW101
Dilution factor: 16700
Moisture %:

Date Received: 11/20/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS17-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	84000	U
108-90-7	Chlorobenzene	84000	U
100-41-4	Ethylbenzene	84000	U
100-42-5	Styrene	84000	U
1330-20-7	Xylenes (total)	84000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K200104 004

Sample WT/Vol: 125.6 / g

Work Order: CE4FW201

Dilution factor: 33400

Moisture %:

Date Received: 11/20/97

Date Extracted:11/20/97

Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS17-02 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	330000	U
74-83-9	Bromomethane	330000	U
75-01-4	Vinyl chloride	330000	U
75-00-3	Chloroethane	330000	U
75-09-2	Methylene chloride	170000	U
67-64-1	Acetone	670000	U
75-15-0	Carbon disulfide	170000	U
75-35-4	1,1-Dichloroethene	170000	U
75-34-3	1,1-Dichloroethane	170000	U
540-59-0	1,2-Dichloroethene (total)	170000	U
67-66-3	Chloroform	170000	U
107-06-2	1,2-Dichloroethane	170000	U
78-93-3	2-Butanone	670000	U
71-55-6	1,1,1-Trichloroethane	170000	U
56-23-5	Carbon tetrachloride	170000	U
75-27-4	Bromodichloromethane	170000	U
78-87-5	1,2-Dichloropropane	170000	U
10061-01-5	cis-1,3-Dichloropropene	170000	U
79-01-6	Trichloroethene	170000	U
124-48-1	Dibromochloromethane	170000	U
79-00-5	1,1,2-Trichloroethane	170000	U
71-43-2	Benzene	170000	U
10061-02-6	trans-1,3-Dichloropropene	170000	U
75-25-2	Bromoform	170000	U
108-10-1	4-Methyl-2-pentanone	670000	U
591-78-6	2-Hexanone	670000	U
127-18-4	**Tetrachloroethene**	**3800000**	D
79-34-5	1,1,2,2-Tetrachloroethane	170000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K200104 004

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 125.6 / g

Work Order: CE4FW201

Dilution factor: 33400

Moisture %:

Date Received: 11/20/97

Date Extracted:11/20/97

Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS17-02 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	170000	U
108-90-7	Chlorobenzene	170000	U
100-41-4	Ethylbenzene	170000	U
100-42-5	Styrene	170000	U
1330-20-7	Xylenes (total)	170000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7K200104 005
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 143.1 / g
Work Order: CE4G0101
Dilution factor: 26.8
Moisture %:
Date Received: 11/20/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS18-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	270	U
74-83-9	Bromomethane	270	U
75-01-4	Vinyl chloride	270	U
75-00-3	Chloroethane	270	U
75-09-2	Methylene chloride	130	U
67-64-1	Acetone	540	U
75-15-0	Carbon disulfide	130	U
75-35-4	1,1-Dichloroethene	130	U
75-34-3	1,1-Dichloroethane	130	U
540-59-0	1,2-Dichloroethene (total)	130	U
67-66-3	Chloroform	130	U
107-06-2	1,2-Dichloroethane	130	U
78-93-3	**2-Butanone**	**350**	**J**
71-55-6	1,1,1-Trichloroethane	130	U
56-23-5	Carbon tetrachloride	130	U
75-27-4	Bromodichloromethane	130	U
78-87-5	1,2-Dichloropropane	130	U
10061-01-5	cis-1,3-Dichloropropene	130	U
79-01-6	**Trichloroethene**	**63**	**J**
124-48-1	Dibromochloromethane	130	U
79-00-5	1,1,2-Trichloroethane	130	U
71-43-2	Benzene	130	U
10061-02-6	trans-1,3-Dichloropropene	130	U
75-25-2	Bromoform	130	U
108-10-1	4-Methyl-2-pentanone	540	U
591-78-6	2-Hexanone	540	U
127-18-4	**Tetrachloroethene**	**3100**	
79-34-5	1,1,2,2-Tetrachloroethane	130	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K200104 005

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 143.1 / g
Work Order: CE4G0101
Dilution factor: 26.8
Moisture %:

Date Received: 11/20/97
Date Extracted:11/20/97
Date Analyzed: 11/20/97

QC Batch: 7324161

Client Sample Id: IR88-IS18-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	130	U
108-90-7	Chlorobenzene	130	U
100-41-4	Ethylbenzene	130	U
100-42-5	Styrene	130	U
1330-20-7	Xylenes (total)	130	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 001

Sample WT/Vol: 105.7 / g
Work Order: CE6NC101
Dilution factor: 16.97

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS19-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	170	U
74-83-9	Bromomethane	170	U
75-01-4	Vinyl chloride	170	U
75-00-3	Chloroethane	170	U
75-09-2	Methylene chloride	85	U
67-64-1	Acetone	340	U
75-15-0	Carbon disulfide	85	U
75-35-4	1,1-Dichloroethene	85	U
75-34-3	1,1-Dichloroethane	85	U
540-59-0	1,2-Dichloroethene (total)	85	U
67-66-3	Chloroform	85	U
107-06-2	1,2-Dichloroethane	85	U
78-93-3	**2-Butanone**	**410**	
71-55-6	1,1,1-Trichloroethane	85	U
56-23-5	Carbon tetrachloride	85	U
75-27-4	Bromodichloromethane	85	U
78-87-5	1,2-Dichloropropane	85	U
10061-01-5	cis-1,3-Dichloropropene	85	U
79-01-6	Trichloroethene	85	U
124-48-1	Dibromochloromethane	85	U
79-00-5	1,1,2-Trichloroethane	85	U
71-43-2	Benzene	85	U
10061-02-6	trans-1,3-Dichloropropene	85	U
75-25-2	Bromoform	85	U
108-10-1	4-Methyl-2-pentanone	340	U
591-78-6	2-Hexanone	340	U
127-18-4	**Tetrachloroethene**	**39**	**J**
79-34-5	1,1,2,2-Tetrachloroethane	85	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K220110 001

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 105.7 / g
Work Order: CE6NC101
Dilution factor: 16.97

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS19-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	85	U
108-90-7	Chlorobenzene	85	U
100-41-4	Ethylbenzene	85	U
100-42-5	Styrene	85	U
1330-20-7	Xylenes (total)	85	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K220110 004

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 128.3 / g
Work Order: CE6NF101
Dilution factor: 15.95

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS20-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	160	U
74-83-9	Bromomethane	160	U
75-01-4	Vinyl chloride	160	U
75-00-3	Chloroethane	160	U
75-09-2	Methylene chloride	80	U
67-64-1	Acetone	320	U
75-15-0	Carbon disulfide	80	U
75-35-4	1,1-Dichloroethene	80	U
75-34-3	1,1-Dichloroethane	80	U
540-59-0	1,2-Dichloroethene (total)	80	U
67-66-3	Chloroform	80	U
107-06-2	1,2-Dichloroethane	80	U
78-93-3	**2-Butanone**	**96**	**J**
71-55-6	1,1,1-Trichloroethane	80	U
56-23-5	Carbon tetrachloride	80	U
75-27-4	Bromodichloromethane	80	U
78-87-5	1,2-Dichloropropane	80	U
10061-01-5	cis-1,3-Dichloropropene	80	U
79-01-6	Trichloroethene	80	U
124-48-1	Dibromochloromethane	80	U
79-00-5	1,1,2-Trichloroethane	80	U
71-43-2	Benzene	80	U
10061-02-6	trans-1,3-Dichloropropene	80	U
75-25-2	Bromoform	80	U
108-10-1	4-Methyl-2-pentanone	320	U
591-78-6	2-Hexanone	320	U
127-18-4	**Tetrachloroethene**	**1800**	
79-34-5	1,1,2,2-Tetrachloroethane	80	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7K220110 004
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 128.3 / g
Work Order: CE6NF101
Dilution factor: 15.95

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS20-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	80	U
108-90-7	Chlorobenzene	80	U
100-41-4	Ethylbenzene	80	U
100-42-5	Styrene	80	U
1330-20-7	Xylenes (total)	80	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K220110 019

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 135.1 / g
Work Order: CE6Q2101
Dilution factor: 36355

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/23/97

QC Batch: 7326121

Client Sample Id: IR88-IS21-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	360000	U
74-83-9	Bromomethane	360000	U
75-01-4	Vinyl chloride	360000	U
75-00-3	Chloroethane	360000	U
75-09-2	Methylene chloride	180000	U
67-64-1	Acetone	730000	U
75-15-0	Carbon disulfide	180000	U
75-35-4	1,1-Dichloroethene	180000	U
75-34-3	1,1-Dichloroethane	180000	U
540-59-0	1,2-Dichloroethene (total)	180000	U
67-66-3	Chloroform	180000	U
107-06-2	1,2-Dichloroethane	180000	U
78-93-3	2-Butanone	730000	U
71-55-6	1,1,1-Trichloroethane	180000	U
56-23-5	Carbon tetrachloride	180000	U
75-27-4	Bromodichloromethane	180000	U
78-87-5	1,2-Dichloropropane	180000	U
10061-01-5	cis-1,3-Dichloropropene	180000	U
79-01-6	Trichloroethene	180000	U
124-48-1	Dibromochloromethane	180000	U
79-00-5	1,1,2-Trichloroethane	180000	U
71-43-2	Benzene	180000	U
10061-02-6	trans-1,3-Dichloropropene	180000	U
75-25-2	Bromoform	180000	U
108-10-1	4-Methyl-2-pentanone	730000	U
591-78-6	2-Hexanone	730000	U
127-18-4	**Tetrachloroethene**	**4200000**	
79-34-5	1,1,2,2-Tetrachloroethane	180000	U

FORM I

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 019

Sample WT/Vol: 135.1 / g

Work Order: CE6Q2101

Dilution factor: 36355

Date Received: 11/22/97

Date Extracted:11/22/97

Date Analyzed: 11/23/97

QC Batch: 7326121

Client Sample Id: IR88-IS21-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	180000	U
108-90-7	Chlorobenzene	180000	U
100-41-4	Ethylbenzene	180000	U
100-42-5	Styrene	180000	U
1330-20-7	Xylenes (total)	180000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K220110 005

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 94.2 / g
Work Order: CE6NG101
Dilution factor: 4117.5

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS21-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	41000	U
74-83-9	Bromomethane	41000	U
75-01-4	Vinyl chloride	41000	U
75-00-3	Chloroethane	41000	U
75-09-2	Methylene chloride	21000	U
67-64-1	Acetone	82000	U
75-15-0	Carbon disulfide	21000	U
75-35-4	1,1-Dichloroethene	21000	U
75-34-3	1,1-Dichloroethane	21000	U
540-59-0	1,2-Dichloroethene (total)	21000	U
67-66-3	Chloroform	21000	U
107-06-2	1,2-Dichloroethane	21000	U
78-93-3	2-Butanone	82000	U
71-55-6	1,1,1-Trichloroethane	21000	U
56-23-5	Carbon tetrachloride	21000	U
75-27-4	Bromodichloromethane	21000	U
78-87-5	1,2-Dichloropropane	21000	U
10061-01-5	cis-1,3-Dichloropropene	21000	U
79-01-6	Trichloroethene	21000	U
124-48-1	Dibromochloromethane	21000	U
79-00-5	1,1,2-Trichloroethane	21000	U
71-43-2	Benzene	21000	U
10061-02-6	trans-1,3-Dichloropropene	21000	U
75-25-2	Bromoform	21000	U
108-10-1	4-Methyl-2-pentanone	82000	U
591-78-6	2-Hexanone	82000	U
127-18-4	**Tetrachloroethene**	**610000**	**D**
79-34-5	1,1,2,2-Tetrachloroethane	21000	U

FORM I

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7K220110 005
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 94.2 / g
Work Order: CE6NG101
Dilution factor: 4117.5

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS21-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	21000	U
108-90-7	Chlorobenzene	21000	U
100-41-4	Ethylbenzene	21000	U
100-42-5	Styrene	21000	U
1330-20-7	Xylenes (total)	21000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 005

Sample WT/Vol: 94.2 / g

Work Order: CE6NG201

Dilution factor: 411.75

Date Received: 11/22/97

Date Extracted:11/22/97

Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS21-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	4100	U
74-83-9	Bromomethane	4100	U
75-01-4	Vinyl chloride	4100	U
75-00-3	Chloroethane	4100	U
75-09-2	Methylene chloride	2100	U
67-64-1	Acetone	8200	U
75-15-0	Carbon disulfide	2100	U
75-35-4	1,1-Dichloroethene	2100	U
75-34-3	1,1-Dichloroethane	2100	U
540-59-0	1,2-Dichloroethene (total)	2100	U
67-66-3	Chloroform	2100	U
107-06-2	1,2-Dichloroethane	2100	U
78-93-3	2-Butanone	8200	U
71-55-6	1,1,1-Trichloroethane	2100	U
56-23-5	Carbon tetrachloride	2100	U
75-27-4	Bromodichloromethane	2100	U
78-87-5	1,2-Dichloropropane	2100	U
10061-01-5	cis-1,3-Dichloropropene	2100	U
79-01-6	Trichloroethene	2100	U
124-48-1	Dibromochloromethane	2100	U
79-00-5	1,1,2-Trichloroethane	2100	U
71-43-2	Benzene	2100	U
10061-02-6	trans-1,3-Dichloropropene	2100	U
75-25-2	Bromoform	2100	U
108-10-1	4-Methyl-2-pentanone	8200	U
591-78-6	2-Hexanone	8200	U
127-18-4	**Tetrachloroethene**	**360000**	**E**
79-34-5	1,1,2,2-Tetrachloroethane	2100	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K220110 005

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 94.2 / g
Work Order: CE6NG201
Dilution factor: 411.75

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS21-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	2100	U
108-90-7	Chlorobenzene	2100	U
100-41-4	Ethylbenzene	2100	U
100-42-5	Styrene	2100	U
1330-20-7	Xylenes (total)	2100	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID: H7K220110 006

Sample WT/Vol: 87.7 / g
Work Order: CE6NH101
Dilution factor: 46099.8

Date Received: 11/22/97
Date Extracted: 11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS21-04

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	460000	U
74-83-9	Bromomethane	460000	U
75-01-4	Vinyl chloride	460000	U
75-00-3	Chloroethane	460000	U
75-09-2	Methylene chloride	230000	U
67-64-1	Acetone	920000	U
75-15-0	Carbon disulfide	230000	U
75-35-4	1,1-Dichloroethene	230000	U
75-34-3	1,1-Dichloroethane	230000	U
540-59-0	1,2-Dichloroethene (total)	230000	U
67-66-3	Chloroform	230000	U
107-06-2	1,2-Dichloroethane	230000	U
78-93-3	2-Butanone	920000	U
71-55-6	1,1,1-Trichloroethane	230000	U
56-23-5	Carbon tetrachloride	230000	U
75-27-4	Bromodichloromethane	230000	U
78-87-5	1,2-Dichloropropane	230000	U
10061-01-5	cis-1,3-Dichloropropene	230000	U
79-01-6	Trichloroethene	230000	U
124-48-1	Dibromochloromethane	230000	U
79-00-5	1,1,2-Trichloroethane	230000	U
71-43-2	Benzene	230000	U
10061-02-6	trans-1,3-Dichloropropene	230000	U
75-25-2	Bromoform	230000	U
108-10-1	4-Methyl-2-pentanone	920000	U
591-78-6	2-Hexanone	920000	U
127-18-4	**Tetrachloroethene**	**6100000**	
79-34-5	1,1,2,2-Tetrachloroethane	230000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 006

Sample WT/Vol: 87.7 / g

Work Order: CE6NH101

Dilution factor: 46099.8

Date Received: 11/22/97

Date Extracted:11/22/97

Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS21-04

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	230000	U
108-90-7	Chlorobenzene	230000	U
100-41-4	Ethylbenzene	230000	U
100-42-5	Styrene	230000	U
1330-20-7	Xylenes (total)	230000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID:H7K220110 007

Sample WT/Vol: 135.4 / g
Work Order: CE6NK101
Dilution factor: 25100.5
Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS22-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	250000	U
74-83-9	Bromomethane	250000	U
75-01-4	Vinyl chloride	250000	U
75-00-3	Chloroethane	250000	U
75-09-2	Methylene chloride	130000	U
67-64-1	Acetone	500000	U
75-15-0	Carbon disulfide	130000	U
75-35-4	1,1-Dichloroethene	130000	U
75-34-3	1,1-Dichloroethane	130000	U
540-59-0	1,2-Dichloroethene (total)	130000	U
67-66-3	Chloroform	130000	U
107-06-2	1,2-Dichloroethane	130000	U
78-93-3	2-Butanone	500000	U
71-55-6	1,1,1-Trichloroethane	130000	U
56-23-5	Carbon tetrachloride	130000	U
75-27-4	Bromodichloromethane	130000	U
78-87-5	1,2-Dichloropropane	130000	U
10061-01-5	cis-1,3-Dichloropropene	130000	U
79-01-6	Trichloroethene	130000	U
124-48-1	Dibromochloromethane	130000	U
79-00-5	1,1,2-Trichloroethane	130000	U
71-43-2	Benzene	130000	U
10061-02-6	trans-1,3-Dichloropropene	130000	U
75-25-2	Bromoform	130000	U
108-10-1	4-Methyl-2-pentanone	500000	U
591-78-6	2-Hexanone	500000	U
127-18-4	**Tetrachloroethene**	**2000000**	
79-34-5	1,1,2,2-Tetrachloroethane	130000	U

FORM I

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 007

Sample WT/Vol: 135.4 / g

Work Order: CE6NK101

Dilution factor: 25100.5

Date Received: 11/22/97

Date Extracted:11/22/97

Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS22-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	130000	U
108-90-7	Chlorobenzene	130000	U
100-41-4	Ethylbenzene	130000	U
100-42-5	Styrene	130000	U
1330-20-7	Xylenes (total)	130000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 008

Sample WT/Vol: 124.4 / g
Work Order: CE6NL101
Dilution factor: 13253.75

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS22-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	130000	U
74-83-9	Bromomethane	130000	U
75-01-4	Vinyl chloride	130000	U
75-00-3	Chloroethane	130000	U
75-09-2	Methylene chloride	66000	U
67-64-1	Acetone	270000	U
75-15-0	Carbon disulfide	66000	U
75-35-4	1,1-Dichloroethene	66000	U
75-34-3	1,1-Dichloroethane	66000	U
540-59-0	1,2-Dichloroethene (total)	66000	U
67-66-3	Chloroform	66000	U
107-06-2	1,2-Dichloroethane	66000	U
78-93-3	2-Butanone	270000	U
71-55-6	1,1,1-Trichloroethane	66000	U
56-23-5	Carbon tetrachloride	66000	U
75-27-4	Bromodichloromethane	66000	U
78-87-5	1,2-Dichloropropane	66000	U
10061-01-5	cis-1,3-Dichloropropene	66000	U
79-01-6	Trichloroethene	66000	U
124-48-1	Dibromochloromethane	66000	U
79-00-5	1,1,2-Trichloroethane	66000	U
71-43-2	Benzene	66000	U
10061-02-6	trans-1,3-Dichloropropene	66000	U
75-25-2	Bromoform	66000	U
108-10-1	4-Methyl-2-pentanone	270000	U
591-78-6	2-Hexanone	270000	U
127-18-4	**Tetrachloroethene**	**1600000**	
79-34-5	1,1,2,2-Tetrachloroethane	66000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 008

Sample WT/Vol: 124.4 / g

Work Order: CE6NL101

Dilution factor: 13253.75

Date Received: 11/22/97

Date Extracted:11/22/97

Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS22-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	66000	U
108-90-7	Chlorobenzene	66000	U
100-41-4	Ethylbenzene	66000	U
100-42-5	Styrene	66000	U
1330-20-7	Xylenes (total)	66000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 009

Sample WT/Vol: 113.6 / g

Work Order: CE6NM101

Dilution factor: 5134.6

Date Received: 11/22/97

Date Extracted:11/22/97

Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS22-04

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	51000	U
74-83-9	Bromomethane	51000	U
75-01-4	Vinyl chloride	51000	U
75-00-3	Chloroethane	51000	U
75-09-2	Methylene chloride	26000	U
67-64-1	Acetone	100000	U
75-15-0	Carbon disulfide	26000	U
75-35-4	1,1-Dichloroethene	26000	U
75-34-3	1,1-Dichloroethane	26000	U
540-59-0	1,2-Dichloroethene (total)	26000	U
67-66-3	Chloroform	26000	U
107-06-2	1,2-Dichloroethane	26000	U
78-93-3	2-Butanone	100000	U
71-55-6	1,1,1-Trichloroethane	26000	U
56-23-5	Carbon tetrachloride	26000	U
75-27-4	Bromodichloromethane	26000	U
78-87-5	1,2-Dichloropropane	26000	U
10061-01-5	cis-1,3-Dichloropropene	26000	U
79-01-6	Trichloroethene	26000	U
124-48-1	Dibromochloromethane	26000	U
79-00-5	1,1,2-Trichloroethane	26000	U
71-43-2	Benzene	26000	U
10061-02-6	trans-1,3-Dichloropropene	26000	U
75-25-2	Bromoform	26000	U
108-10-1	4-Methyl-2-pentanone	100000	U
591-78-6	2-Hexanone	100000	U
127-18-4	**Tetrachloroethene**	**550000**	
79-34-5	1,1,2,2-Tetrachloroethane	26000	U

FORM I

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 009

Sample WT/Vol: 113.6 / g

Work Order: CE6NM101

Dilution factor: 5134.6

Date Received: 11/22/97

Date Extracted:11/22/97

Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS22-04

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	26000	U
108-90-7	Chlorobenzene	26000	U
100-41-4	Ethylbenzene	26000	U
100-42-5	Styrene	26000	U
1330-20-7	Xylenes (total)	26000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 010

Sample WT/Vol: 126 / g
Work Order: CE6NN101
Dilution factor: 29.5

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS23-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	300	U
74-83-9	Bromomethane	300	U
75-01-4	Vinyl chloride	300	U
75-00-3	Chloroethane	300	U
75-09-2	Methylene chloride	150	U
67-64-1	Acetone	590	U
75-15-0	Carbon disulfide	150	U
75-35-4	1,1-Dichloroethene	150	U
75-34-3	1,1-Dichloroethane	150	U
540-59-0	1,2-Dichloroethene (total)	150	U
67-66-3	Chloroform	150	U
107-06-2	1,2-Dichloroethane	150	U
78-93-3	**2-Butanone**	**400**	J
71-55-6	1,1,1-Trichloroethane	150	U
56-23-5	Carbon tetrachloride	150	U
75-27-4	Bromodichloromethane	150	U
78-87-5	1,2-Dichloropropane	150	U
10061-01-5	cis-1,3-Dichloropropene	150	U
79-01-6	Trichloroethene	150	U
124-48-1	Dibromochloromethane	150	U
79-00-5	1,1,2-Trichloroethane	150	U
71-43-2	Benzene	150	U
10061-02-6	trans-1,3-Dichloropropene	150	U
75-25-2	Bromoform	150	U
108-10-1	4-Methyl-2-pentanone	590	U
591-78-6	2-Hexanone	590	U
127-18-4	**Tetrachloroethene**	**5500**	
79-34-5	1,1,2,2-Tetrachloroethane	150	U

FORM I

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K220110 010

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 126 / g
Work Order: CE6NN101
Dilution factor: 29.5

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS23-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	150	U
108-90-7	Chlorobenzene	150	U
100-41-4	Ethylbenzene	150	U
100-42-5	Styrene	150	U
1330-20-7	Xylenes (total)	150	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 012

Sample WT/Vol: 133.1 / g

Work Order: CE6NR101

Dilution factor: 1385.9

Date Received: 11/22/97

Date Extracted:11/22/97

Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS23-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	14000	U
74-83-9	Bromomethane	14000	U
75-01-4	Vinyl chloride	14000	U
75-00-3	Chloroethane	14000	U
75-09-2	Methylene chloride	6900	U
67-64-1	Acetone	28000	U
75-15-0	Carbon disulfide	6900	U
75-35-4	1,1-Dichloroethene	6900	U
75-34-3	1,1-Dichloroethane	6900	U
540-59-0	1,2-Dichloroethene (total)	6900	U
67-66-3	Chloroform	6900	U
107-06-2	1,2-Dichloroethane	6900	U
78-93-3	2-Butanone	28000	U
71-55-6	1,1,1-Trichloroethane	6900	U
56-23-5	Carbon tetrachloride	6900	U
75-27-4	Bromodichloromethane	6900	U
78-87-5	1,2-Dichloropropane	6900	U
10061-01-5	cis-1,3-Dichloropropene	6900	U
79-01-6	Trichloroethene	6900	U
124-48-1	Dibromochloromethane	6900	U
79-00-5	1,1,2-Trichloroethane	6900	U
71-43-2	Benzene	6900	U
10061-02-6	trans-1,3-Dichloropropene	6900	U
75-25-2	Bromoform	6900	U
108-10-1	4-Methyl-2-pentanone	28000	U
591-78-6	2-Hexanone	28000	U
127-18-4	**Tetrachloroethene**	**180000**	
79-34-5	1,1,2,2-Tetrachloroethane	6900	U

FORM I

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA SDG Number:

Matrix: (soil/water) SOLID Lab Sample ID:H7K220110·012
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 133.1 / g Date Received: 11/22/97
Work Order: CE6NR101 Date Extracted:11/22/97
Dilution factor: 1385.9 Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS23-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	6900	U
108-90-7	Chlorobenzene	6900	U
100-41-4	Ethylbenzene	6900	U
100-42-5	Styrene	6900	U
1330-20-7	Xylenes (total)	6900	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 013

Sample WT/Vol: 151.2 / g
Work Order: CE6NT101
Dilution factor: 5995.4

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS25-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	60000	U
74-83-9	Bromomethane	60000	U
75-01-4	Vinyl chloride	60000	U
75-00-3	Chloroethane	60000	U
75-09-2	Methylene chloride	30000	U
67-64-1	Acetone	120000	U
75-15-0	Carbon disulfide	30000	U
75-35-4	1,1-Dichloroethene	30000	U
75-34-3	1,1-Dichloroethane	30000	U
540-59-0	1,2-Dichloroethene (total)	30000	U
67-66-3	Chloroform	30000	U
107-06-2	1,2-Dichloroethane	30000	U
78-93-3	2-Butanone	120000	U
71-55-6	1,1,1-Trichloroethane	30000	U
56-23-5	Carbon tetrachloride	30000	U
75-27-4	Bromodichloromethane	30000	U
78-87-5	1,2-Dichloropropane	30000	U
10061-01-5	cis-1,3-Dichloropropene	30000	U
79-01-6	Trichloroethene	30000	U
124-48-1	Dibromochloromethane	30000	U
79-00-5	1,1,2-Trichloroethane	30000	U
71-43-2	Benzene	30000	U
10061-02-6	trans-1,3-Dichloropropene	30000	U
75-25-2	Bromoform	30000	U
108-10-1	4-Methyl-2-pentanone	120000	U
591-78-6	2-Hexanone	120000	U
127-18-4	**Tetrachloroethene**	**990000**	
79-34-5	1,1,2,2-Tetrachloroethane	30000	U

FORM I

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K220110 013

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 151.2 / g
Work Order: CE6NT101
Dilution factor: 5995.4

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS25-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	30000	U
108-90-7	Chlorobenzene	30000	U
100-41-4	Ethylbenzene	30000	U
100-42-5	Styrene	30000	U
1330-20-7	Xylenes (total)	30000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K220110 014

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 112.6 / g
Work Order: CE6NV101
Dilution factor: 50866.2

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS25-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	510000	U
74-83-9	Bromomethane	510000	U
75-01-4	Vinyl chloride	510000	U
75-00-3	Chloroethane	510000	U
75-09-2	Methylene chloride	250000	U
67-64-1	Acetone	1000000	U
75-15-0	Carbon disulfide	250000	U
75-35-4	1,1-Dichloroethene	250000	U
75-34-3	1,1-Dichloroethane	250000	U
540-59-0	1,2-Dichloroethene (total)	250000	U
67-66-3	Chloroform	250000	U
107-06-2	1,2-Dichloroethane	250000	U
78-93-3	2-Butanone	1000000	U
71-55-6	1,1,1-Trichloroethane	250000	U
56-23-5	Carbon tetrachloride	250000	U
75-27-4	Bromodichloromethane	250000	U
78-87-5	1,2-Dichloropropane	250000	U
10061-01-5	cis-1,3-Dichloropropene	250000	U
79-01-6	Trichloroethene	250000	U
124-48-1	Dibromochloromethane	250000	U
79-00-5	1,1,2-Trichloroethane	250000	U
71-43-2	Benzene	250000	U
10061-02-6	trans-1,3-Dichloropropene	250000	U
75-25-2	Bromoform	250000	U
108-10-1	4-Methyl-2-pentanone	1000000	U
591-78-6	2-Hexanone	1000000	U
127-18-4	**Tetrachloroethene**	**5900000**	
79-34-5	1,1,2,2-Tetrachloroethane	250000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K220110 014

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 112.6 / g
Work Order: CE6NV101
Dilution factor: 50866.2

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS25-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	250000	U
108-90-7	Chlorobenzene	250000	U
100-41-4	Ethylbenzene	250000	U
100-42-5	Styrene	250000	U
1330-20-7	Xylenes (total)	250000	U

FORM I

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID: H7K220110 015

Sample WT/Vol: 120.5 / g

Work Order: CE6NW101

Dilution factor: 4735.7

Date Received: 11/22/97

Date Extracted: 11/22/97

Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS25-04

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	47000	U
74-83-9	Bromomethane	47000	U
75-01-4	Vinyl chloride	47000	U
75-00-3	Chloroethane	47000	U
75-09-2	Methylene chloride	24000	U
67-64-1	Acetone	95000	U
75-15-0	Carbon disulfide	24000	U
75-35-4	1,1-Dichloroethene	24000	U
75-34-3	1,1-Dichloroethane	24000	U
540-59-0	1,2-Dichloroethene (total)	24000	U
67-66-3	Chloroform	24000	U
107-06-2	1,2-Dichloroethane	24000	U
78-93-3	2-Butanone	95000	U
71-55-6	1,1,1-Trichloroethane	24000	U
56-23-5	Carbon tetrachloride	24000	U
75-27-4	Bromodichloromethane	24000	U
78-87-5	1,2-Dichloropropane	24000	U
10061-01-5	cis-1,3-Dichloropropene	24000	U
79-01-6	Trichloroethene	24000	U
124-48-1	Dibromochloromethane	24000	U
79-00-5	1,1,2-Trichloroethane	24000	U
71-43-2	Benzene	24000	U
10061-02-6	trans-1,3-Dichloropropene	24000	U
75-25-2	Bromoform	24000	U
108-10-1	4-Methyl-2-pentanone	95000	U
591-78-6	2-Hexanone	95000	U
127-18-4	**Tetrachloroethene**	**490000**	
79-34-5	1,1,2,2-Tetrachloroethane	24000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 015

Sample WT/Vol: 120.5 / g
Work Order: CE6NW101
Dilution factor: 4735.7

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS25-04

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	24000	U
108-90-7	Chlorobenzene	24000	U
100-41-4	Ethylbenzene	24000	U
100-42-5	Styrene	24000	U
1330-20-7	Xylenes (total)	24000	U

FORM I

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7K220110 016
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 132.1 / g
Work Order: CE6NX101
Dilution factor: 976.79

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/23/97

QC Batch: 7326121

Client Sample Id: IR88-IS26-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	9800	U
74-83-9	Bromomethane	9800	U
75-01-4	Vinyl chloride	9800	U
75-00-3	Chloroethane	9800	U
75-09-2	Methylene chloride	4900	U
67-64-1	Acetone	20000	U
75-15-0	Carbon disulfide	4900	U
75-35-4	1,1-Dichloroethene	4900	U
75-34-3	1,1-Dichloroethane	4900	U
540-59-0	1,2-Dichloroethene (total)	4900	U
67-66-3	Chloroform	4900	U
107-06-2	1,2-Dichloroethane	4900	U
78-93-3	2-Butanone	20000	U
71-55-6	1,1,1-Trichloroethane	4900	U
56-23-5	Carbon tetrachloride	4900	U
75-27-4	Bromodichloromethane	4900	U
78-87-5	1,2-Dichloropropane	4900	U
10061-01-5	cis-1,3-Dichloropropene	4900	U
79-01-6	Trichloroethene	4900	U
124-48-1	Dibromochloromethane	4900	U
79-00-5	1,1,2-Trichloroethane	4900	U
71-43-2	Benzene	4900	U
10061-02-6	trans-1,3-Dichloropropene	4900	U
75-25-2	Bromoform	4900	U
108-10-1	4-Methyl-2-pentanone	20000	U
591-78-6	2-Hexanone	20000	U
127-18-4	**Tetrachloroethene**	**120000**	
79-34-5	1,1,2,2-Tetrachloroethane	4900	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 016

Sample WT/Vol: 132.1 / g
Work Order: CE6NX101
Dilution factor: 976.79

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/23/97

QC Batch: 7326121

Client Sample Id: IR88-IS26-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	4900	U
108-90-7	Chlorobenzene	4900	U
100-41-4	Ethylbenzene	4900	U
100-42-5	Styrene	4900	U
1330-20-7	Xylenes (total)	4900	U

BAKER ENVIRONMENTAL

Lab Name: QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID: H7K220110 017

Sample WT/Vol: 130.1 / g
Work Order: CE6P1101
Dilution factor: 6530.8
Date Received: 11/22/97
Date Extracted: 11/22/97
Date Analyzed: 11/23/97

QC Batch: 7326121

Client Sample Id: IR88-IS26-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	65000	U
74-83-9	Bromomethane	65000	U
75-01-4	Vinyl chloride	65000	U
75-00-3	Chloroethane	65000	U
75-09-2	Methylene chloride	33000	U
67-64-1	Acetone	130000	U
75-15-0	Carbon disulfide	33000	U
75-35-4	1,1-Dichloroethene	33000	U
75-34-3	1,1-Dichloroethane	33000	U
540-59-0	1,2-Dichloroethene (total)	33000	U
67-66-3	Chloroform	33000	U
107-06-2	1,2-Dichloroethane	33000	U
78-93-3	2-Butanone	130000	U
71-55-6	1,1,1-Trichloroethane	33000	U
56-23-5	Carbon tetrachloride	33000	U
75-27-4	Bromodichloromethane	33000	U
78-87-5	1,2-Dichloropropane	33000	U
10061-01-5	cis-1,3-Dichloropropene	33000	U
79-01-6	Trichloroethene	33000	U
124-48-1	Dibromochloromethane	33000	U
79-00-5	1,1,2-Trichloroethane	33000	U
71-43-2	Benzene	33000	U
10061-02-6	trans-1,3-Dichloropropene	33000	U
75-25-2	Bromoform	33000	U
108-10-1	4-Methyl-2-pentanone	130000	U
591-78-6	2-Hexanone	130000	U
127-18-4	**Tetrachloroethene**	**910000**	
79-34-5	1,1,2,2-Tetrachloroethane	33000	U

BAKER ENVIRONMENTAL '

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 017

Sample WT/Vol: 130.1 / g
Work Order: CE6P1101
Dilution factor: 6530.8

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/23/97

QC Batch: 7326121

Client Sample Id: IR88-IS26-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	33000	U
108-90-7	Chlorobenzene	33000	U
100-41-4	Ethylbenzene	33000	U
100-42-5	Styrene	33000	U
1330-20-7	Xylenes (total)	33000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7K220110 018
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 120.5 / g
Date Received: 11/22/97
Work Order: CE6P2101
Date Extracted:11/22/97
Dilution factor: 121.9
Date Analyzed: 11/23/97

QC Batch: 7326121

Client Sample Id: IR88-IS26-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	1200	U
74-83-9	Bromomethane	1200	U
75-01-4	Vinyl chloride	1200	U
75-00-3	Chloroethane	1200	U
75-09-2	Methylene chloride	610	U
67-64-1	Acetone	2400	U
75-15-0	Carbon disulfide	610	U
75-35-4	1,1-Dichloroethene	610	U
75-34-3	1,1-Dichloroethane	610	U
540-59-0	1,2-Dichloroethene (total)	610	U
67-66-3	Chloroform	610	U
107-06-2	1,2-Dichloroethane	610	U
78-93-3	**2-Butanone**	**370**	**J**
71-55-6	1,1,1-Trichloroethane	610	U
56-23-5	Carbon tetrachloride	610	U
75-27-4	Bromodichloromethane	610	U
78-87-5	1,2-Dichloropropane	610	U
10061-01-5	cis-1,3-Dichloropropene	610	U
79-01-6	Trichloroethene	610	U
124-48-1	Dibromochloromethane	610	U
79-00-5	1,1,2-Trichloroethane	610	U
71-43-2	Benzene	610	U
10061-02-6	trans-1,3-Dichloropropene	610	U
75-25-2	Bromoform	610	U
108-10-1	4-Methyl-2-pentanone	2400	U
591-78-6	2-Hexanone	2400	U
127-18-4	**Tetrachloroethene**	**52000**	**E**
79-34-5	1,1,2,2-Tetrachloroethane	610	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K220110 018

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 120.5 / g
Work Order: CE6P2101
Dilution factor: 121.9

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/23/97

QC Batch: 7326121

Client Sample Id: IR88-IS26-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	610	U
108-90-7	Chlorobenzene	610	U
100-41-4	Ethylbenzene	610	U
100-42-5	Styrene	610	U
1330-20-7	Xylenes (total)	610	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7K220110 018
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 120.5 / g
Work Order: CE6P2201
Dilution factor: 585
Date Received: 11/22/97
Date Extracted:11/24/97
Date Analyzed: 11/24/97

QC Batch: 7328116

Client Sample Id: IR88-IS26-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	5800	U
74-83-9	**Bromomethane**	**1800**	**J D**
75-01-4	Vinyl chloride	5800	U
75-00-3	Chloroethane	5800	U
75-09-2	**Methylene chloride**	**980**	**J D**
67-64-1	Acetone	12000	U
75-15-0	Carbon disulfide	2900	U
75-35-4	1,1-Dichloroethene	2900	U
75-34-3	1,1-Dichloroethane	2900	U
540-59-0	1,2-Dichloroethene (total)	2900	U
67-66-3	Chloroform	2900	U
107-06-2	1,2-Dichloroethane	2900	U
78-93-3	2-Butanone	12000	U
71-55-6	1,1,1-Trichloroethane	2900	U
56-23-5	Carbon tetrachloride	2900	U
75-27-4	Bromodichloromethane	2900	U
78-87-5	1,2-Dichloropropane	2900	U
10061-01-5	cis-1,3-Dichloropropene	2900	U
79-01-6	Trichloroethene	2900	U
124-48-1	Dibromochloromethane	2900	U
79-00-5	1,1,2-Trichloroethane	2900	U
71-43-2	Benzene	2900	U
10061-02-6	trans-1,3-Dichloropropene	2900	U
75-25-2	Bromoform	2900	U
108-10-1	4-Methyl-2-pentanone	12000	U
591-78-6	2-Hexanone	12000	U
127-18-4	**Tetrachloroethene**	**63000**	**D**
79-34-5	1,1,2,2-Tetrachloroethane	2900	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K220110 018

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 120.5 / g
Work Order: CE6P2201
Dilution factor: 585

Date Received: 11/22/97
Date Extracted:11/24/97
Date Analyzed: 11/24/97

QC Batch: 7328116

Client Sample Id: IR88-IS26-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	2900	U
108-90-7	Chlorobenzene	2900	U
100-41-4	Ethylbenzene	2900	U
100-42-5	Styrene	2900	U
1330-20-7	Xylenes (total)	2900	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K240145 001

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 129.3 / g

Work Order: CE7VP101

Dilution factor: 29705

Date Received: 11/24/97

Date Extracted:11/25/97

Date Analyzed: 11/25/97

QC Batch: 7329136

Client Sample Id: IR88-IS29-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	300000	U
74-83-9	Bromomethane	300000	U
75-01-4	Vinyl chloride	300000	U
75-00-3	Chloroethane	300000	U
75-09-2	Methylene chloride	150000	U
67-64-1	Acetone	590000	U
75-15-0	Carbon disulfide	150000	U
75-35-4	1,1-Dichloroethene	150000	U
75-34-3	1,1-Dichloroethane	150000	U
540-59-0	1,2-Dichloroethene (total)	150000	U
67-66-3	Chloroform	150000	U
107-06-2	1,2-Dichloroethane	150000	U
78-93-3	2-Butanone	590000	U
71-55-6	1,1,1-Trichloroethane	150000	U
56-23-5	Carbon tetrachloride	150000	U
75-27-4	Bromodichloromethane	150000	U
78-87-5	1,2-Dichloropropane	150000	U
10061-01-5	cis-1,3-Dichloropropene	150000	U
79-01-6	Trichloroethene	150000	U
124-48-1	Dibromochloromethane	150000	U
79-00-5	1,1,2-Trichloroethane	150000	U
71-43-2	Benzene	150000	U
10061-02-6	trans-1,3-Dichloropropene	150000	U
75-25-2	Bromoform	150000	U
108-10-1	4-Methyl-2-pentanone	590000	U
591-78-6	2-Hexanone	590000	U
127-18-4	**Tetrachloroethene**	**2600000**	
79-34-5	1,1,2,2-Tetrachloroethane	150000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K240145 001

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 129.3 / g
Work Order: CE7VP101
Dilution factor: 29705

Date Received: 11/24/97
Date Extracted:11/25/97
Date Analyzed: 11/25/97

QC Batch: 7329136

Client Sample Id: IR88-IS29-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	150000	U
108-90-7	Chlorobenzene	150000	U
100-41-4	Ethylbenzene	150000	U
100-42-5	Styrene	150000	U
1330-20-7	Xylenes (total)	150000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K240145 002

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 119.2 / g

Work Order: CE7VQ101

Dilution factor: 20819.9

Date Received: 11/24/97

Date Extracted:11/25/97

Date Analyzed: 11/25/97

QC Batch: 7329136

Client Sample Id: IR88-IS30-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	210000	U
74-83-9	Bromomethane	210000	U
75-01-4	Vinyl chloride	210000	U
75-00-3	Chloroethane	210000	U
75-09-2	Methylene chloride	100000	U
67-64-1	Acetone	420000	U
75-15-0	Carbon disulfide	100000	U
75-35-4	1,1-Dichloroethene	100000	U
75-34-3	1,1-Dichloroethane	100000	U
540-59-0	1,2-Dichloroethene (total)	100000	U
67-66-3	Chloroform	100000	U
107-06-2	1,2-Dichloroethane	100000	U
78-93-3	2-Butanone	420000	U
71-55-6	1,1,1-Trichloroethane	100000	U
56-23-5	Carbon tetrachloride	100000	U
75-27-4	Bromodichloromethane	100000	U
78-87-5	1,2-Dichloropropane	100000	U
10061-01-5	cis-1,3-Dichloropropene	100000	U
79-01-6	Trichloroethene	100000	U
124-48-1	Dibromochloromethane	100000	U
79-00-5	1,1,2-Trichloroethane	100000	U
71-43-2	Benzene	100000	U
10061-02-6	trans-1,3-Dichloropropene	100000	U
75-25-2	Bromoform	100000	U
108-10-1	4-Methyl-2-pentanone	420000	U
591-78-6	2-Hexanone	420000	U
127-18-4	**Tetrachloroethene**	**1900000**	
79-34-5	1,1,2,2-Tetrachloroethane	100000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7K240145 002

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 119.2 / g
Work Order: CE7VQ101
Dilution factor: 20819.9

Date Received: 11/24/97
Date Extracted:11/25/97
Date Analyzed: 11/25/97

QC Batch: 7329136

Client Sample Id: IR88-IS30-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	100000	U
108-90-7	Chlorobenzene	100000	U
100-41-4	Ethylbenzene	100000	U
100-42-5	Styrene	100000	U
1330-20-7	Xylenes (total)	100000	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K240145 003

Sample WT/Vol: 104.8 / g

Work Order: CE7VR101

Dilution factor: 267.23

Date Received: 11/24/97

Date Extracted:11/25/97

Date Analyzed: 11/25/97

QC Batch: 7329136

Client Sample Id: IR88-IS31-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	2700	U
74-83-9	Bromomethane	2700	U
75-01-4	Vinyl chloride	2700	U
75-00-3	Chloroethane	2700	U
75-09-2	Methylene chloride	1300	U
67-64-1	Acetone	5300	U
75-15-0	Carbon disulfide	1300	U
75-35-4	1,1-Dichloroethene	1300	U
75-34-3	1,1-Dichloroethane	1300	U
540-59-0	1,2-Dichloroethene (total)	1300	U
67-66-3	Chloroform	1300	U
107-06-2	1,2-Dichloroethane	1300	U
78-93-3	2-Butanone	5300	U
71-55-6	1,1,1-Trichloroethane	1300	U
56-23-5	Carbon tetrachloride	1300	U
75-27-4	Bromodichloromethane	1300	U
78-87-5	1,2-Dichloropropane	1300	U
10061-01-5	cis-1,3-Dichloropropene	1300	U
79-01-6	Trichloroethene	1300	U
124-48-1	Dibromochloromethane	1300	U
79-00-5	1,1,2-Trichloroethane	1300	U
71-43-2	Benzene	1300	U
10061-02-6	trans-1,3-Dichloropropene	1300	U
75-25-2	Bromoform	1300	U
108-10-1	4-Methyl-2-pentanone	5300	U
591-78-6	2-Hexanone	5300	U
127-18-4	**Tetrachloroethene**	**33000**	
79-34-5	1,1,2,2-Tetrachloroethane	1300	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K240145 003

Sample WT/Vol: 104.8 / g

Work Order: CE7VR101

Dilution factor: 267.23

Date Received: 11/24/97

Date Extracted:11/25/97

Date Analyzed: 11/25/97

QC Batch: 7329136

Client Sample Id: IR88-IS31-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	1300	U
108-90-7	Chlorobenzene	1300	U
100-41-4	Ethylbenzene	1300	U
100-42-5	Styrene	1300	U
1330-20-7	Xylenes (total)	1300	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L060115 001

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 37 / g

Work Order: CEE8T101

Dilution factor: 4900

Date Received: 12/06/97

Date Extracted:12/09/97

Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX01-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	24000	U
108-90-7	Chlorobenzene	24000	U
100-41-4	Ethylbenzene	24000	U
100-42-5	Styrene	24000	U
1330-20-7	Xylenes (total)	24000	U

BAKER ENVIRONMENTAL, INC.

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID: H7L060115 001

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 37 / g

Work Order: CEE8T201

Dilution factor: 24500

Date Received: 12/06/97

Date Extracted: 12/10/97

Date Analyzed: 12/10/97

QC Batch: 7344136

DuP.

Client Sample Id: IR88-EX01-01 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	240000	U
74-83-9	Bromomethane	240000	U
75-01-4	Vinyl chloride	240000	U
75-00-3	Chloroethane	240000	U
75-09-2	Methylene chloride	120000	U
67-64-1	Acetone	490000	U
75-15-0	Carbon disulfide	120000	U
75-35-4	1,1-Dichloroethene	120000	U
75-34-3	1,1-Dichloroethane	120000	U
540-59-0	1,2-Dichloroethene (total)	120000	U
67-66-3	Chloroform	120000	U
107-06-2	1,2-Dichloroethane	120000	U
78-93-3	2-Butanone	490000	U
71-55-6	1,1,1-Trichloroethane	120000	U
56-23-5	Carbon tetrachloride	120000	U
75-27-4	Bromodichloromethane	120000	U
78-87-5	1,2-Dichloropropane	120000	U
10061-01-5	cis-1,3-Dichloropropene	120000	U
79-01-6	Trichloroethene	120000	U
124-48-1	Dibromochloromethane	120000	U
79-00-5	1,1,2-Trichloroethane	120000	U
71-43-2	Benzene	120000	U
10061-02-6	trans-1,3-Dichloropropene	120000	U
75-25-2	Bromoform	120000	U
108-10-1	4-Methyl-2-pentanone	490000	U
591-78-6	2-Hexanone	490000	U
127-18-4	**Tetrachloroethene**	**2700000**	**D**
79-34-5	1,1,2,2-Tetrachloroethane	120000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 001

Sample WT/Vol: 37 / g
Work Order: CEE8T201
Dilution factor: 24500

Date Received: 12/06/97
Date Extracted:12/10/97
Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-EX01-01 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	120000	U
108-90-7	Chlorobenzene	120000	U
100-41-4	Ethylbenzene	120000	U
100-42-5	Styrene	120000	U
1330-20-7	Xylenes (total)	120000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L060115 002

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 45.3 / g
Work Order: CEE8X101
Dilution factor: 86738

Date Received: 12/06/97
Date Extracted:12/09/97
Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX01-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	870000	U
74-83-9	Bromomethane	870000	U
75-01-4	Vinyl chloride	870000	U
75-00-3	Chloroethane	870000	U
75-09-2	Methylene chloride	430000	U
67-64-1	Acetone	1700000	U
75-15-0	Carbon disulfide	430000	U
75-35-4	1,1-Dichloroethene	430000	U
75-34-3	1,1-Dichloroethane	430000	U
540-59-0	1,2-Dichloroethene (total)	430000	U
67-66-3	Chloroform	430000	U
107-06-2	1,2-Dichloroethane	430000	U
78-93-3	2-Butanone	1700000	U
71-55-6	1,1,1-Trichloroethane	430000	U
56-23-5	Carbon tetrachloride	430000	U
75-27-4	Bromodichloromethane	430000	U
78-87-5	1,2-Dichloropropane	430000	U
10061-01-5	cis-1,3-Dichloropropene	430000	U
79-01-6	Trichloroethene	430000	U
124-48-1	Dibromochloromethane	430000	U
79-00-5	1,1,2-Trichloroethane	430000	U
71-43-2	Benzene	430000	U
10061-02-6	trans-1,3-Dichloropropene	430000	U
75-25-2	Bromoform	430000	U
108-10-1	4-Methyl-2-pentanone	1700000	U
591-78-6	2-Hexanone	1700000	U
127-18-4	Tetrachloroethene	36000000	E
79-34-5	1,1,2,2-Tetrachloroethane	430000	U

BAKER ENVIRONMENTAL, INC.

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID: H7L060115 002

Sample WT/Vol: 45.3 / g

Work Order: CEE8X101

Dilution factor: 86738

Date Received: 12/06/97

Date Extracted: 12/09/97

Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX01-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	430000	U
108-90-7	Chlorobenzene	430000	U
100-41-4	Ethylbenzene	430000	U
100-42-5	Styrene	430000	U
1330-20-7	Xylenes (total)	430000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID:H7L060115 002

Sample WT/Vol: 45.3 / g
Work Order: CEE8X201
Dilution factor: 289125
Date Received: 12/06/97
Date Extracted:12/10/97
Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-EX01-02 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	2900000	U
74-83-9	Bromomethane	2900000	U
75-01-4	Vinyl chloride	2900000	U
75-00-3	Chloroethane	2900000	U
75-09-2	Methylene chloride	1400000	U
67-64-1	Acetone	5800000	U
75-15-0	Carbon disulfide	1400000	U
75-35-4	1,1-Dichloroethene	1400000	U
75-34-3	1,1-Dichloroethane	1400000	U
540-59-0	1,2-Dichloroethene (total)	1400000	U
67-66-3	Chloroform	1400000	U
107-06-2	1,2-Dichloroethane	1400000	U
78-93-3	2-Butanone	5800000	U
71-55-6	1,1,1-Trichloroethane	1400000	U
56-23-5	Carbon tetrachloride	1400000	U
75-27-4	Bromodichloromethane	1400000	U
78-87-5	1,2-Dichloropropane	1400000	U
10061-01-5	cis-1,3-Dichloropropene	1400000	U
79-01-6	Trichloroethene	1400000	U
124-48-1	Dibromochloromethane	1400000	U
79-00-5	1,1,2-Trichloroethane	1400000	U
71-43-2	Benzene	1400000	U
10061-02-6	trans-1,3-Dichloropropene	1400000	U
75-25-2	Bromoform	1400000	U
108-10-1	4-Methyl-2-pentanone	5800000	U
591-78-6	2-Hexanone	5800000	U
127-18-4	**Tetrachloroethene**	**38000000**	**D**
79-34-5	1,1,2,2-Tetrachloroethane	1400000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 002

Sample WT/Vol: 45.3 / g

Work Order: CEE8X201

Dilution factor: 289,125

Date Received: 12/06/97

Date Extracted:12/10/97

Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-EX01-02 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	1400000	U
108-90-7	Chlorobenzene	1400000	U
100-41-4	Ethylbenzene	1400000	U
100-42-5	Styrene	1400000	U
1330-20-7	Xylenes (total)	1400000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 003

Sample WT/Vol: 50.2 / g

Work Order: CEE90101

Dilution factor: 40772

Date Received: 12/06/97

Date Extracted:12/09/97

Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX01-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	410000	U
74-83-9	Bromomethane	410000	U
75-01-4	Vinyl chloride	410000	U
75-00-3	Chloroethane	410000	U
75-09-2	Methylene chloride	200000	U
67-64-1	Acetone	820000	U
75-15-0	Carbon disulfide	200000	U
75-35-4	1,1-Dichloroethene	200000	U
75-34-3	1,1-Dichloroethane	200000	U
540-59-0	1,2-Dichloroethene (total)	200000	U
67-66-3	Chloroform	200000	U
107-06-2	1,2-Dichloroethane	200000	U
78-93-3	2-Butanone	820000	U
71-55-6	1,1,1-Trichloroethane	200000	U
56-23-5	Carbon tetrachloride	200000	U
75-27-4	Bromodichloromethane	200000	U
78-87-5	1,2-Dichloropropane	200000	U
10061-01-5	cis-1,3-Dichloropropene	200000	U
79-01-6	Trichloroethene	200000	U
124-48-1	Dibromochloromethane	200000	U
79-00-5	1,1,2-Trichloroethane	200000	U
71-43-2	Benzene	200000	U
10061-02-6	trans-1,3-Dichloropropene	200000	U
75-25-2	Bromoform	200000	U
108-10-1	4-Methyl-2-pentanone	820000	U
591-78-6	2-Hexanone	820000	U
127-18-4	**Tetrachloroethene**	**24000000**	E
79-34-5	1,1,2,2-Tetrachloroethane	200000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 003

Sample WT/Vol: 50.2 / g

Work Order: CEE90101

Dilution factor: 40772

Date Received: 12/06/97

Date Extracted:12/09/97

Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX01-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	200000	U
108-90-7	Chlorobenzene	200000	U
100-41-4	Ethylbenzene	200000	U
100-42-5	Styrene	200000	U
1330-20-7	Xylenes (total)	200000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L060115 003

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 50.2 / g
Work Order: CEE90201
Dilution factor: 203859

Date Received: 12/06/97
Date Extracted:12/10/97
Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-EX01-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	2000000	U
74-83-9	Bromomethane	2000000	U
75-01-4	Vinyl chloride	2000000	U
75-00-3	Chloroethane	2000000	U
75-09-2	Methylene chloride	1000000	U
67-64-1	Acetone	4100000	U
75-15-0	Carbon disulfide	1000000	U
75-35-4	1,1-Dichloroethene	1000000	U
75-34-3	1,1-Dichloroethane	1000000	U
540-59-0	1,2-Dichloroethene (total)	1000000	U
67-66-3	Chloroform	1000000	U
107-06-2	1,2-Dichloroethane	1000000	U
78-93-3	2-Butanone	4100000	U
71-55-6	1,1,1-Trichloroethane	1000000	U
56-23-5	Carbon tetrachloride	1000000	U
75-27-4	Bromodichloromethane	1000000	U
78-87-5	1,2-Dichloropropane	1000000	U
10061-01-5	cis-1,3-Dichloropropene	1000000	U
79-01-6	Trichloroethene	1000000	U
124-48-1	Dibromochloromethane	1000000	U
79-00-5	1,1,2-Trichloroethane	1000000	U
71-43-2	Benzene	1000000	U
10061-02-6	trans-1,3-Dichloropropene	1000000	U
75-25-2	Bromoform	1000000	U
108-10-1	4-Methyl-2-pentanone	4100000	U
591-78-6	2-Hexanone	4100000	U
127-18-4	**Tetrachloroethene**	**27000000**	D
79-34-5	1,1,2,2-Tetrachloroethane	1000000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 003

Sample WT/Vol: 50.2 / g

Work Order: CEE90201

Dilution factor: 203859

Date Received: 12/06/97

Date Extracted:12/10/97

Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-EX01-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	1000000	U
108-90-7	Chlorobenzene	1000000	U
100-41-4	Ethylbenzene	1000000	U
100-42-5	Styrene	1000000	U
1330-20-7	Xylenes (total)	1000000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 004

Sample WT/Vol: 54.1 / g

Work Order: CEE91101

Dilution factor: 41.69

Date Received: 12/06/97

Date Extracted:12/09/97

Date Analyzed: 12/10/97

QC Batch: 7343138

* EX03-01

Client Sample Id: IR88-~~EX02~~-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	420	U
74-83-9	Bromomethane	420	U
75-01-4	Vinyl chloride	420	U
75-00-3	Chloroethane	420	U
75-09-2	Methylene chloride	210	U
67-64-1	Acetone	830	U
75-15-0	Carbon disulfide	210	U
75-35-4	1,1-Dichloroethene	210	U
75-34-3	1,1-Dichloroethane	210	U
540-59-0	1,2-Dichloroethene (total)	210	U
67-66-3	Chloroform	210	U
107-06-2	1,2-Dichloroethane	210	U
78-93-3	**2-Butanone**	**1600**	
71-55-6	1,1,1-Trichloroethane	210	U
56-23-5	Carbon tetrachloride	210	U
75-27-4	Bromodichloromethane	210	U
78-87-5	1,2-Dichloropropane	210	U
10061-01-5	cis-1,3-Dichloropropene	210	U
79-01-6	Trichloroethene	210	U
124-48-1	Dibromochloromethane	210	U
79-00-5	1,1,2-Trichloroethane	210	U
71-43-2	Benzene	210	U
10061-02-6	trans-1,3-Dichloropropene	210	U
75-25-2	Bromoform	210	U
108-10-1	4-Methyl-2-pentanone	830	U
591-78-6	2-Hexanone	830	U
127-18-4	**Tetrachloroethene**	**1000**	
79-34-5	1,1,2,2-Tetrachloroethane	210	U

* Note: Soil Sample jars from EX03 were mislabeled as EX02. However, no soil samples were collected from EX02 (see Geol Log for EX02), and samples were collected from EX03 (see Geol Log for EX03) but were reported herein as analytical results for EX02. Hence the correction to sample ID's.

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 004

Sample WT/Vol: 54.1 / g

Work Order: CEE91101

Dilution factor: 41.69

Date Received: 12/06/97

Date Extracted:12/09/97

Date Analyzed: 12/10/97

QC Batch: 7343138

* EX03-01

Client Sample Id: IR88-~~EX02~~-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	210	U
108-90-7	Chlorobenzene	210	U
100-41-4	Ethylbenzene	210	U
100-42-5	Styrene	210	U
1330-20-7	Xylenes (total)	210	U

* See NOTE on previous pg.

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 005

Sample WT/Vol: 57.8 / g
Work Order: CEE93101
Dilution factor: 122.77

Date Received: 12/06/97
Date Extracted:12/10/97
Date Analyzed: 12/10/97

QC Batch: 7344136

* EX03-02

Client Sample Id: IR88-E~~X02~~-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	1200	U
74-83-9	Bromomethane	1200	U
75-01-4	Vinyl chloride	1200	U
75-00-3	Chloroethane	1200	U
75-09-2	Methylene chloride	610	U
67-64-1	Acetone	2500	U
75-15-0	Carbon disulfide	610	U
75-35-4	1,1-Dichloroethene	610	U
75-34-3	1,1-Dichloroethane	610	U
540-59-0	1,2-Dichloroethene (total)	610	U
67-66-3	Chloroform	610	U
107-06-2	1,2-Dichloroethane	610	U
78-93-3	2-Butanone	1300	J
71-55-6	1,1,1-Trichloroethane	610	U
56-23-5	Carbon tetrachloride	610	U
75-27-4	Bromodichloromethane	610	U
78-87-5	1,2-Dichloropropane	610	U
10061-01-5	cis-1,3-Dichloropropene	610	U
79-01-6	Trichloroethene	610	U
124-48-1	Dibromochloromethane	610	U
79-00-5	1,1,2-Trichloroethane	610	U
71-43-2	Benzene	610	U
10061-02-6	trans-1,3-Dichloropropene	610	U
75-25-2	Bromoform	610	U
108-10-1	4-Methyl-2-pentanone	2500	U
591-78-6	2-Hexanone	2500	U
127-18-4	Tetrachloroethene	15000	
79-34-5	1,1,2,2-Tetrachloroethane	610	U

* See NOTE on sample EX03-01

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 005

Sample WT/Vol: 57.8 / g
Work Order: CEE93101
Dilution factor: 122.77

Date Received: 12/06/97
Date Extracted:12/10/97
Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-~~EX02~~-02 * EX03-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	610	U
108-90-7	Chlorobenzene	610	U
100-41-4	Ethylbenzene	610	U
100-42-5	Styrene	610	U
1330-20-7	Xylenes (total)	610	U

* See NOTE on sample EX03-01

BAKER ENVIRONMENTAL, INC.

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID: H7L060115 006

Sample WT/Vol: 32.4 / g

Work Order: CEE95101

Dilution factor: 666.81

Date Received: 12/06/97

Date Extracted: 12/10/97

Date Analyzed: 12/10/97

* EX03-03

QC Batch: 7344136

Client Sample Id: IR88-~~EX02~~-03

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	6700	U
74-83-9	Bromomethane	6700	U
75-01-4	Vinyl chloride	6700	U
75-00-3	Chloroethane	6700	U
75-09-2	Methylene chloride	3300	U
67-64-1	Acetone	13000	U
75-15-0	Carbon disulfide	3300	U
75-35-4	1,1-Dichloroethene	3300	U
75-34-3	1,1-Dichloroethane	3300	U
540-59-0	1,2-Dichloroethene (total)	3300	U
67-66-3	Chloroform	3300	U
107-06-2	1,2-Dichloroethane	3300	U
78-93-3	2-Butanone	3500	J
71-55-6	1,1,1-Trichloroethane	3300	U
56-23-5	Carbon tetrachloride	3300	U
75-27-4	Bromodichloromethane	3300	U
78-87-5	1,2-Dichloropropane	3300	U
10061-01-5	cis-1,3-Dichloropropene	3300	U
79-01-6	Trichloroethene	3300	U
124-48-1	Dibromochloromethane	3300	U
79-00-5	1,1,2-Trichloroethane	3300	U
71-43-2	Benzene	3300	U
10061-02-6	trans-1,3-Dichloropropene	3300	U
75-25-2	Bromoform	3300	U
108-10-1	4-Methyl-2-pentanone	13000	U
591-78-6	2-Hexanone	13000	U
127-18-4	Tetrachloroethene	83000	
79-34-5	1,1,2,2-Tetrachloroethane	3300	U

* See NOTE on sample EX03-01

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 006

Sample WT/Vol: 32.4 / g
Work Order: CEE95101
Dilution factor: 666.81

Date Received: 12/06/97
Date Extracted:12/10/97
Date Analyzed: 12/10/97

QC Batch: 7344136

* EX03-03

Client Sample Id: IR88-~~EX02~~-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	3300	U
108-90-7	Chlorobenzene	3300	U
100-41-4	Ethylbenzene	3300	U
100-42-5	Styrene	3300	U
1330-20-7	Xylenes (total)	3300	U

* See NOTE on sample EX03-01

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 007

Sample WT/Vol: 46.5 / g
Work Order: CEE97101
Dilution factor: 912.93

Date Received: 12/06/97
Date Extracted:12/09/97
Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX04-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	9100	U
74-83-9	Bromomethane	9100	U
75-01-4	Vinyl chloride	9100	U
75-00-3	Chloroethane	9100	U
75-09-2	Methylene chloride	4600	U
67-64-1	Acetone	18000	U
75-15-0	Carbon disulfide	4600	U
75-35-4	1,1-Dichloroethene	4600	U
75-34-3	1,1-Dichloroethane	4600	U
540-59-0	1,2-Dichloroethene (total)	1800	J
67-66-3	Chloroform	4600	U
107-06-2	1,2-Dichloroethane	4600	U
78-93-3	2-Butanone	18000	U
71-55-6	1,1,1-Trichloroethane	4600	U
56-23-5	Carbon tetrachloride	4600	U
75-27-4	Bromodichloromethane	4600	U
78-87-5	1,2-Dichloropropane	4600	U
10061-01-5	cis-1,3-Dichloropropene	4600	U
79-01-6	Trichloroethene	1500	J
124-48-1	Dibromochloromethane	4600	U
79-00-5	1,1,2-Trichloroethane	4600	U
71-43-2	Benzene	4600	U
10061-02-6	trans-1,3-Dichloropropene	4600	U
75-25-2	Bromoform	4600	U
108-10-1	4-Methyl-2-pentanone	18000	U
591-78-6	2-Hexanone	18000	U
127-18-4	Tetrachloroethene	100000	
79-34-5	1,1,2,2-Tetrachloroethane	4600	U

BAKER ENVIRONMENTAL, INC.

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID: H7L060115 007

Sample WT/Vol: 46.5 / g

Work Order: CEE97101

Dilution factor: 912.93

Date Received: 12/06/97

Date Extracted: 12/09/97

Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX04-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	4600	U
108-90-7	Chlorobenzene	4600	U
100-41-4	Ethylbenzene	4600	U
100-42-5	Styrene	4600	U
1330-20-7	Xylenes (total)	4600	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L060115 008

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 79.3 / g
Work Order: CEE99101
Dilution factor: 174,71

Date Received: 12/06/97
Date Extracted:12/09/97
Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX04-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	1700	U
74-83-9	Bromomethane	1700	U
75-01-4	Vinyl chloride	1700	U
75-00-3	Chloroethane	1700	U
75-09-2	Methylene chloride	870	U
67-64-1	Acetone	3500	U
75-15-0	Carbon disulfide	870	U
75-35-4	1,1-Dichloroethene	870	U
75-34-3	1,1-Dichloroethane	870	U
540-59-0	1,2-Dichloroethene (total)	870	U
67-66-3	Chloroform	870	U
107-06-2	1,2-Dichloroethane	870	U
78-93-3	2-Butanone	1000	J
71-55-6	1,1,1-Trichloroethane	870	U
56-23-5	Carbon tetrachloride	870	U
75-27-4	Bromodichloromethane	870	U
78-87-5	1,2-Dichloropropane	870	U
10061-01-5	cis-1,3-Dichloropropene	870	U
79-01-6	Trichloroethene	870	U
124-48-1	Dibromochloromethane	870	U
79-00-5	1,1,2-Trichloroethane	870	U
71-43-2	Benzene	870	U
10061-02-6	trans-1,3-Dichloropropene	870	U
75-25-2	Bromoform	870	U
108-10-1	4-Methyl-2-pentanone	3500	U
591-78-6	2-Hexanone	3500	U
127-18-4	Tetrachloroethene	18000	
79-34-5	1,1,2,2-Tetrachloroethane	870	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L060115 008

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 79.3 / g
Work Order: CEE99101
Dilution factor: 174.71

Date Received: 12/06/97
Date Extracted:12/09/97
Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX04-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	870	U
108-90-7	Chlorobenzene	870	U
100-41-4	Ethylbenzene	870	U
100-42-5	Styrene	870	U
1330-20-7	Xylenes (total)	870	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)
Lab Sample ID:H7L060115 009

Sample WT/Vol: 103.1 / g
Work Order: CEE9D101
Dilution factor: 21506 .
Date Received: 12/06/97
Date Extracted:12/09/97
Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX04-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	220000	U
74-83-9	Bromomethane	220000	U
75-01-4	Vinyl chloride	220000	U
75-00-3	Chloroethane	220000	U
75-09-2	Methylene chloride	110000	U
67-64-1	Acetone	430000	U
75-15-0	Carbon disulfide	110000	U
75-35-4	1,1-Dichloroethene	110000	U
75-34-3	1,1-Dichloroethane	110000	U
540-59-0	1,2-Dichloroethene (total)	110000	U
67-66-3	Chloroform	110000	U
107-06-2	1,2-Dichloroethane	110000	U
78-93-3	2-Butanone	430000	U
71-55-6	1,1,1-Trichloroethane	110000	U
56-23-5	Carbon tetrachloride	110000	U
75-27-4	Bromodichloromethane	110000	U
78-87-5	1,2-Dichloropropane	110000	U
10061-01-5	cis-1,3-Dichloropropene	110000	U
79-01-6	Trichloroethene	110000	U
124-48-1	Dibromochloromethane	110000	U
79-00-5	1,1,2-Trichloroethane	110000	U
71-43-2	Benzene	110000	U
10061-02-6	trans-1,3-Dichloropropene	110000	U
75-25-2	Bromoform	110000	U
108-10-1	4-Methyl-2-pentanone	430000	U
591-78-6	2-Hexanone	430000	U
127-18-4	**Tetrachloroethene**	8000000	E
79-34-5	1,1,2,2-Tetrachloroethane	110000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 009

Sample WT/Vol: 103.1 / g
Work Order: CEE9D101
Dilution factor: 21506

Date Received: 12/06/97
Date Extracted:12/09/97
Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX04-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	110000	U
108-90-7	Chlorobenzene	110000	U
100-41-4	Ethylbenzene	110000	U
100-42-5	Styrene	110000	U
1330-20-7	Xylenes (total)	110000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 009

Sample WT/Vol: 103.1 / g

Work Order: CEE9D201

Dilution factor: 71689.4

Date Received: 12/06/97

Date Extracted:12/10/97

Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-EX04-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	720000	U
74-83-9	Bromomethane	720000	U
75-01-4	Vinyl chloride	720000	U
75-00-3	Chloroethane	720000	U
75-09-2	Methylene chloride	360000	U
67-64-1	Acetone	1400000	U
75-15-0	Carbon disulfide	360000	U
75-35-4	1,1-Dichloroethene	360000	U
75-34-3	1,1-Dichloroethane	360000	U
540-59-0	1,2-Dichloroethene (total)	360000	U
67-66-3	Chloroform	360000	U
107-06-2	1,2-Dichloroethane	360000	U
78-93-3	2-Butanone	1400000	U
71-55-6	1,1,1-Trichloroethane	360000	U
56-23-5	Carbon tetrachloride	360000	U
75-27-4	Bromodichloromethane	360000	U
78-87-5	1,2-Dichloropropane	360000	U
10061-01-5	cis-1,3-Dichloropropene	360000	U
79-01-6	Trichloroethene	360000	U
124-48-1	Dibromochloromethane	360000	U
79-00-5	1,1,2-Trichloroethane	360000	U
71-43-2	Benzene	360000	U
10061-02-6	trans-1,3-Dichloropropene	360000	U
75-25-2	Bromoform	360000	U
108-10-1	4-Methyl-2-pentanone	1400000	U
591-78-6	2-Hexanone	1400000	U
127-18-4	**Tetrachloroethene**	**8400000**	D
79-34-5	1,1,2,2-Tetrachloroethane	360000	U

FORM I

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA SDG Number:

Matrix: (soil/water) SOLID Lab Sample ID:H7L060115 009
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 103.1 / g Date Received: 12/06/97
Work Order: CEE9D201 Date Extracted:12/10/97
Dilution factor: 71689.4 Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-EX04-03 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	360000	U
108-90-7	Chlorobenzene	360000	U
100-41-4	Ethylbenzene	360000	U
100-42-5	Styrene	360000	U
1330-20-7	Xylenes (total)	360000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 010

Sample WT/Vol: 74.5 / g

Work Order: CEE9E101

Dilution factor: 30.7

Date Received: 12/06/97

Date Extracted:12/09/97

Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX05-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	310	U
74-83-9	Bromomethane	310	U
75-01-4	Vinyl chloride	310	U
75-00-3	Chloroethane	310	U
75-09-2	Methylene chloride	150	U
67-64-1	Acetone	610	U
75-15-0	Carbon disulfide	150	U
75-35-4	1,1-Dichloroethene	150	U
75-34-3	1,1-Dichloroethane	150	U
540-59-0	**1,2-Dichloroethene (total)**	**270**	
67-66-3	Chloroform	150	U
107-06-2	1,2-Dichloroethane	150	U
78-93-3	**2-Butanone**	**990**	
71-55-6	1,1,1-Trichloroethane	150	U
56-23-5	Carbon tetrachloride	150	U
75-27-4	Bromodichloromethane	150	U
78-87-5	1,2-Dichloropropane	150	U
10061-01-5	cis-1,3-Dichloropropene	150	U
79-01-6	Trichloroethene	150	U
124-48-1	Dibromochloromethane	150	U
79-00-5	1,1,2-Trichloroethane	150	U
71-43-2	Benzene	150	U
10061-02-6	trans-1,3-Dichloropropene	150	U
75-25-2	Bromoform	150	U
108-10-1	4-Methyl-2-pentanone	610	U
591-78-6	2-Hexanone	610	U
127-18-4	**Tetrachloroethene**	**1700**	
79-34-5	1,1,2,2-Tetrachloroethane	150	U

BAKER ENVIRONMENTAL, INC.

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID: H7L060115 010

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 74.5 / g
Work Order: CEE9E101
Dilution factor: 30.7

Date Received: 12/06/97
Date Extracted: 12/09/97
Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX05-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	150	U
108-90-7	Chlorobenzene	150	U
100-41-4	Ethylbenzene	150	U
100-42-5	Styrene	150	U
1330-20-7	Xylenes (total)	150	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 011

Sample WT/Vol: 91.4 / g

Work Order: CEE9F101

Dilution factor: 23.71

Date Received: 12/06/97

Date Extracted:12/10/97

Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-EX05-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	240	U
74-83-9	Bromomethane	240	U
75-01-4	**Vinyl chloride**	**1100**	
75-00-3	Chloroethane	240	U
75-09-2	Methylene chloride	120	U
67-64-1	Acetone	470	U
75-15-0	Carbon disulfide	120	U
75-35-4	1,1-Dichloroethene	120	U
75-34-3	1,1-Dichloroethane	120	U
540-59-0	**1,2-Dichloroethene (total)**	**2200**	
67-66-3	Chloroform	120	U
107-06-2	1,2-Dichloroethane	120	U
78-93-3	**2-Butanone**	**860**	
71-55-6	1,1,1-Trichloroethane	120	U
56-23-5	Carbon tetrachloride	120	U
75-27-4	Bromodichloromethane	120	U
78-87-5	1,2-Dichloropropane	120	U
10061-01-5	cis-1,3-Dichloropropene	120	U
79-01-6	Trichloroethene	120	U
124-48-1	Dibromochloromethane	120	U
79-00-5	1,1,2-Trichloroethane	120	U
71-43-2	Benzene	120	U
10061-02-6	trans-1,3-Dichloropropene	120	U
75-25-2	Bromoform	120	U
108-10-1	4-Methyl-2-pentanone	470	U
591-78-6	2-Hexanone	470	U
127-18-4	**Tetrachloroethene**	**570**	
79-34-5	1,1,2,2-Tetrachloroethane	120	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 011

Sample WT/Vol: 91.4 / g
Work Order: CEE9F101
Dilution factor: 23.71

Date Received: 12/06/97
Date Extracted:12/10/97
Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-EX05-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	120	U
108-90-7	Chlorobenzene	120	U
100-41-4	Ethylbenzene	120	U
100-42-5	Styrene	120	U
1330-20-7	Xylenes (total)	54	J

BAKER ENVIRONMENTAL, INC.

Lab Name: QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID: H7L060115 012

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 33.6 / g

Work Order: CEE9G101

Dilution factor: 560.27

Date Received: 12/06/97

Date Extracted: 12/09/97

Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX05-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	5600	U
74-83-9	Bromomethane	5600	U
75-01-4	Vinyl chloride	5600	U
75-00-3	Chloroethane	5600	U
75-09-2	Methylene chloride	2800	U
67-64-1	Acetone	11000	U
75-15-0	Carbon disulfide	2800	U
75-35-4	1,1-Dichloroethene	2800	U
75-34-3	1,1-Dichloroethane	2800	U
540-59-0	1,2-Dichloroethene (total)	2800	U
67-66-3	Chloroform	2800	U
107-06-2	1,2-Dichloroethane	2800	U
78-93-3	**2-Butanone**	**2600**	J
71-55-6	1,1,1-Trichloroethane	2800	U
56-23-5	Carbon tetrachloride	2800	U
75-27-4	Bromodichloromethane	2800	U
78-87-5	1,2-Dichloropropane	2800	U
10061-01-5	cis-1,3-Dichloropropene	2800	U
79-01-6	Trichloroethene	2800	U
124-48-1	Dibromochloromethane	2800	U
79-00-5	1,1,2-Trichloroethane	2800	U
71-43-2	Benzene	2800	U
10061-02-6	trans-1,3-Dichloropropene	2800	U
75-25-2	Bromoform	2800	U
108-10-1	4-Methyl-2-pentanone	11000	U
591-78-6	2-Hexanone	11000	U
127-18-4	**Tetrachloroethene**	**73000**	
79-34-5	1,1,2,2-Tetrachloroethane	2800	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA SDG Number:

Matrix: (soil/water) SOLID Lab Sample ID:H7L060115 012
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 33.6 / g Date Received: 12/06/97
Work Order: CEE9G101 Date Extracted:12/09/97
Dilution factor: 560,27 Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX05-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	2800	U
108-90-7	Chlorobenzene	2800	U
100-41-4	Ethylbenzene	2800	U
100-42-5	Styrene	2800	U
1330-20-7	Xylenes (total)	2800	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 013

Sample WT/Vol: 105.6 / g

Work Order: CEE9H101

Dilution factor: 22.01

Date Received: 12/06/97

Date Extracted:12/10/97

Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-EX06-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	220	U
74-83-9	Bromomethane	220	U
75-01-4	**Vinyl chloride**	**200**	J
75-00-3	Chloroethane	220	U
75-09-2	Methylene chloride	110	U
67-64-1	Acetone	440	U
75-15-0	Carbon disulfide	110	U
75-35-4	1,1-Dichloroethene	110	U
75-34-3	1,1-Dichloroethane	110	U
540-59-0	**1,2-Dichloroethene (total)**	**330**	
67-66-3	Chloroform	110	U
107-06-2	1,2-Dichloroethane	110	U
78-93-3	**2-Butanone**	**810**	
71-55-6	1,1,1-Trichloroethane	110	U
56-23-5	Carbon tetrachloride	110	U
75-27-4	Bromodichloromethane	110	U
78-87-5	1,2-Dichloropropane	110	U
10061-01-5	cis-1,3-Dichloropropene	110	U
79-01-6	Trichloroethene	110	U
124-48-1	Dibromochloromethane	110	U
79-00-5	1,1,2-Trichloroethane	110	U
71-43-2	Benzene	110	U
10061-02-6	trans-1,3-Dichloropropene	110	U
75-25-2	Bromoform	110	U
108-10-1	4-Methyl-2-pentanone	440	U
591-78-6	2-Hexanone	440	U
127-18-4	**Tetrachloroethene**	**450**	
79-34-5	1,1,2,2-Tetrachloroethane	110	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA SDG Number:

Matrix: (soil/water) SOLID Lab Sample ID:H7L060115 013

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 105.6 / g Date Received: 12/06/97

Work Order: CEE9H101 Date Extracted:12/10/97

Dilution factor: 22.01 Date Analyzed: 12/10/97

QC Batch: 7344136

Client Sample Id: IR88-EX06-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	110	U
108-90-7	Chlorobenzene	110	U
100-41-4	Ethylbenzene	110	U
100-42-5	Styrene	110	U
1330-20-7	Xylenes (total)	110	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 014

Sample WT/Vol: 111.5 / g
Work Order: CEE9J101
Dilution factor: 19.04

Date Received: 12/06/97
Date Extracted:12/09/97
Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX06-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	190	U
74-83-9	Bromomethane	190	U
75-01-4	Vinyl chloride	190	U
75-00-3	Chloroethane	190	U
75-09-2	Methylene chloride	95	U
67-64-1	Acetone	380	U
75-15-0	Carbon disulfide	95	U
75-35-4	1,1-Dichloroethene	95	U
75-34-3	1,1-Dichloroethane	95	U
540-59-0	1,2-Dichloroethene (total)	95	U
67-66-3	Chloroform	95	U
107-06-2	1,2-Dichloroethane	95	U
78-93-3	**2-Butanone**	**540**	
71-55-6	1,1,1-Trichloroethane	95	U
56-23-5	Carbon tetrachloride	95	U
75-27-4	Bromodichloromethane	95	U
78-87-5	1,2-Dichloropropane	95	U
10061-01-5	cis-1,3-Dichloropropene	95	U
79-01-6	Trichloroethene	95	U
124-48-1	Dibromochloromethane	95	U
79-00-5	1,1,2-Trichloroethane	95	U
71-43-2	Benzene	95	U
10061-02-6	trans-1,3-Dichloropropene	95	U
75-25-2	Bromoform	95	U
108-10-1	4-Methyl-2-pentanone	380	U
591-78-6	2-Hexanone	380	U
127-18-4	**Tetrachloroethene**	**520**	
79-34-5	1,1,2,2-Tetrachloroethane	95	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 014

Sample WT/Vol: 111.5 / g

Work Order: CEE9J101

Dilution factor: 19.04

Date Received: 12/06/97

Date Extracted:12/09/97

Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX06-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	95	U
108-90-7	Chlorobenzene	95	U
100-41-4	Ethylbenzene	95	U
100-42-5	Styrene	95	U
1330-20-7	Xylenes (total)	95	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 015

Sample WT/Vol: 61.3 / g
Work Order: CEE9K101
Dilution factor: 32.56

Date Received: 12/06/97
Date Extracted:12/09/97
Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX06-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	330	U
74-83-9	Bromomethane	330	U
75-01-4	Vinyl chloride	330	U
75-00-3	Chloroethane	330	U
75-09-2	Methylene chloride	160	U
67-64-1	Acetone	650	U
75-15-0	Carbon disulfide	160	U
75-35-4	1,1-Dichloroethene	160	U
75-34-3	1,1-Dichloroethane	160	U
540-59-0	1,2-Dichloroethene (total)	160	U
67-66-3	Chloroform	160	U
107-06-2	1,2-Dichloroethane	160	U
78-93-3	**2-Butanone**	**1200**	
71-55-6	1,1,1-Trichloroethane	160	U
56-23-5	Carbon tetrachloride	160	U
75-27-4	Bromodichloromethane	160	U
78-87-5	1,2-Dichloropropane	160	U
10061-01-5	cis-1,3-Dichloropropene	160	U
79-01-6	Trichloroethene	160	U
124-48-1	Dibromochloromethane	160	U
79-00-5	1,1,2-Trichloroethane	160	U
71-43-2	Benzene	160	U
10061-02-6	trans-1,3-Dichloropropene	160	U
75-25-2	Bromoform	160	U
108-10-1	4-Methyl-2-pentanone	650	U
591-78-6	2-Hexanone	650	U
127-18-4	**Tetrachloroethene**	**380**	
79-34-5	1,1,2,2-Tetrachloroethane	160	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L060115 015

Sample WT/Vol: 61.3 / g

Work Order: CEE9K101

Dilution factor: 32.56

Date Received: 12/06/97

Date Extracted:12/09/97

Date Analyzed: 12/09/97

QC Batch: 7343138

Client Sample Id: IR88-EX06-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	160	U
108-90-7	Chlorobenzene	160	U
100-41-4	Ethylbenzene	160	U
100-42-5	Styrene	160	U
1330-20-7	Xylenes (total)	160	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 007

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 78.7 / g
Work Order: CEG43101
Dilution factor: 12562
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-HC01-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	130000	U
74-83-9	Bromomethane	130000	U
75-01-4	Vinyl chloride	130000	U
75-00-3	Chloroethane	130000	U
75-09-2	**Methylene chloride**	**19000**	
67-64-1	Acetone	250000	U
75-15-0	Carbon disulfide	63000	U
75-35-4	1,1-Dichloroethene	63000	U
75-34-3	1,1-Dichloroethane	63000	U
540-59-0	1,2-Dichloroethene (total)	63000	U
67-66-3	Chloroform	63000	U
107-06-2	1,2-Dichloroethane	63000	U
78-93-3	2-Butanone	250000	U
71-55-6	1,1,1-Trichloroethane	63000	U
56-23-5	Carbon tetrachloride	63000	U
75-27-4	Bromodichloromethane	63000	U
78-87-5	1,2-Dichloropropane	63000	U
10061-01-5	cis-1,3-Dichloropropene	63000	U
79-01-6	Trichloroethene	63000	U
124-48-1	Dibromochloromethane	63000	U
79-00-5	1,1,2-Trichloroethane	63000	U
71-43-2	Benzene	63000	U
10061-02-6	trans-1,3-Dichloropropene	63000	U
75-25-2	Bromoform	63000	U
108-10-1	4-Methyl-2-pentanone	250000	U
591-78-6	2-Hexanone	250000	U
127-18-4	**Tetrachloroethene**	**1100000**	
79-34-5	1,1,2,2-Tetrachloroethane	63000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L100182 007

Sample WT/Vol: 78.7 / g
Work Order: CEG43101
Dilution factor: 12562
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-HC01-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	63000	U
108-90-7	Chlorobenzene	63000	U
100-41-4	Ethylbenzene	63000	U
100-42-5	Styrene	63000	U
1330-20-7	Xylenes (total)	63000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 008

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 98.6 / g
Work Order: CEG44101
Dilution factor: 50485.7
Moisture %:

Date Received: 12/10/97
Date Extracted:12/16/97
Date Analyzed: 12/16/97

QC Batch: 7350194

Client Sample Id: IR88-HC01-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	500000	U
74-83-9	Bromomethane	500000	U
75-01-4	Vinyl chloride	500000	U
75-00-3	Chloroethane	500000	U
75-09-2	Methylene chloride	250000	U
67-64-1	Acetone	1000000	U
75-15-0	Carbon disulfide	250000	U
75-35-4	1,1-Dichloroethene	250000	U
75-34-3	1,1-Dichloroethane	250000	U
540-59-0	1,2-Dichloroethene (total)	250000	U
67-66-3	Chloroform	250000	U
107-06-2	1,2-Dichloroethane	250000	U
78-93-3	2-Butanone	1000000	U
71-55-6	1,1,1-Trichloroethane	250000	U
56-23-5	Carbon tetrachloride	250000	U
75-27-4	Bromodichloromethane	250000	U
78-87-5	1,2-Dichloropropane	250000	U
10061-01-5	cis-1,3-Dichloropropene	250000	U
79-01-6	Trichloroethene	250000	U
124-48-1	Dibromochloromethane	250000	U
79-00-5	1,1,2-Trichloroethane	250000	U
71-43-2	Benzene	250000	U
10061-02-6	trans-1,3-Dichloropropene	250000	U
75-25-2	Bromoform	250000	U
108-10-1	4-Methyl-2-pentanone	1000000	U
591-78-6	2-Hexanone	1000000	U
127-18-4	**Tetrachloroethene**	**7500000**	
79-34-5	1,1,2,2-Tetrachloroethane	250000	U

FORM I

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 008

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 98.6 / g
Work Order: CEG44101
Dilution factor: 50485.7
Moisture %:

Date Received: 12/10/97
Date Extracted:12/16/97
Date Analyzed: 12/16/97

QC Batch: 7350194

Client Sample Id: IR88-HC01-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	250000	U
108-90-7	Chlorobenzene	250000	U
100-41-4	Ethylbenzene	250000	U
100-42-5	Styrene	250000	U
1330-20-7	Xylenes (total)	250000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L100182 009

Sample WT/Vol: 95.2 / g

Work Order: CEG45101

Dilution factor: 3915.02

Moisture %:

Date Received: 12/10/97

Date Extracted:12/12/97

Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-HC01-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	39000	U
74-83-9	Bromomethane	39000	U
75-01-4	Vinyl chloride	39000	U
75-00-3	Chloroethane	39000	U
75-09-2	**Methylene chloride**	**5900**	
67-64-1	Acetone	78000	U
75-15-0	Carbon disulfide	20000	U
75-35-4	1,1-Dichloroethene	20000	U
75-34-3	1,1-Dichloroethane	20000	U
540-59-0	1,2-Dichloroethene (total)	20000	U
67-66-3	Chloroform	20000	U
107-06-2	1,2-Dichloroethane	20000	U
78-93-3	2-Butanone	78000	U
71-55-6	1,1,1-Trichloroethane	20000	U
56-23-5	Carbon tetrachloride	20000	U
75-27-4	Bromodichloromethane	20000	U
78-87-5	1,2-Dichloropropane	20000	U
10061-01-5	cis-1,3-Dichloropropene	20000	U
79-01-6	Trichloroethene	20000	U
124-48-1	Dibromochloromethane	20000	U
79-00-5	1,1,2-Trichloroethane	20000	U
71-43-2	Benzene	20000	U
10061-02-6	trans-1,3-Dichloropropene	20000	U
75-25-2	Bromoform	20000	U
108-10-1	4-Methyl-2-pentanone	78000	U
591-78-6	2-Hexanone	78000	U
127-18-4	**Tetrachloroethene**	**470000**	
79-34-5	1,1,2,2-Tetrachloroethane	20000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 009

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 95.2 / g
Work Order: CEG45101
Dilution factor: 3915.02
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-HC01-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	20000	U
108-90-7	Chlorobenzene	20000	U
100-41-4	Ethylbenzene	20000	U
100-42-5	Styrene	20000	U
1330-20-7	Xylenes (total)	20000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 010

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 80.7 / g
Work Order: CEG46201
Dilution factor: 25.75
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-HC02-01 -RE 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	260	U
74-83-9	Bromomethane	260	U
75-01-4	Vinyl chloride	260	U
75-00-3	Chloroethane	260	U
75-09-2	Methylene chloride	130	U
67-64-1	Acetone	520	U
75-15-0	Carbon disulfide	130	U
75-35-4	1,1-Dichloroethene	130	U
75-34-3	1,1-Dichloroethane	130	U
540-59-0	**1,2-Dichloroethene (total)**	**48**	**J**
67-66-3	Chloroform	130	U
107-06-2	1,2-Dichloroethane	130	U
78-93-3	**2-Butanone**	**920**	
71-55-6	1,1,1-Trichloroethane	130	U
56-23-5	Carbon tetrachloride	130	U
75-27-4	Bromodichloromethane	130	U
78-87-5	1,2-Dichloropropane	130	U
10061-01-5	cis-1,3-Dichloropropene	130	U
79-01-6	**Trichloroethene**	**58**	**J**
124-48-1	Dibromochloromethane	130	U
79-00-5	1,1,2-Trichloroethane	130	U
71-43-2	Benzene	130	U
10061-02-6	trans-1,3-Dichloropropene	130	U
75-25-2	Bromoform	130	U
108-10-1	4-Methyl-2-pentanone	520	U
591-78-6	2-Hexanone	520	U
127-18-4	**Tetrachloroethene**	**840**	
79-34-5	1,1,2,2-Tetrachloroethane	130	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L100182 010

Sample WT/Vol: 80.7 / g
Work Order: CEG46201
Dilution factor: 25.75
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-HC02-01 -RE 1

		CONCENTRATION UNITS:	
CAS NO.	COMPOUND	(ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	130	U
108-90-7	Chlorobenzene	130	U
100-41-4	Ethylbenzene	130	U
100-42-5	Styrene	130	U
1330-20-7	Xylenes (total)	130	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 011

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 85.6 / g
Work Order: CEG47101
Dilution factor: 118.08
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-HC02-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	1200	U
74-83-9	Bromomethane	1200	U
75-01-4	Vinyl chloride	1200	U
75-00-3	Chloroethane	1200	U
75-09-2	**Methylene chloride**	**180**	
67-64-1	Acetone	2400	U
75-15-0	Carbon disulfide	590	U
75-35-4	1,1-Dichloroethene	590	U
75-34-3	1,1-Dichloroethane	590	U
540-59-0	1,2-Dichloroethene (total)	590	U
67-66-3	Chloroform	590	U
107-06-2	1,2-Dichloroethane	590	U
78-93-3	**2-Butanone**	**1100**	**J**
71-55-6	1,1,1-Trichloroethane	590	U
56-23-5	Carbon tetrachloride	590	U
75-27-4	Bromodichloromethane	590	U
78-87-5	1,2-Dichloropropane	590	U
10061-01-5	cis-1,3-Dichloropropene	590	U
79-01-6	**Trichloroethene**	**95**	
124-48-1	Dibromochloromethane	590	U
79-00-5	1,1,2-Trichloroethane	590	U
71-43-2	Benzene	590	U
10061-02-6	trans-1,3-Dichloropropene	590	U
75-25-2	Bromoform	590	U
108-10-1	4-Methyl-2-pentanone	2400	U
591-78-6	2-Hexanone	2400	U
127-18-4	**Tetrachloroethene**	**7000**	
79-34-5	1,1,2,2-Tetrachloroethane	590	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 011

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 85.6 / g
Work Order: CEG47101
Dilution factor: 118.08
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-HC02-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	590	U
108-90-7	Chlorobenzene	590	U
100-41-4	Ethylbenzene	590	U
100-42-5	Styrene	590	U
1330-20-7	Xylenes (total)	590	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L100182 012

Sample WT/Vol: 76.5 / g
Work Order: CEG48101
Dilution factor: 155.24
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-HC02-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	1600	U
74-83-9	Bromomethane	1600	U
75-01-4	Vinyl chloride	1600	U
75-00-3	Chloroethane	1600	U
75-09-2	**Methylene chloride**	**240**	
67-64-1	Acetone	3100	U
75-15-0	Carbon disulfide	780	U
75-35-4	1,1-Dichloroethene	780	U
75-34-3	1,1-Dichloroethane	780	U
540-59-0	1,2-Dichloroethene (total)	780	U
67-66-3	Chloroform	780	U
107-06-2	1,2-Dichloroethane	780	U
78-93-3	**2-Butanone**	**1300**	J
71-55-6	1,1,1-Trichloroethane	780	U
56-23-5	Carbon tetrachloride	780	U
75-27-4	Bromodichloromethane	780	U
78-87-5	1,2-Dichloropropane	780	U
10061-01-5	cis-1,3-Dichloropropene	780	U
79-01-6	**Trichloroethene**	**110**	
124-48-1	Dibromochloromethane	780	U
79-00-5	1,1,2-Trichloroethane	780	U
71-43-2	Benzene	780	U
10061-02-6	trans-1,3-Dichloropropene	780	U
75-25-2	Bromoform	780	U
108-10-1	4-Methyl-2-pentanone	3100	U
591-78-6	2-Hexanone	3100	U
127-18-4	**Tetrachloroethene**	**19000**	
79-34-5	1,1,2,2-Tetrachloroethane	780	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L100182 012

Sample WT/Vol: 76.5 / g

Work Order: CEG48101

Dilution factor: 155.24

Moisture %:

Date Received: 12/10/97

Date Extracted:12/12/97

Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-HC02-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	780	U
108-90-7	Chlorobenzene	780	U
100-41-4	Ethylbenzene	780	U
100-42-5	Styrene	780	U
1330-20-7	Xylenes (total)	780	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA SDG Number:

Matrix: (soil/water) SOLID Lab Sample ID:H7L100182 001
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 62.2 / g Date Received: 12/10/97
Work Order: CEG3V101 Date Extracted:12/12/97
Dilution factor: 92014.63 Date Analyzed: 12/12/97
Moisture %:
QC Batch: 7346142
Client Sample Id: IR88-IN01-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	920000	U
74-83-9	Bromomethane	920000	U
75-01-4	Vinyl chloride	920000	U
75-00-3	Chloroethane	920000	U
75-09-2	**Methylene chloride**	**140000**	
67-64-1	Acetone	1800000	U
75-15-0	Carbon disulfide	460000	U
75-35-4	1,1-Dichloroethene	460000	U
75-34-3	1,1-Dichloroethane	460000	U
540-59-0	1,2-Dichloroethene (total)	460000	U
67-66-3	Chloroform	460000	U
107-06-2	1,2-Dichloroethane	460000	U
78-93-3	2-Butanone	1800000	U
71-55-6	1,1,1-Trichloroethane	460000	U
56-23-5	Carbon tetrachloride	460000	U
75-27-4	Bromodichloromethane	460000	U
78-87-5	1,2-Dichloropropane	460000	U
10061-01-5	cis-1,3-Dichloropropene	460000	U
79-01-6	Trichloroethene	460000	U
124-48-1	Dibromochloromethane	460000	U
79-00-5	1,1,2-Trichloroethane	460000	U
71-43-2	Benzene	460000	U
10061-02-6	trans-1,3-Dichloropropene	460000	U
75-25-2	Bromoform	460000	U
108-10-1	4-Methyl-2-pentanone	1800000	U
591-78-6	2-Hexanone	1800000	U
127-18-4	**Tetrachloroethene**	**11000000**	
79-34-5	1,1,2,2-Tetrachloroethane	460000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 001

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 62.2 / g
Work Order: CEG3V101
Dilution factor: 92014.63
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-IN01-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	460000	U
108-90-7	Chlorobenzene	460000	U
100-41-4	Ethylbenzene	460000	U
100-42-5	Styrene	460000	U
1330-20-7	Xylenes (total)	460000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA SDG Number:

Matrix: (soil/water) SOLID Lab Sample ID:H7L100182 002
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 80.5 / g Date Received: 12/10/97
Work Order: CEG3W101 Date Extracted:12/12/97
Dilution factor: 113286 Date Analyzed: 12/12/97
Moisture %:
QC Batch: 7346142

Client Sample Id: IR88-IN01-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	1100000	U
74-83-9	Bromomethane	1100000	U
75-01-4	Vinyl chloride	1100000	U
75-00-3	Chloroethane	1100000	U
75-09-2	**Methylene chloride**	**190000**	**J**
67-64-1	Acetone	2300000	U
75-15-0	Carbon disulfide	570000	U
75-35-4	1,1-Dichloroethene	570000	U
75-34-3	1,1-Dichloroethane	570000	U
540-59-0	1,2-Dichloroethene (total)	570000	U
67-66-3	Chloroform	570000	U
107-06-2	1,2-Dichloroethane	570000	U
78-93-3	2-Butanone	2300000	U
71-55-6	1,1,1-Trichloroethane	570000	U
56-23-5	Carbon tetrachloride	570000	U
75-27-4	Bromodichloromethane	570000	U
78-87-5	1,2-Dichloropropane	570000	U
10061-01-5	cis-1,3-Dichloropropene	570000	U
79-01-6	Trichloroethene	570000	U
124-48-1	Dibromochloromethane	570000	U
79-00-5	1,1,2-Trichloroethane	570000	U
71-43-2	Benzene	570000	U
10061-02-6	trans-1,3-Dichloropropene	570000	U
75-25-2	Bromoform	570000	U
108-10-1	4-Methyl-2-pentanone	2300000	U
591-78-6	2-Hexanone	2300000	U
127-18-4	**Tetrachloroethene**	**12000000**	
79-34-5	1,1,2,2-Tetrachloroethane	570000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L100182 002

Sample WT/Vol: 80.5 / g
Work Order: CEG3W101
Dilution factor: 113286
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-IN01-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	570000	U
108-90-7	Chlorobenzene	570000	U
100-41-4	Ethylbenzene	570000	U
100-42-5	Styrene	570000	U
1330-20-7	Xylenes (total)	570000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA
SDG Number:

Matrix: (soil/water) SOLID
Lab Sample ID:H7L100182 003
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 96.5 / g
Work Order: CEG3X101
Dilution factor: 3233.84
Moisture %:
Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97
QC Batch: 7346142

Client Sample Id: IR88-IN01-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	32000	U
74-83-9	Bromomethane	32000	U
75-01-4	Vinyl chloride	32000	U
75-00-3	Chloroethane	32000	U
75-09-2	Methylene chloride	16000	U
67-64-1	Acetone	65000	U
75-15-0	Carbon disulfide	16000	U
75-35-4	1,1-Dichloroethene	16000	U
75-34-3	1,1-Dichloroethane	16000	U
540-59-0	1,2-Dichloroethene (total)	16000	U
67-66-3	Chloroform	16000	U
107-06-2	1,2-Dichloroethane	16000	U
78-93-3	2-Butanone	65000	U
71-55-6	1,1,1-Trichloroethane	16000	U
56-23-5	Carbon tetrachloride	16000	U
75-27-4	Bromodichloromethane	16000	U
78-87-5	1,2-Dichloropropane	16000	U
10061-01-5	cis-1,3-Dichloropropene	16000	U
79-01-6	Trichloroethene	16000	U
124-48-1	Dibromochloromethane	16000	U
79-00-5	1,1,2-Trichloroethane	16000	U
71-43-2	Benzene	16000	U
10061-02-6	trans-1,3-Dichloropropene	16000	U
75-25-2	Bromoform	16000	U
108-10-1	4-Methyl-2-pentanone	65000	U
591-78-6	2-Hexanone	65000	U
127-18-4	**Tetrachloroethene**	**540000**	
79-34-5	1,1,2,2-Tetrachloroethane	16000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 003

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 96.5 / g
Work Order: CEG3X101
Dilution factor: 3233.84
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-IN01-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	16000	U
108-90-7	Chlorobenzene	16000	U
100-41-4	Ethylbenzene	16000	U
100-42-5	Styrene	16000	U
1330-20-7	Xylenes (total)	16000	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 004

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 58.7 / g
Work Order: CEG40101
Dilution factor: 54.48
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-IN03-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	540	U
74-83-9	Bromomethane	540	U
75-01-4	Vinyl chloride	540	U
75-00-3	Chloroethane	540	U
75-09-2	Methylene chloride	270	U
67-64-1	Acetone	1100	U
75-15-0	Carbon disulfide	270	U
75-35-4	1,1-Dichloroethene	270	U
75-34-3	1,1-Dichloroethane	270	U
540-59-0	**1,2-Dichloroethene (total)**	**490**	
67-66-3	Chloroform	270	U
107-06-2	1,2-Dichloroethane	270	U
78-93-3	**2-Butanone**	**1400**	
71-55-6	1,1,1-Trichloroethane	270	U
56-23-5	Carbon tetrachloride	270	U
75-27-4	Bromodichloromethane	270	U
78-87-5	1,2-Dichloropropane	270	U
10061-01-5	cis-1,3-Dichloropropene	270	U
79-01-6	**Trichloroethene**	**80**	
124-48-1	Dibromochloromethane	270	U
79-00-5	1,1,2-Trichloroethane	270	U
71-43-2	Benzene	270	U
10061-02-6	trans-1,3-Dichloropropene	270	U
75-25-2	Bromoform	270	U
108-10-1	4-Methyl-2-pentanone	1100	U
591-78-6	2-Hexanone	1100	U
127-18-4	**Tetrachloroethene**	**4200**	
79-34-5	1,1,2,2-Tetrachloroethane	270	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L100182 004

Sample WT/Vol: 58.7 / g
Work Order: CEG40101
Dilution factor: 54.48
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-IN03-01

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	270	U
108-90-7	Chlorobenzene	270	U
100-41-4	Ethylbenzene	270	U
100-42-5	Styrene	270	U
1330-20-7	Xylenes (total)	270	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L100182 005

Sample WT/Vol: 47.8 / g
Work Order: CEG41101
Dilution factor: 51.94
Moisture %:

Date Received: 12/10/97
Date Extracted:12/16/97
Date Analyzed: 12/16/97

QC Batch: 7350194

Client Sample Id: IR88-IN03-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	520	U
74-83-9	Bromomethane	520	U
75-01-4	Vinyl chloride	520	U
75-00-3	Chloroethane	520	U
75-09-2	Methylene chloride	260	U
67-64-1	Acetone	1000	U
75-15-0	Carbon disulfide	260	U
75-35-4	1,1-Dichloroethene	260	U
75-34-3	1,1-Dichloroethane	260	U
540-59-0	1,2-Dichloroethene (total)	260	U
67-66-3	Chloroform	260	U
107-06-2	1,2-Dichloroethane	260	U
78-93-3	**2-Butanone**	**2200**	
71-55-6	1,1,1-Trichloroethane	260	U
56-23-5	Carbon tetrachloride	260	U
75-27-4	Bromodichloromethane	260	U
78-87-5	1,2-Dichloropropane	260	U
10061-01-5	cis-1,3-Dichloropropene	260	U
79-01-6	Trichloroethene	260	U
124-48-1	Dibromochloromethane	260	U
79-00-5	1,1,2-Trichloroethane	260	U
71-43-2	Benzene	260	U
10061-02-6	trans-1,3-Dichloropropene	260	U
75-25-2	Bromoform	260	U
108-10-1	4-Methyl-2-pentanone	1000	U
591-78-6	2-Hexanone	1000	U
127-18-4	**Tetrachloroethene**	**2300**	
79-34-5	1,1,2,2-Tetrachloroethane	260	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 005

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 47.8 / g
Work Order: CEG41101
Dilution factor: 51.94
Moisture %:

Date Received: 12/10/97
Date Extracted:12/16/97
Date Analyzed: 12/16/97

QC Batch: 7350194

Client Sample Id: IR88-IN03-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	260	U
108-90-7	Chlorobenzene	260	U
100-41-4	Ethylbenzene	260	U
100-42-5	Styrene	260	U
1330-20-7	Xylenes (total)	260	U

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7L100182 006

Sample WT/Vol: 97.6 / g
Work Order: CEG42101
Dilution factor: 132.3
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-IN03-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	1300	U
74-83-9	Bromomethane	1300	U
75-01-4	Vinyl chloride	1300	U
75-00-3	Chloroethane	1300	U
75-09-2	Methylene chloride	660	U
67-64-1	Acetone	2600	U
75-15-0	Carbon disulfide	660	U
75-35-4	1,1-Dichloroethene	660	U
75-34-3	1,1-Dichloroethane	660	U
540-59-0	1,2-Dichloroethene (total)	660	U
67-66-3	Chloroform	660	U
107-06-2	1,2-Dichloroethane	660	U
78-93-3	**2-Butanone**	**1300**	J
71-55-6	1,1,1-Trichloroethane	660	U
56-23-5	Carbon tetrachloride	660	U
75-27-4	Bromodichloromethane	660	U
78-87-5	1,2-Dichloropropane	660	U
10061-01-5	cis-1,3-Dichloropropene	660	U
79-01-6	**Trichloroethene**	**130**	
124-48-1	Dibromochloromethane	660	U
79-00-5	1,1,2-Trichloroethane	660	U
71-43-2	Benzene	660	U
10061-02-6	trans-1,3-Dichloropropene	660	U
75-25-2	Bromoform	660	U
108-10-1	4-Methyl-2-pentanone	2600	U
591-78-6	2-Hexanone	2600	U
127-18-4	**Tetrachloroethene**	**14000**	
79-34-5	1,1,2,2-Tetrachloroethane	660	U

FORM I

BAKER ENVIRONMENTAL, INC.

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Lab Sample ID:H7L100182 006

Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Sample WT/Vol: 97.6 / g
Work Order: CEG42101
Dilution factor: 132.3
Moisture %:

Date Received: 12/10/97
Date Extracted:12/12/97
Date Analyzed: 12/12/97

QC Batch: 7346142

Client Sample Id: IR88-IN03-03

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	660	U
108-90-7	Chlorobenzene	660	U
100-41-4	Ethylbenzene	660	U
100-42-5	Styrene	660	U
1330-20-7	Xylenes (total)	660	U

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID

Method: SW846 8260A

Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 011

Sample WT/Vol: 126.9 / g

Work Order: CE6NP101

Dilution factor: 7019

Date Received: 11/22/97

Date Extracted:11/22/97

Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS23-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	70000	U
74-83-9	Bromomethane	70000	U
75-01-4	Vinyl chloride	70000	U
75-00-3	Chloroethane	70000	U
75-09-2	Methylene chloride	35000	U
67-64-1	Acetone	140000	U
75-15-0	Carbon disulfide	35000	U
75-35-4	1,1-Dichloroethene	35000	U
75-34-3	1,1-Dichloroethane	35000	U
540-59-0	1,2-Dichloroethene (total)	35000	U
67-66-3	Chloroform	35000	U
107-06-2	1,2-Dichloroethane	35000	U
78-93-3	2-Butanone	140000	U
71-55-6	1,1,1-Trichloroethane	35000	U
56-23-5	Carbon tetrachloride	35000	U
75-27-4	Bromodichloromethane	35000	U
78-87-5	1,2-Dichloropropane	35000	U
10061-01-5	cis-1,3-Dichloropropene	35000	U
79-01-6	Trichloroethene	35000	U
124-48-1	Dibromochloromethane	35000	U
79-00-5	1,1,2-Trichloroethane	35000	U
71-43-2	Benzene	35000	U
10061-02-6	trans-1,3-Dichloropropene	35000	U
75-25-2	Bromoform	35000	U
108-10-1	4-Methyl-2-pentanone	140000	U
591-78-6	2-Hexanone	140000	U
127-18-4	**Tetrachloroethene**	**860000**	
79-34-5	1,1,2,2-Tetrachloroethane	35000	U

FORM I

BAKER ENVIRONMENTAL

Lab Name:QUANTERRA

SDG Number:

Matrix: (soil/water) SOLID
Method: SW846 8260A
Volatile Organics, GC/MS (8260A)

Lab Sample ID:H7K220110 011

Sample WT/Vol: 126.9 / g
Work Order: CE6NP101
Dilution factor: 7019

Date Received: 11/22/97
Date Extracted:11/22/97
Date Analyzed: 11/22/97

QC Batch: 7326121

Client Sample Id: IR88-IS23-02

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	35000	U
108-90-7	Chlorobenzene	35000	U
100-41-4	Ethylbenzene	35000	U
100-42-5	Styrene	35000	U
1330-20-7	Xylenes (total)	35000	U

APPENDIX I

Capillary Pressure Tests: Results, Data Analysis and Interpretation

Appendix I
Capillary Pressure Testing: Results, Data Analysis and Interpretation

Capillary Pressure Testing of the Clay Aquitard

One of the primary concerns in a DNAPL-contaminated field site is the vertical migration of the DNAPL. Such vertical migration is usually arrested by the presence of clay aquitards, which have much lower permeabilities than the aquifer materials. The lower permeabilities impart a greater ability to resist further invasion and migration of DNAPL. This also accounts for the pooling of DNAPL at greater than residual immobile saturations above formations with low permeabilities i.e. a capillary trap. The ability of an aquitard to prevent entry and downward flow of DNAPL is determined by the pore size distribution of the medium, the head of DNAPL on the aquitard, and the wetting nature of the mineral surfaces in contact with the DNAPL.

The process of water displacement by a nonaqueous phase is termed drainage; conversely, the process of displacement of the nonaqueous phase by water is termed imbibition. This assumes that water is the wetting phase. Capillary pressure experiments provide information on the pore throat geometry and the capillary pressure-saturation relationship of the porous medium. This information is very useful in determining the entry pressure required to penetrate a given capillary barrier. In addition it provides information on the ability of such capillary barriers to support a column of DNAPL. This information is significant while using a remediation technology such as surfactant flooding, which reduces the NAPL-water IFT and hence alters the capillary characteristics.

A capillary pressure experiment was conducted with aquitard material from the boring for injection well IN-1 in the demonstration area. The objective of this experiment was to determine the pore-size distribution and the ability of the aquitard material to resist the entry of DNAPL (i.e. determine the DNAPL-entry pressure). The details of the soil sample tested by the capillary pressure experiment are given in Table E-1. DNAPL collected from monitor wells installed in the demonstration area was used as the invading fluid in the capillary pressure experiment with sample IN-1.

Table I-1 Description of Soil Samples Tested in Capillary Pressure Experiments

Sample ID	Depth (ft)	Porosity (%)	Permeability (μ m^2)	Infiltrating Fluid Used
IN-1	18.0-22.0	49.5	not measured	Field DNAPL

Theory

Capillary pressure experiments provide both the capillary entry pressure and a characterization of the pore-throat diameters of the porous medium being tested. In these experiments, mercury is forced into a soil pack at a fixed pressure. The pressure at which mercury first penetrates the soil pack is termed the capillary entry pressure. The volume of mercury which invades the pack is measured to determine the non-wetting phase saturation at a given inlet pressure. The pore-throat diameter for a given inlet pressure is calculated using the following equation:

$$P_C = \frac{2\sigma Cos\theta}{r} \qquad (5.1.1\text{-}1)$$

where:

P_C = capillary pressure (Pa)
σ = displacing-displaced phase IFT (N-m^{-1})
r = pore throat radius (m)
θ = contact angle (degrees)

In these experiments mercury is the non-wetting fluid and hence the process of mercury invasion is a capillary drainage process, i.e., water drainage.

In the DNAPL-entry capillary pressure experiment, mercury was replaced with field DNAPL from Camp Lejeune as the displacing fluid. The displaced fluid was water. The objective in this experiment was to determine the capillary entry pressure characteristics of the aquitard material in the presence of the Camp Lejeune DNAPL.

Results and Discussion of Capillary Pressure Experiments

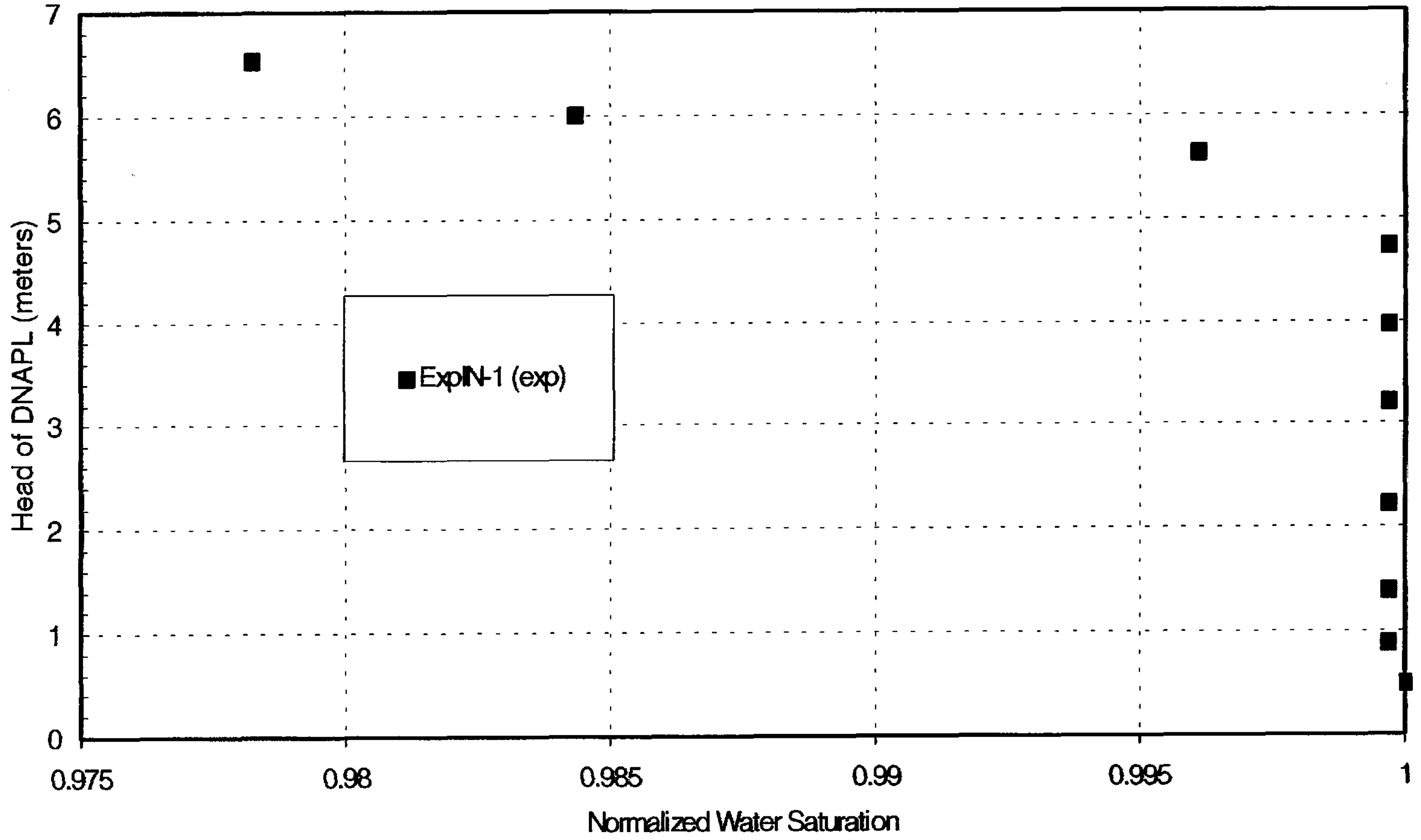
The DNAPL-water capillary pressure curve was estimated by using equation (5.1.1-1), the measured DNAPL-water IFT (10.36 dynes/cm or 0.01 N/m), and assuming a DNAPL-water contact angle of 30°. The capillary pressure was converted into an equivalent head of DNAPL using the following equation:

$$H = \frac{P_C}{\rho_{DNAPL} g} \qquad (5.1.2\text{-}1)$$

H = head of DNAPL (m)
ρ_{DNAPL} = density of DNAPL (kg/m^3)
g = acceleration due to gravity = 9.81 m/s^2

The capillary-pressure saturation relationship for the sample tested is shown in Figure I-1. The figure shows that the aquitard is a significant capillary barrier as it requires approximately 5 meters of DNAPL (i.e., ~15 ft) in order to enter the aquitard sample.

Based on these results it can be concluded that vertical mobilization of DNAPL through the aquitard will not be expected as sediments with similar characteristics can support approximately 15 ft of DNAPL without allowing infiltration. Under such conditions these sediments will act as an effective capillary barrier, allowing the DNAPL to collect at greater than immobile residual saturations. If surfactant solutions injected into the shallow aquifer lowers the DNAPL-ground water interfacial tension by an order of magnitude, the entry pressure of any DNAPL that has not been solubilized will also be lowered by a similar amount.



DATE: 2/23/99

REF: TDN 307

FILE: Fig I-1.PPT

Duke Engineering & Services
A Duke Energy Company

Capillary Pressure Characteristics of the Aquitard Sample

MCB Camp Lejeune, NC

Figure I-1

PTS Laboratories, Inc.

Duke Engineering & Services
File No.: 21585

PHYSICAL PROPERTIES DATA

(Methodology: API RP40, EPA 9100)

Project Name: MCB Camp Lejeune

			Confining Stress: 25.0 psi	
Sample ID.	Depth, ft.	Sample Orientation	Native State Effective Permeability to Water (millidarcy)	Native State Effective Water Conductivity (cm/s)
IS23-04	19.5 - 19.9	vertical	0.082	7.74E-08
IS22-06	21.0 - 21.7	vertical	0.341	3.22E-07

TerraTek

TerraTek Inc.

June 16, 1998

Mr. John Londergan
Duke Engineering
9111 Research Blvd.
Austin, TX 78758

Dear Mr. Londergan:

Attached are the procedures I used in order to determine the capillary pressure curve and porosity on the sample you submitted for testing.

If you have any questions or need more information, please give me a call at (801)584-2489. TerraTek sincerely appreciates the opportunity to work with you on this project.

Respectfully,
TerraTek, Inc.

Dick Winzenried

Dick Winzenried
Laboratory Supervisor

DW/sh

University Research Park • 400 Wakara Way • Salt Lake City, Utah 84108, U.S.A. • (801) 584-2400 • Fax (801) 584-2406

Introduction

Two soil samples, one approximately 18 inches long and one approximately 6 inches long by 1-5/8 inches diameter were submitted for testing. The samples were designated IN01, 18-22 ft. Two test samples from the 18 inch long piece were prepared for testing and designated Sample #1 (21.0 ft.) and Sample #2 (21.1 ft.). Sample #1 was used to determine capillary pressure using DNAPL as the driving fluid and Sample #2 was used to determine porosity of the formation.

Procedures for Capillary Pressure Test

- Sample was cut to length.
- Measurements were taken to determine bulk volume.
- Sample was placed in test apparatus at an overburden stress of 25 psi.
- The sample and flow system was vacuum back-filled with water.
- Approximately 2.3 ml of water was flowed through the sample at in injection pressure of 5.4 psi. This was over a period of three days.
- DNAPL was flowed across the face of the sample to displace water from the flow lines and establish DNAPL contact with the face of the sample.
- The injection pressure of DNAPL was established at 1.05 psi and maintained for approximately 3 days. Water displaced = 0.00 ml.
- The injection pressure of DNAPL was raised to 2.02 psi and maintained for approximately 4 days. Water displaced = 0.01 ml.
- The injection pressure of DNAPL was raised to 3.17 psi and maintained for approximately 2 days. Water displaced = 0.00 ml.
- The injection pressure of DNAPL was raised to 5.25 psi and maintained for approximately 2 days. Water displaced = 0.00 ml.
- The injection pressure of DNAPL was raised to 7.25 psi and maintained for approximately 2 days. Water displaced = 0.00 ml.
- The injection pressure of DNAPL was raised to 8.75 psi and maintained for approximately 1 day. Water displaced = 0.00 ml.
- The injection pressure of DNAPL was raised to 10.85 psi and maintained for approximately 2 days. Water displaced = 0.00 ml.
- The injection pressure of DNAPL was raised to 12.55 psi and maintained for approximately 5 days. Water displaced = 0.10 ml.
- The injection pressure of DNAPL was raised to 14.0 psi and maintained for approximately 12 days. Water displaced = 0.20 ml.

- The injection pressure of DNAPL was raised to 14.4 psi and maintained for approximately 9 days. Water displaced = 0.13 ml.
- The injection pressure of DNAPL was raised to 14.7 psi and maintained for approximately 29 days. Water displaced = 0.22 ml.
- Total water displaced over a 63 day period was 0.66 ml.

The test was terminated at this time. The water continued to be displaced at a fairly constant rate, but at the rate it was going it would take a very unreasonable amount of time to reach equilibrium. Since it was taking so long it was decided that enough data had been generated so that calculations could be made in order to get the required information.

Procedures for Porosity Determination

- Sample was cut to length.
- Measurements were taken to determine bulk volume.
- Sample was placed in test apparatus at an overburden stress of 25 psi.
- The sample and flow system was vacuum back-filled with water.
- Approximately 3 ml of water was flowed through the sample at in injection pressure of ~10 psi in order to ensure 100% saturation of the sample.
- The sample was removed from the test fixture and the sample was weighed to determine the saturated mass.
- The sample was placed in a convection oven at 60° C until a constant dry mass was achieved.
- The weight change and the original bulk volume were then used to calculate porosity.

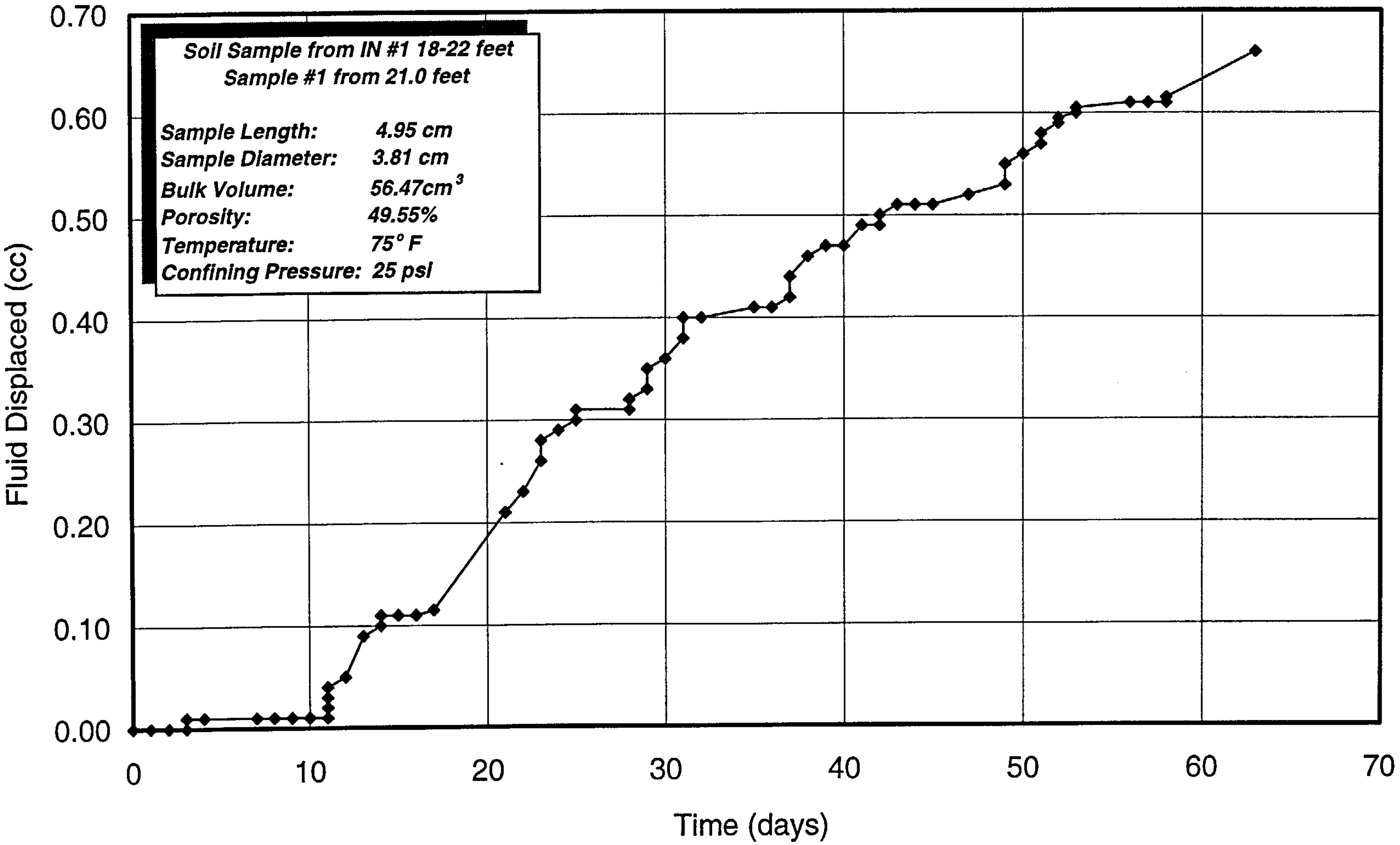
Sample Identification Table

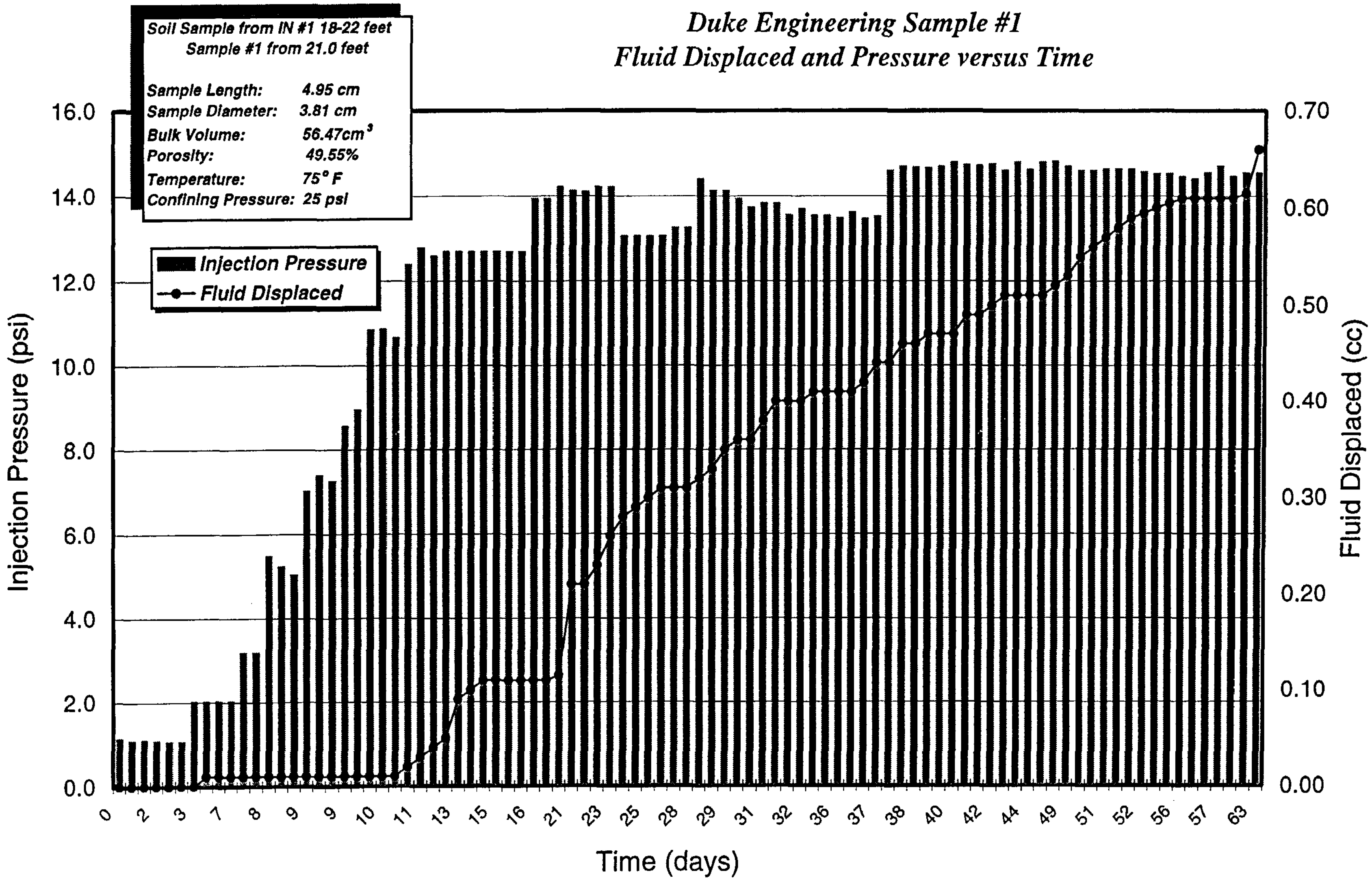
Sample Number	*Length (cm)*	*Diameter (cm)*	*Bulk Volume (cm^3)*	*Wet Mass (g)*	*Dry Mass (g)*	*Pore Volume (ml)*	*Porosity (%)*
1	4.95	3.81	56.47			27.98	49.55
2	5.347	3.81	60.953	104.733	74.534	32.20	49.55

All of the raw data for the capillary pressure study was entered in an Excel file spread sheet. This information was e-mailed to Duke Engineering so they could make their own observations as to what took place during the test.

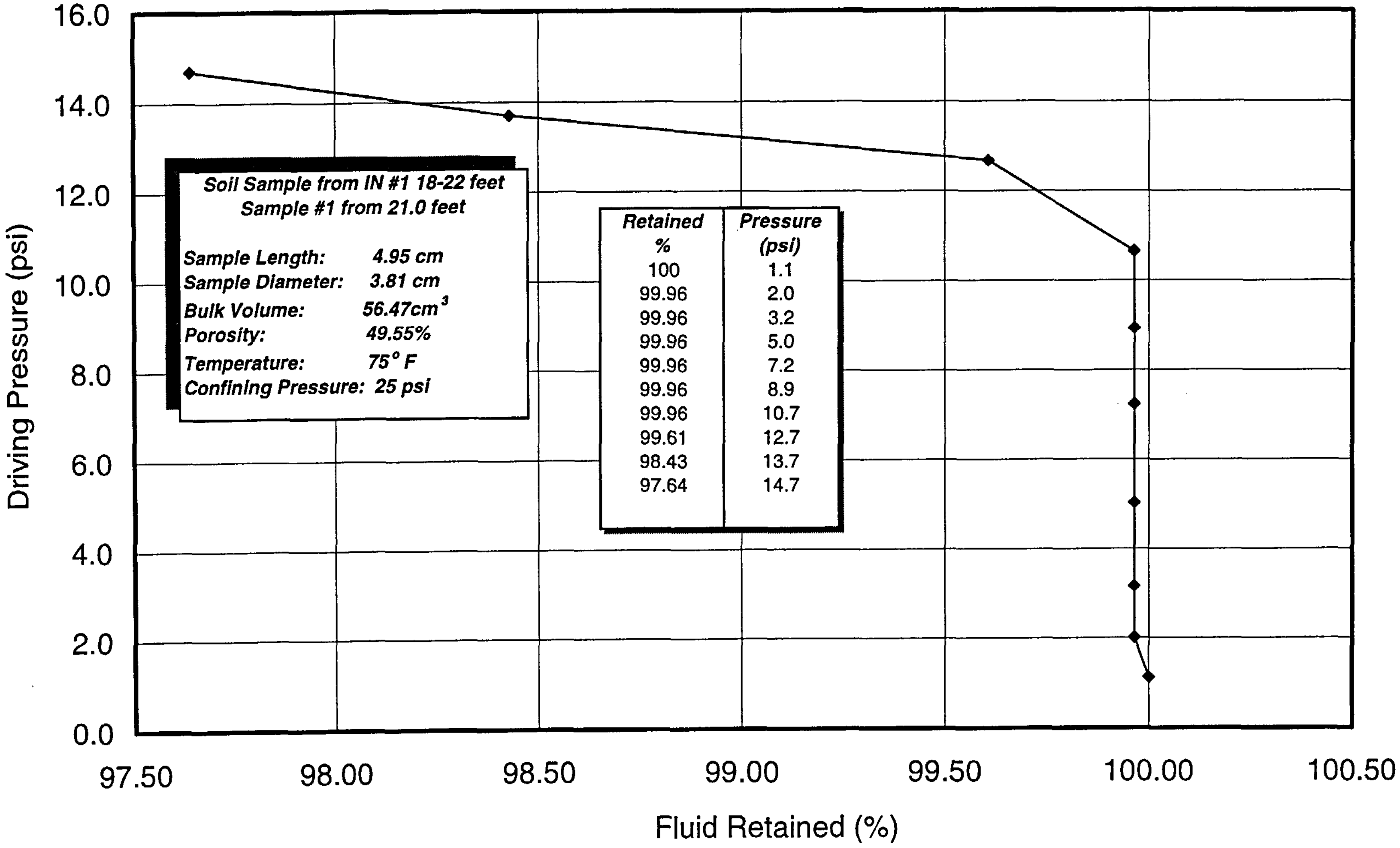
Included in this letter report is a table of the raw data and three plots of the data acquired. The three plots including a Capillary Pressure Curve, Fluid Displaced versus Time and Fluid Displaced and Pressure versus Time.

Duke Engineering Sample #1
Fluid Displaced versus Time




Duke Engineering Sample #1
Fluid Displaced and Pressure versus Time
Soil Sample from IN #1 18-22 feet
Sample #1 from 21.0 feet
Sample Length: 4.95 cm
Sample Diameter: 3.81 cm
Bulk Volume: 56.47cm³
Porosity: 49.55%
Temperature: 75° F
Confining Pressure: 25 psi
Injection Pressure
Fluid Displaced
Injection Pressure (psi)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Fluid Displaced (cc)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0
2
3
7
8
9
9
10
11
13
15
16
21
23
25
28
29
31
32
36
37
38
40
42
44
49
51
52
56
57
63
Time (days)

Duke Engineering Sample #1
Capillary Pressure Curve



Soil Sample from IN #1 18-22 feet
Sample #1 from 21.0 feet

Sample Length: *4.95 cm*
Sample Diameter: *3.81 cm*
Bulk Volume: *56.47cm^3*
Porosity: *49.55%*
Temperature: *75° F*
Confining Pressure: *25 psi*

Retained %	***Pressure (psi)***
100	1.1
99.96	2.0
99.96	3.2
99.96	5.0
99.96	7.2
99.96	8.9
99.96	10.7
99.61	12.7
98.43	13.7
97.64	14.7

Capillary Pressure Study
Soil Core from IN#1 18-22 feet
Sample #1 from 21 feet

Sample Length:	*4.95 cm*	*Pore Volume:*	*27.98 cm^3*
Sample Diameter:	*3.81 cm*	*Porosity:*	*49.55%*
Bulk Volume:	*56.47 cm^3*		

Raw Data used for Calculations						Data used for Plots						
Date	Time	Time (days)	Total Fluid Displaced (cc)	Effluent Burette Reading (cc)	DNAPL Injection Pressure (mm/Hg)	Time (days)	DNAPL Injection Pressure (psi)	Total Fluid Displaced (cc)	DNAPL Injection Pressure (psi)	Water Retained (%)	Water Retained (%)	DNAPL Injection Pressure (psi)
23-Feb	8:00a.m.	0	0.00	1.31	5.9	0	1.1	0.00	1.1	100	100.00	1.1
24-Feb	7:12a.m.	1	0.00	1.31	5.6	1	1.1	0.00	1.1		99.96	2.0
24-Feb	5:00p.m.	1	0.00	1.31	5.7	1	1.1	0.00	1.1		99.96	3.2
25-Feb	9:35a.m.	2	0.00	1.31	5.6	2	1.1	0.00	1.1		99.96	5.0
25-Feb	5:00p.m.	2	0.00	1.31	5.5	2	1.1	0.00	1.1		99.96	7.2
26-Feb	9:15a.m.	3	0.00	1.31	5.5	3	1.1	0.00	1.1		99.96	8.9
26-Feb	9:19a.m.	3	0.00	1.31	10.5	3	2.0	0.00	2.0	99.96	99.96	10.7
26-Feb	4:37p.m.	3	0.01	1.30	10.5	3	2.0	0.01	2.0		99.61	12.7
27-Feb	9:21a.m.	4	0.01	1.30	10.5	4	2.0	0.01	2.0		98.43	13.7
2-Mar	8:05a.m.	7	0.01	1.30	10.5	7	2.0	0.01	2.0		97.64	14.7
2-Mar	8:00a.m.	7	0.01	1.30	16.5	7	3.2	0.01	3.2	99.96		
3-Mar	8:00a.m.	8	0.01	1.30	16.5	8	3.2	0.01	3.2			
3-Mar	8:02a.m.	8	0.01	1.30	28.5	8	5.5	0.01	5.5			
3-Mar	5:14p.m.	8	0.01	1.30	27.2	8	5.2	0.01	5.2			
4-Mar	7:53a.m.	9	0.01	1.30	26.2	9	5.0	0.01	5.0	99.96		

Raw Data used for Calculations						Data used for Plots				
Date	***Time***	***Time (days)***	***Total Fluid Displaced (cc)***	***Effluent Burette Reading (cc)***	***DNAPL Injection Pressure (mm/Hg)***	***Time (days)***	***DNAPL Injection Pressure (psi)***	***Total Fluid Displaced (cc)***	***DNAPL Injection Pressure (psi)***	***Water Retained (%)***
4-Mar	7:54a.m.	9	0.01	1.30	36.5	9	7.0	0.01	7.0	99.96
4-Mar	9:47a.m.	9	0.01	1.30	38.5	9	7.4	0.01	7.4	
4-Mar	5:09p.m.	9	0.01	1.30	37.7	9	7.2	0.01	7.2	
4-Mar	5:11p.m.	9	0.01	1.30	44.5	9	8.5	0.01	8.5	99.96
5-Mar	8:14a.m.	10	0.01	1.30	46.5	10	8.9	0.01	8.9	
5-Mar	8:16a.m.	10	0.01	1.30	56	10	10.8	0.01	10.8	99.96
5-Mar	11:44a.m.	10	0.01	1.30	56.5	10	10.9	0.01	10.9	
6-Mar	8:29a.m.	11	0.01	1.30	55.5	11	10.7	0.01	10.7	
6-Mar	8:30a.m.	11	0.02	1.29	64.5	11	12.4	0.02	12.4	99.61
6-Mar	9:23a.m.	11	0.03	1.28	66.5	11	12.8	0.03	12.8	
6-Mar	5:02p.m.	11	0.04	1.27	65.5	11	12.6	0.04	12.6	
7-Mar	8:25a.m.	12	0.05	1.26	66	12	12.7	0.05	12.7	
8-Mar	3:00p.m	13	0.09	1.22	66	13	12.7	0.09	12.7	
9-Mar	7:32p.m.	14	0.10	1.21	66	14	12.7	0.10	12.7	
9-Mar	4:08a.m.	14	0.11	1.20	66	14	12.7	0.11	12.7	
10-Mar	9:26a.m.	15	0.11	1.20	66	15	12.7	0.11	12.7	
10-Mar	5:34p.m.	15	0.11	1.20	66	15	12.7	0.11	12.7	
11-Mar	8:26a.m.	16	0.11	1.20	66	16	12.7	0.11	12.7	
11-Mar	8:27a.m.	16	0.11	1.20	72.5	16	13.9	0.11	13.9	
11-Mar	5:39p.m.	16	0.11	1.20	72.5	16	13.9	0.11	13.9	
12-Mar	10:25a.m.	17	0.12	1.20	74	17	14.2	0.12	14.2	

Raw Data used for Calculations						Data used for Plots				
Date	Time	Time (days)	Total Fluid Displaced (cc)	Effluent Burette Reading (cc)	DNAPL Injection Pressure (mm/Hg)	Time (days)	DNAPL Injection Pressure (psi)	Total Fluid Displaced (cc)	DNAPL Injection Pressure (psi)	Water Retained (%)
16-Mar	7:45a.m.	21	0.21	1.10	73.5	21	14.1	0.21	14.1	
16-Mar	5:04p.m.	21	0.21	1.10	73.4	21	14.1	0.21	14.1	
17-Mar	10:13a.m.	22	0.23	1.08	74	22	14.2	0.23	14.2	
18-Mar	9:44a.m.	23	0.26	1.05	74	23	14.2	0.26	14.2	
18-Mar	5:13p.m.	23	0.28	1.03	68	23	13.1	0.28	13.1	
19-Mar	9:07a.m.	24	0.29	1.02	68	24	13.1	0.29	13.1	
20-Mar	8:11a.m.	25	0.30	1.01	68	25	13.1	0.30	13.1	
20-Mar	3:27p.m.	25	0.31	1.00	68	25	13.1	0.31	13.1	
20-Mar	6:18p.m.	25	0.31	1.00	69	25	13.2	0.31	13.2	
23-Mar	7:59a.m.	28	0.31	1.00	69	28	13.2	0.31	13.2	
23-Mar	5:13p.m.	28	0.32	0.99	75	28	14.4	0.32	14.4	
24-Mar	8:01a.m.	29	0.33	0.98	73.5	29	14.1	0.33	14.1	
24-Mar	4:33p.m.	29	0.35	0.96	73.5	29	14.1	0.35	14.1	
25-Mar	7:46a.m.	30	0.36	0.95	72.5	30	13.9	0.36	13.9	
25-Mar	5:48p.m.	30	0.36	0.95	71.5	30	13.7	0.36	13.7	
26-Mar	7:58a.m.	31	0.38	0.93	72	31	13.8	0.38	13.8	
26-Mar	5:06p.m.	31	0.40	0.91	72	31	13.8	0.40	13.8	
27-Mar	7:58a.m.	32	0.40	0.91	70.5	32	13.5	0.40	13.5	
27-Mar	12:25p.m.	32	0.40	0.91	71.3	32	13.7	0.40	13.7	
30-Mar	7:29a.m.	35	0.41	0.90	70.5	35	13.5	0.41	13.5	
30-Mar	5:15p.m.	35	0.41	0.90	70.5	35	13.5	0.41	13.5	

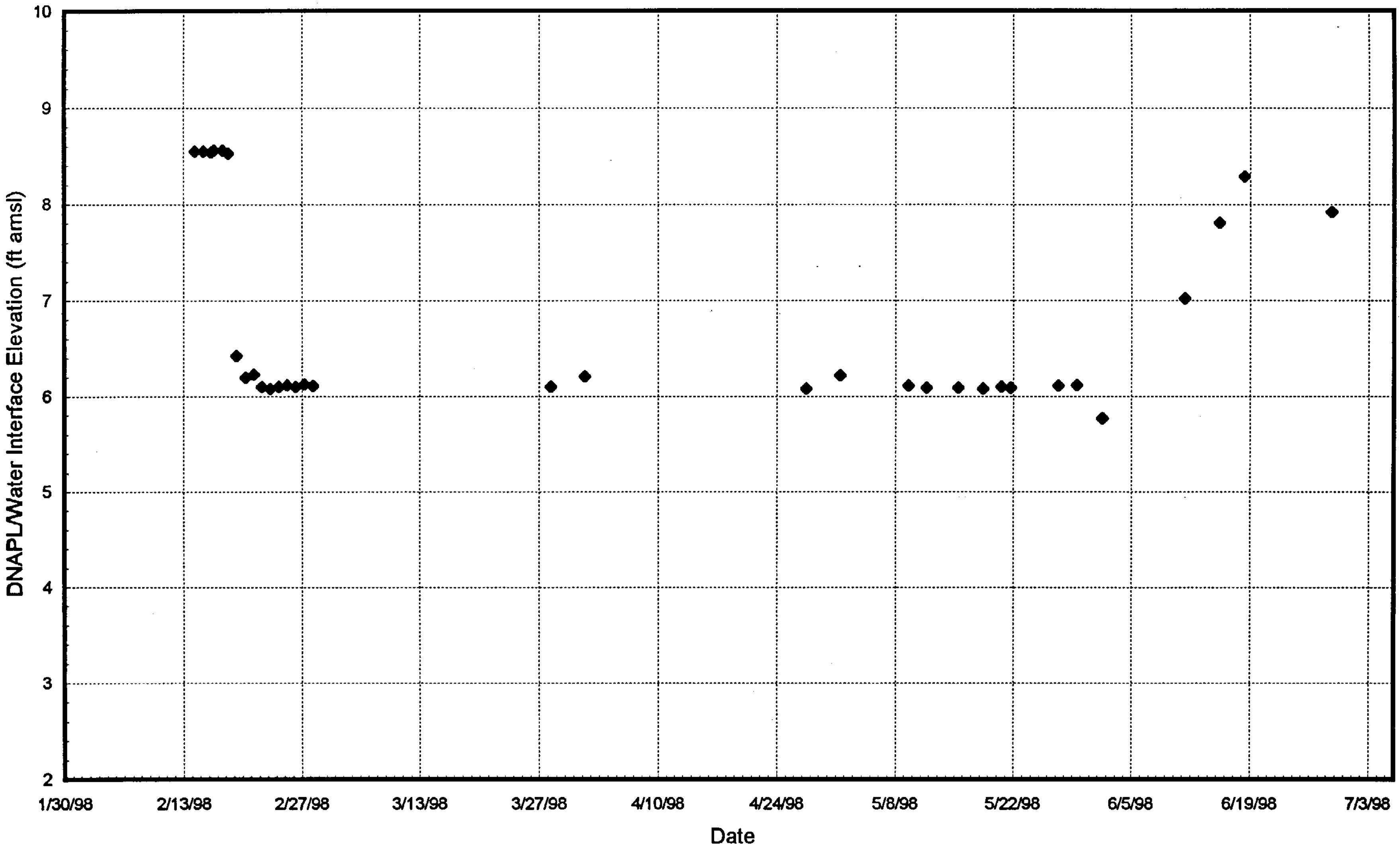
Raw Data used for Calculations						Data used for Plots				
Date	Time	Time (days)	Total Fluid Displaced (cc)	Effluent Burette Reading (cc)	DNAPL Injection Pressure (mm/Hg)	Time (days)	DNAPL Injection Pressure (psi)	Total Fluid Displaced (cc)	DNAPL Injection Pressure (psi)	Water Retained (%)
31-Mar	7:56a.m.	36	0.41	0.90	70.2	36	13.5	0.41	13.5	
31-Mar	5:26p.m.	36	0.41	0.90	70.9	36	13.6	0.41	13.6	
1-Apr	8:05a.m.	37	0.42	0.89	70.1	37	13.5	0.42	13.5	Avg = 13.7
1-Apr	5:01p.m.	37	0.44	0.87	70.4	37	13.5	0.44	13.5	98.43
1-Apr	5:02p.m.	37	0.44	0.87	76	37	14.6	0.44	14.6	
2-Apr	8:29a.m.	38	0.46	0.85	76.5	38	14.7	0.46	14.7	
2-Apr	6:30p.m.	38	0.46	0.85	76.4	38	14.7	0.46	14.7	
3-Apr	7:43a.m.	39	0.47	0.84	76.3	39	14.6	0.47	14.6	
3-Apr	4:00p.m.	39	0.47	0.84	76.5	39	14.7	0.47	14.7	
4-Apr	10:00a.m.	40	0.47	0.84	77	40	14.8	0.47	14.8	
5-Apr	2:30p.m.	41	0.49	0.82	76.7	41	14.7	0.49	14.7	
6-Apr	8:00a.m..	42	0.49	0.82	76.6	42	14.7	0.49	14.7	
6-Apr	5:00p.m.	42	0.50	0.81	76.8	42	14.7	0.50	14.7	
7-Apr	8:00a.m.	43	0.51	0.80	76	43	14.6	0.51	14.6	
7-Apr	4:30p.m.	43	0.51	0.80	77	43	14.8	0.51	14.8	
8-Apr	8:00a.m.	44	0.51	0.80	76.1	44	14.6	0.51	14.6	
9-Apr	1:35p.m.	45	0.51	0.80	77	45	14.8	0.51	14.8	
11-Apr	1:48p.m.	47	0.52	0.79	77.1	47	14.8	0.52	14.8	
13-Apr	8:10a.m.	49	0.53	0.78	76.5	49	14.7	0.53	14.7	
13-Apr	5:34p.m.	49	0.55	0.76	76	49	14.6	0.55	14.6	

Raw Data used for Calculations						***Data used for Plots***				
Date	***Time***	***Time (days)***	***Total Fluid Displaced (cc)***	***Effluent Burette Reading (cc)***	***DNAPL Injection Pressure (mm/Hg)***	***Time (days)***	***DNAPL Injection Pressure (psi)***	***Total Fluid Displaced (cc)***	***DNAPL Injection Pressure (psi)***	***Water Retained (%)***
14-Apr	4:28p.m.	50	0.56	0.75	76	50	14.6	0.56	14.6	
15-Apr	11:18a.m.	51	0.57	0.74	76.2	51	14.6	0.57	14.6	
15-Apr	5:33p.m.	51	0.58	0.73	76.2	51	14.6	0.58	14.6	
16-Apr	7:47a.m.	52	0.59	0.72	76.2	52	14.6	0.59	14.6	
16-Apr	5:15p.m.	52	0.60	0.72	75.8	52	14.6	0.60	14.6	
17-Apr	8:03a.m.	53	0.60	0.71	75.6	53	14.5	0.60	14.5	
17-Apr	5:32p.m.	53	0.61	0.71	75.6	53	14.5	0.61	14.5	
20-Apr	10:40a.m.	56	0.61	0.70	75.3	56	14.5	0.61	14.5	
20-Apr	5:00p.m.	56	0.61	0.70	75	56	14.4	0.61	14.4	
21-Apr	7:44a.m.	57	0.61	0.70	75.7	57	14.5	0.61	14.5	
21-Apr	6:04p.m.	57	0.61	0.70	76.5	57	14.7	0.61	14.7	
22-Apr	7:59a.m.	58	0.61	0.70	75.3	58	14.5	0.61	14.5	
22-Apr	5:26	58	0.62	0.70	75.7	58	14.5	0.62	14.5	
27-Apr	11:32	63	0.66	0.65	75.7	63	14.5	0.66	14.5	97.64

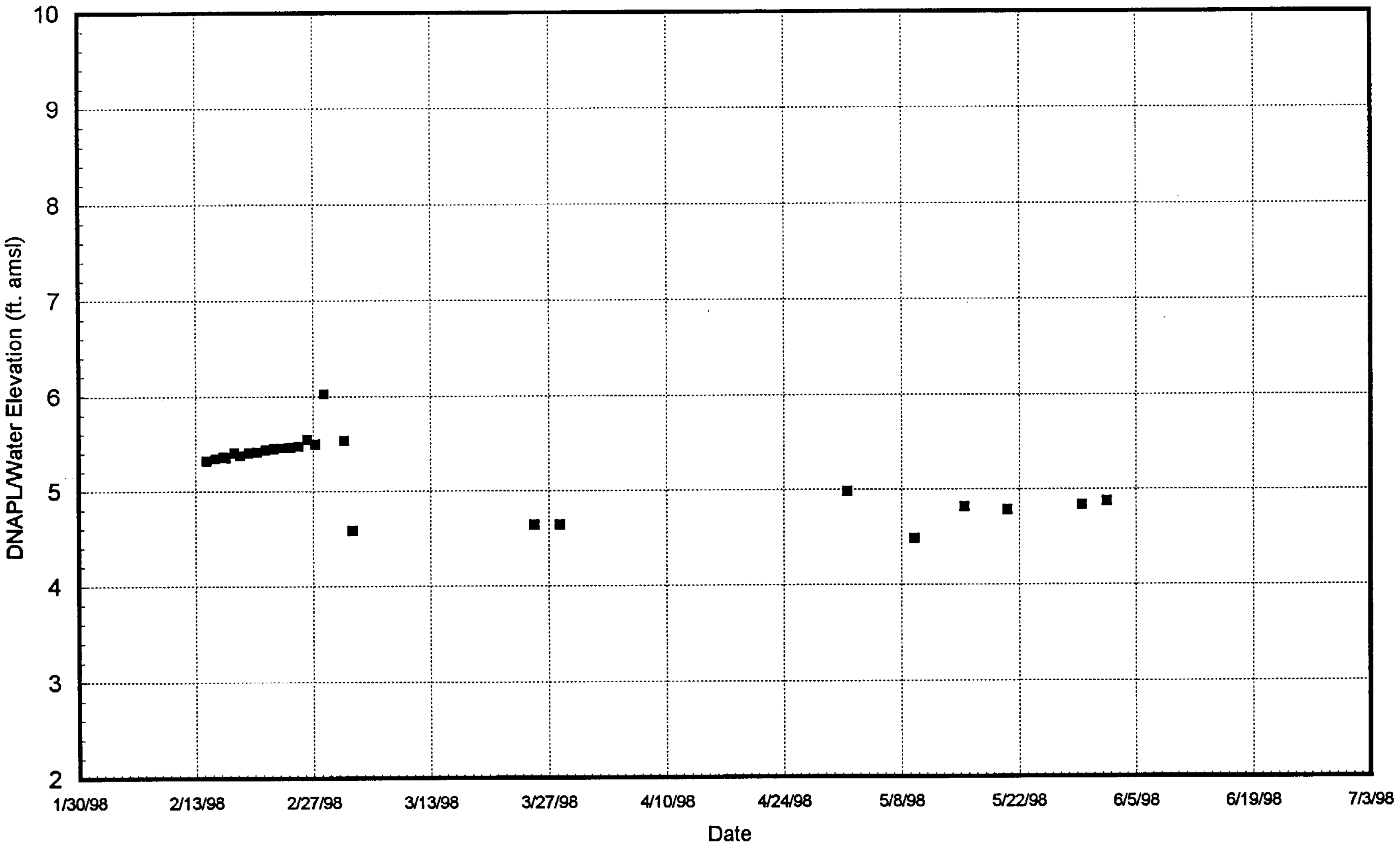
APPENDIX J

Plots of DNAPL/Water Interface Elevations

EX01 plot

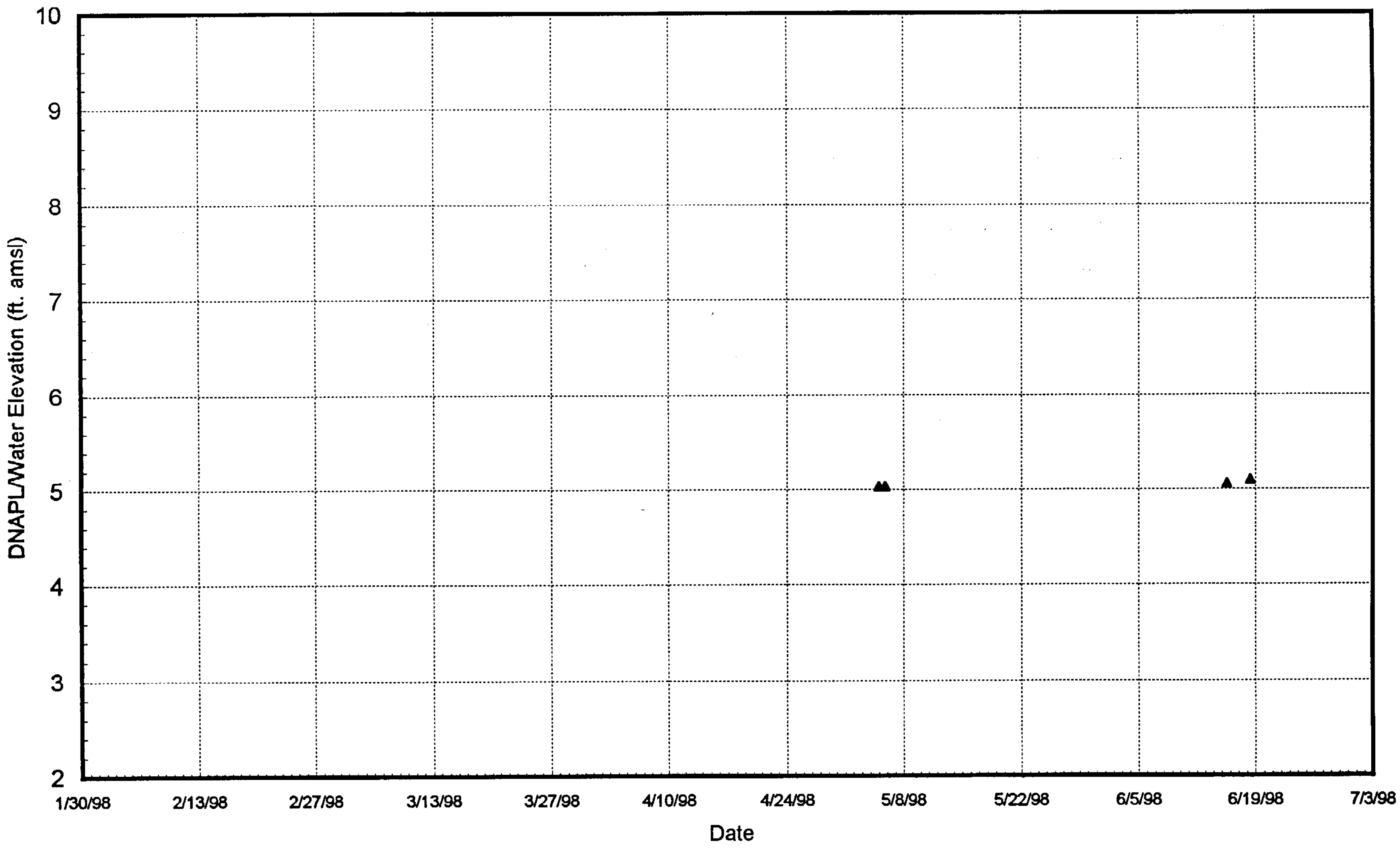


DNAPL/Water Interface Elevation During Field Operations in Well EX01



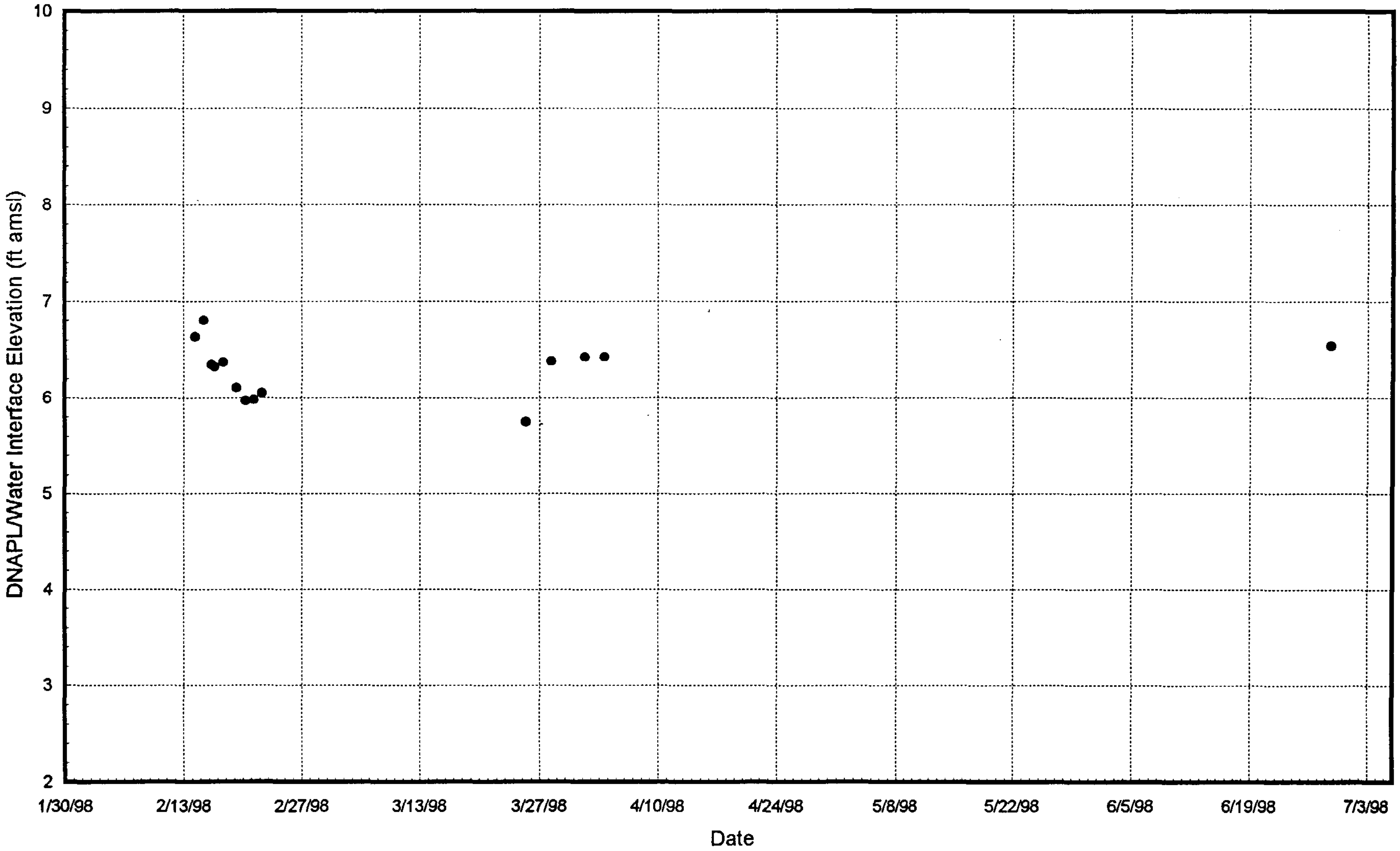
DNAPL/Water interface Elevation During Field Operations in Well EX02

EX04 Plot



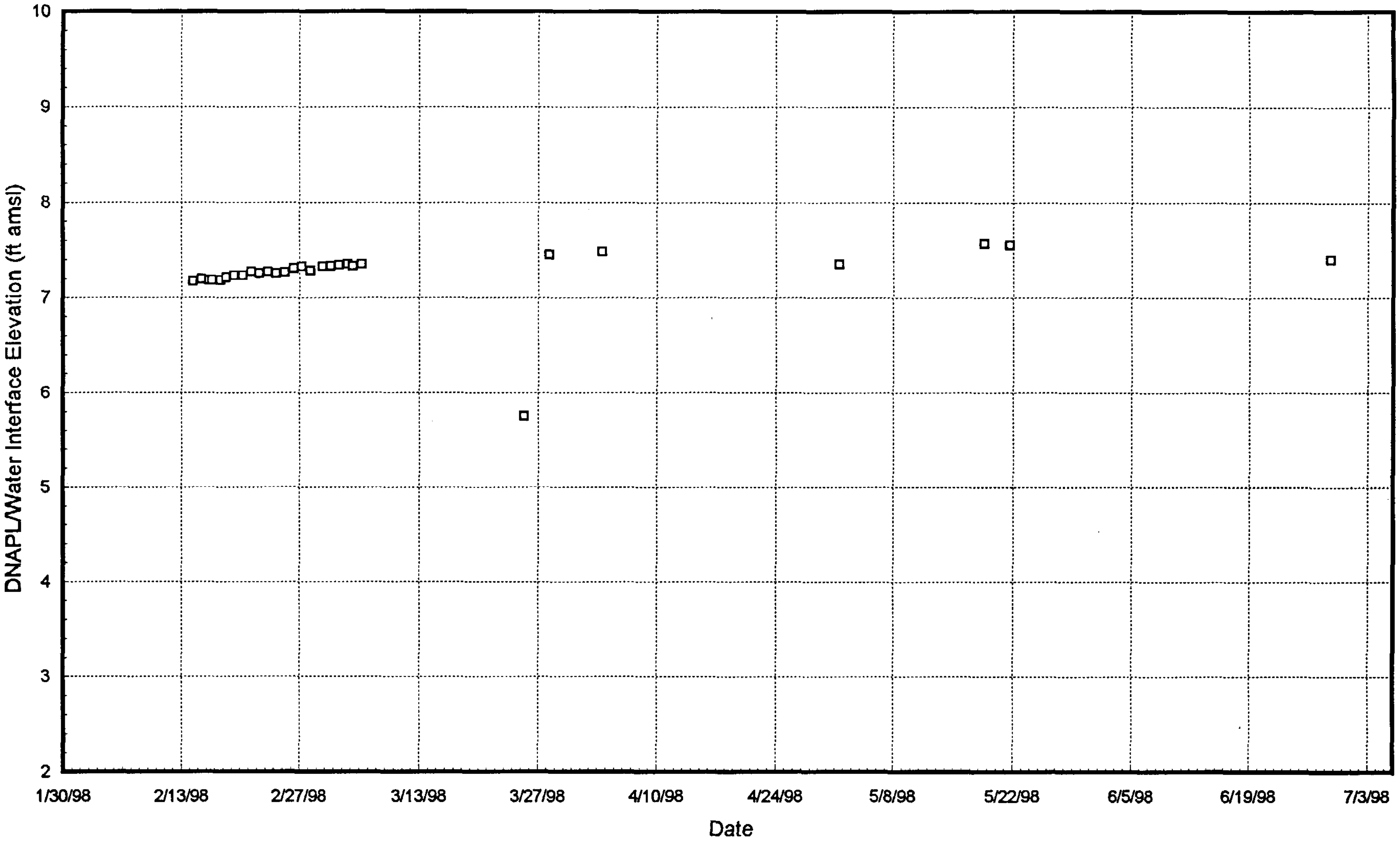
DNAPL/Water interface Elevation During Field Operations in Well EX04

RW01 Plot

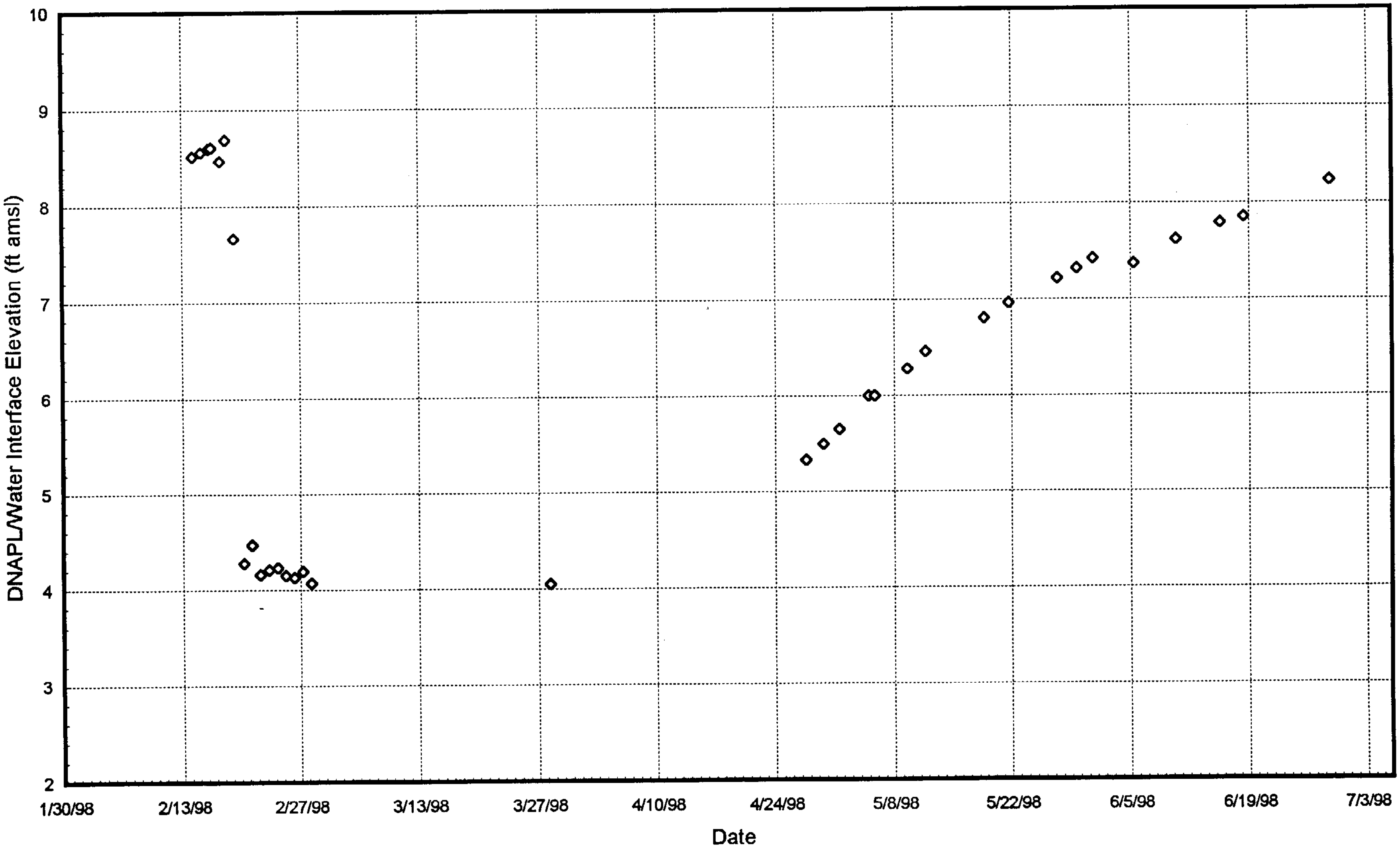


DNAPL/Water Interface Elevation During Field Operations in Well RW01

RW02 Plot

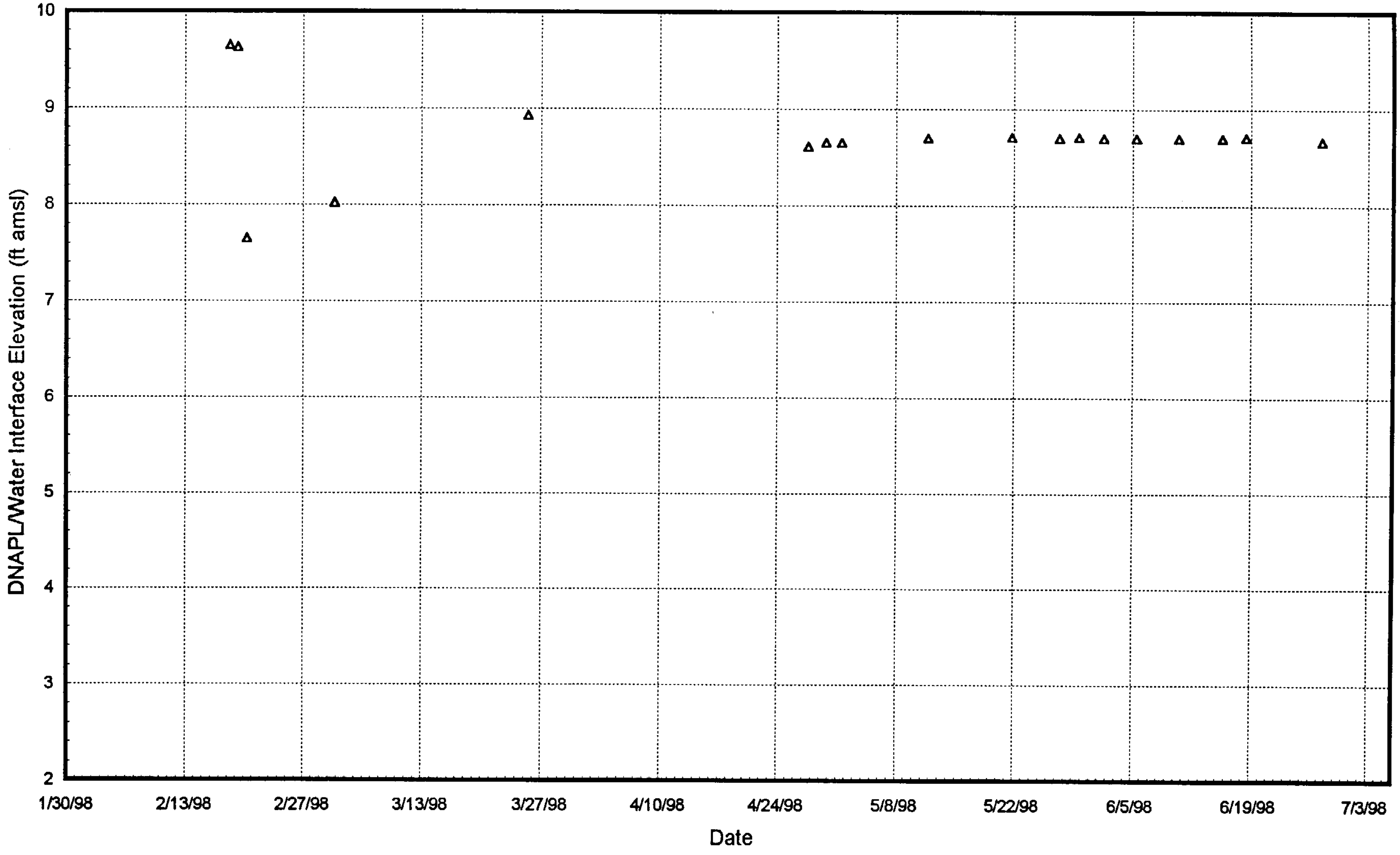


DNAPL/Water Interface Elevation During Field Operations in Well RW02



DNAPL/Water Interface Elevation During Field Operations in Well RW04

RW06 Plot



DNAPL/Water Interface Elevation During Field Operations in Well RW06

APPENDIX K

Laboratory Procedures for Tracer Selection and Column Tests, and the Method of Moments for Data Analysis

APPENDIX K
LABORATORY PROCEDURES FOR TRACER SELECTION AND COLUMN TESTS, AND THE METHOD OF MOMENTS FOR DATA ANALYSIS

DNAPL Density Measurement

The density of Site 88 DNAPL was measured using a pycnometer. First, the weight of the empty pycnometer was measured. The pycnometer was filled with deionized water and weighed again. The difference in weight between the dry and water-filled pycnometer was divided by the density of water under ambient conditions to calculate the volume of the pycnometer. The pycnometer was then dried, filled with DNAPL and weighed again. The difference in weight between the empty pycnometer and the DNAPL-filled pycnometer was divided by the previously determined volume of the pycnometer to calculate the density of the DNAPL – put in Appendix. This measurement was done three times to ensure repeatability. The density of the field DNAPL sample from Site 88, Camp Lejeune (from well RW02) was 1.588 g/cm^3. This is very close to the density of pure PCE (1.63 g/cm^3) which suggests that the DNAPL contained a small fraction of dissolved mineral oils and grease.

Measurement of Static Partition Coefficients

Experimental Procedures and Results

Measuring static partition coefficients involved the mixing of fixed volumes of DNAPL with water containing candidate partitioning tracer. The DNAPL-tracer-water samples were vigorously mixed and allowed to equilibrate for two days. The initial and equilibrium concentrations of the partitioning tracers in the aqueous phase were measured using a gas chromatograph (GC) with a flame ionization detector (FID). The concentration of the partitioning tracer in the DNAPL was calculated by mass balance using the following equation:

$$C_{i,DNAPL} = \frac{V_{water}}{V_{DNAPL}}(C_{i,water}^{initial} - C_{i,water}) \qquad (7.2.2\text{-}1)$$

where:

V_{water} = volume of water (cm^3)
V_{DNAPL} = volume of DNAPL (cm^3)
$C_{i,water}^{initial}$ = initial concentration of tracer 'i' in water (mg/L)

The experiments were repeated for a range of initial tracer concentrations in the aqueous phase. A tracer partitioning isotherm in which the variation of the tracer concentration in the DNAPL with the increase in the tracer concentration in the aqueous phase was plotted. An example calculation is shown in Figure K-1 in which the partition coefficient of 4-methyl-2-pentanol for a sample of the Camp Lejeune DNAPL is determined. The slope of the best-fit line through the partitioning isotherm is the static partition coefficient, and the apparent non-linearity of the isotherm is due to the hydrophobicity of the PCE. The summary of results from static partition coefficient experiments, along with the percentage uncertainty in each of the experimental measurements are given in Table K-1.

The accuracy of the experimental measurements was tested by using the equivalent alkaline carbon number approach, developed by Dwarakanath and Pope (1998) to estimate the partition coefficients. Both the measured and estimated static partition coefficients are presented in Table K-1. A close match between the measured and predicted static partition coefficients is observed, within the experimental uncertainty, suggesting that the accuracy of the partition coefficient measurements was acceptable.

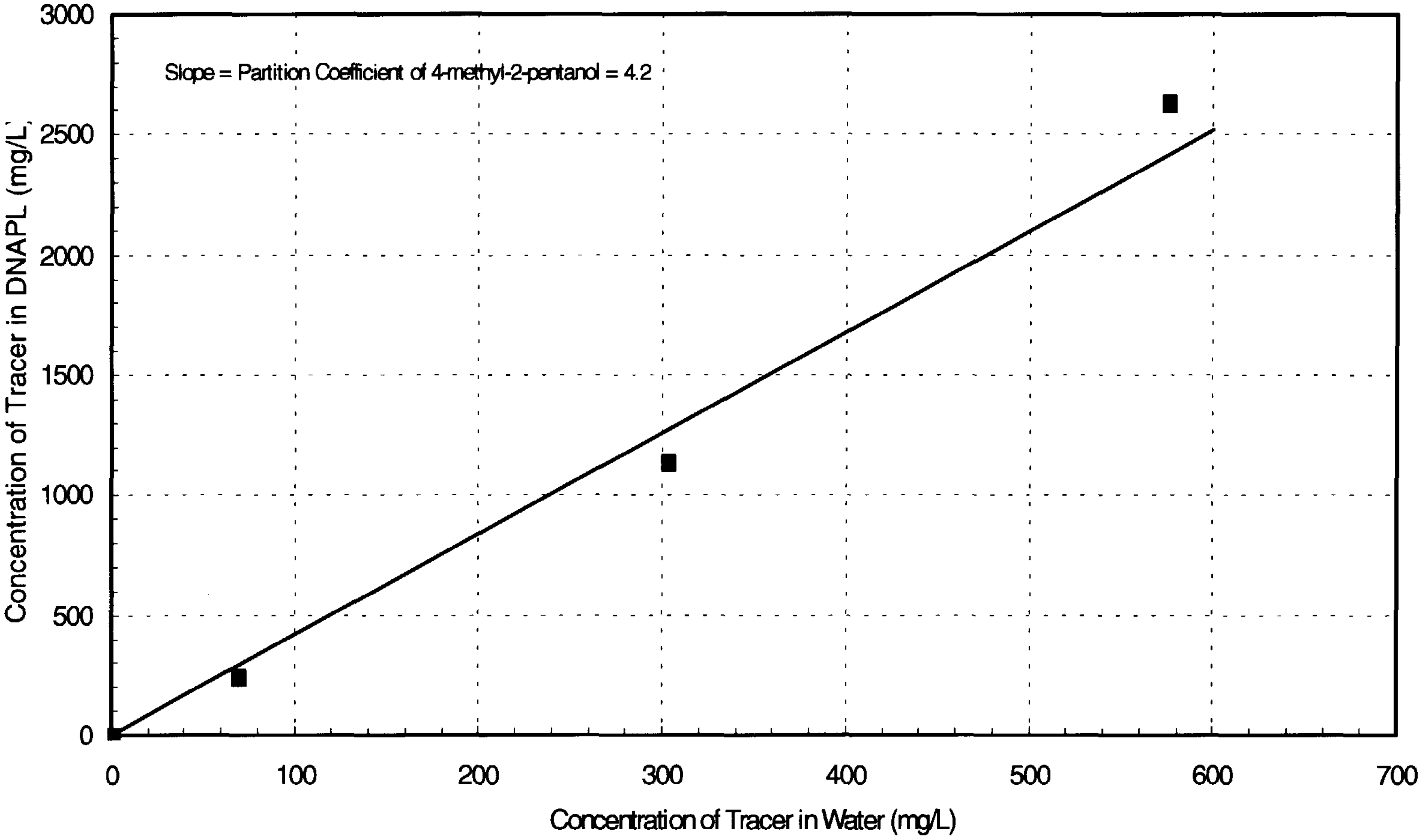
Table K-1 Partition Coefficients of Alcohols with Camp Lejeune DNAPL

Alcohol	Measured Partition Coefficient	% Uncertainty	Estimated Partition Coefficient
1-Methanol	0.0	?	0.1
1-Propanol	0.0	?	0.1
4-Methyl-2-Pentanol	4.2	3.8	4.4
1-Hexanol	8.1	3.6	7.6
2-Ethyl-1-Butanol	6.0	3.9	5.7
5-Methyl-2-Hexanol	24.1	8.7	24.4
1-Heptanol	35.0	9.3	34.5
2-Ethyl-1-Hexanol	115	2.6	115

Soil Column Experiments

Experimental Procedures

Two different columns were used to perform the partitioning tracer experiments. Both columns were 2.21 cm in diameter and made of 304 stainless steel with specially designed end pieces. One column was 60 cm long and the other column was 30.5 cm long. Two sets of stainless steel screens were used in each of the end pieces to hold the soil in place. The first screen was a fine #150 mesh (99 μm) screen and the



DATE: 7/27/99	Calculation of Static Partition Coefficient
REF: TDN 307	
FILE: Fig7-1.PPT	
Duke Engineering & Services A Duke Energy Company	MCB Camp Lejeune, NC

Figure K-1

second screen was a #60 mesh (250 µm) screen. The columns were pressure tested at 100 psi (6.9 X 10^5 Pa) to ensure that the system was free of leaks. The columns were then mounted on a vibrating jig. Sediment was slowly added in increments of approximately 3-4 grams using a spatula. Particles larger than 0.5 cm in diameter were not packed into the columns. The soil column was slowly tamped down using a steel rod while the jig was vibrating. Once the column was packed, it was saturated by flushing the alluvium with 500 mL of deaired water. In the first column experiment, water containing 150 mg/L calcium chloride was used for saturating the column, permeability measurements and the initial partitioning tracer test. At the end of the first partitioning tracer test, the mobilization of large quantities of fines was observed. This was attributed to ion exchange. Hence in both the second and third soil column experiment, a solution containing a mixture of 1000 mg/L calcium chloride and 1000 mg/L sodium chloride was used in all the injection and extraction operations. Under these conditions, no visible mobilization of fines was observed.

After packing and saturating with water, each column was attached to the flow apparatus. The initial permeability of the soil column was measured by allowing water to flow through the column at different flow rates and measuring the potential across the column at these different flow rates. Darcy's Law was then applied:

$$k = \frac{Q\mu L}{A\Delta\Phi}$$

where:

k = intrinsic permeability (m^2)
Q = flow rate (m^3/sec)
μ = viscosity of the flowing fluid (N/m)
A = cross sectional area (m^2)
$\Delta\Phi$ = potential drop across the column (Pa)
L = length of the column (m)

After measuring the permeabilities, an initial partitioning tracer test was conducted in all the experiments to determine the retardation of the partitioning tracers by the uncontaminated soil. At the end of the initial partitioning tracer test, two columns were saturated with Camp Lejeune DNAPL by introducing a fixed volume of DNAPL from the bottom up. This was done to ensure stable mobilization of the water by the DNAPL. The columns were then water-flooded from the top down to remove the mobile DNAPL. A partitioning tracer test was conducted on the DNAPL-contaminated soil columns to determine the ability of the partitioning tracers to accurately estimate the volume of DNAPL. A summary of the experiments conducted and the depth interval from which the soil used to pack the columns was taken are given in Table K-2. The physical properties of all the soil columns are given Table K-3.

Table K- 2 Summary of Soil Column Experiments with Site 88 Shallow Aquifer Sediments

Column	Soil Source	Experiments Conducted
CLJ#1	Well RW01, 15'-17' bgs and IW01, 16.25'-17' bgs	Uncontaminated Soil PITT
CLJ#2	Well RW02, 13'-15' bgs	Uncontaminated Soil PITT, Contaminated Soil PITT
CLJ#3	Well RW-02, 15'-17' bgs	Contaminated Soil PITT

Table K- 3 Summary of Soil Column Properties

Column	Length (cm)	Diameter (cm)	Porosity fraction	Permeability (X 10^{-11} cm^2)
CLJ#1	60.4	2.21	0.420	214
CLJ#2	30.2	2.21	0.424	199
CLJ#3	60.4	2.21	0.453	1455

Analysis of Partitioning Tracer Experiments by Method of Moments

Detailed information on the method of moments for the DNAPL saturation estimation can be found in Jin et al. (1995) and Jin (1995). In general, the residual DNAPL saturation can be estimated from the first moments of conservative and partitioning tracers using the following equation:

$$S_N = \frac{\bar{V}_{2-} - \bar{V}_1}{(K_2 - 1)\bar{V}_1 - (K_1 - 1)\bar{V}_2}$$

where:

$$\bar{V}_i = \frac{\int_0^\infty V_i C(V_i) dV_i}{\int_0^\infty C(V_i) dV_i}$$

$C(V_i)$ = the tracer concentration expressed as a function of volume (mg/L),
V_i = the first moment of volume (cm^3),
S_N = saturation of the DNAPL,
K_1 = partition coefficient of tracer '1',
K_2 = partition coefficient of tracer '2',

To estimate the DNAPL volume accurately, the tracer response curves should be complete, but some of the information contained in the tails of the tracer response curves can be lost if tracer concentrations fall below the detection limit. However the tracer response curves can be extrapolated with an exponential function provided the experiment is long enough to establish this decline (Pope et al., 1994; Jin, 1995). The first moments of the tracer curves can be obtained by dividing the data into two parts. The first part represents the data from zero to the volume V_b where it becomes exponential, and the second covers the exponential part in which it goes from V_b to infinity. After the cumulative volume V_b, the tracer response is assumed to follow an exponential decline given by:

$$C = C_b e^{-(\frac{V-V_b}{a})}$$

$\frac{1}{a}$ = the slope of the straight line when the tracer response curves are plotted on a semi-log scale

C_b = the tracer concentration at the cumulative volume V_b (mg/L).

By integration of the above, the first moment can be re-derived as (Jin, 1995):

$$\bar{V} = \frac{\int_0^{V_b} VC(V)dV + a(a+V_b)C_b}{\int_0^{V_b} C(V)dV + aC_b}$$

Tracer extrapolation was significant in the analysis of experimental data from all the soil column experiments as much of the retardation was evident in the tails of the tracer curves.

APPENDIX L

DE&S Standard Operating Procedures for Br Analysis, and Monitor-Well Sampling

SOP-BR-1
February 14, 1997
Revision 0

I. SCOPE AND APPLICATION

This procedure is used to ensure proper preparation, start up, monitoring, and operation of the DE&S bromide analysis method. The procedure includes methods for calibration, quality control checks, sample analysis and instrument setup.

II. PREPARATION

1. Electrodes.
    - a.) The reference electrode should contain no liquid. If it does empty the old liquid out and clean any filling solution residue that may remain. Failure to do so will result in leaks of the filling solutions and inaccurate measurements.
    - b.) Cleaning of the reference electrode can be done by rinsing with deionized water. Caution should be used to not touch the sensory ends of the electrodes. See the electrode instruction manual for specific instructions for electrode disassembly.
    - c.) The ion specific electrode needs no filling solution. The cap should be removed from the electrode and it should be rinsed with deionized water. This should be followed by buffing of the sensor end of the electrode with a polishing strip and a second rinse.
    - d.) The inside of the reference electrode should be filled with the inner solution (green) and the band replaced over the hole (or parafilm). The outer chamber should then be filled with the outer solution (KNO_3).
    - e.) The reference electrode should then be re-assembled and rinsed with deionized water.
2. Meter
    - a.) The electrodes should be plugged into the meter and the power turned on. The electrodes should be kept wet anytime the meter is on. The meter should be allowed to warm up for several minutes.
    - b.) Instructions should then be followed to program the meter as given in the meter s instruction manual:
        1. The Alarm setting should be five minutes. The reading at the sounding of the alarm should be recorded as the measured value.

III. CALIBRATION

1. Preparing Standards.
    - a.) Standards should be prepared which encompass the expected range of concentrations in the samples. A three point calibration curve should be constructed. The calibration standards should be run once a day. The r-squared value obtained from this calibration should be at least .999. The slope-intercept equation should also be determined to calculate the concentrations in the samples. This is obtained by the log of the concentration representing the x value and the mV reading representing the y value.

b.) A calibration check standard should be prepared at a low midpoint in the calibration range. This solution should be used to check the calibration for every batch and to determine the precision at the beginning of the analyses.

c.) Deionized water should be run at the beginning of each batch, before and after the calibration, and before and after the precision check. Additionally the deionized water rinse measurement should be allowed to reach a reading of at least 125 mV prior to the next analysis.

d.) All samples and standards should have ionic strength adjuster added at a concentration of ###% for $NaNO_3$, or ###% for KNO_3 prior to analysis.

IV. SAMPLES

1. Sample Selection

a.) Samples should be run for every three samples collected prior to and just after the peak. This can be extended to every four samples for the tail of the curve. A single well should be selected and the samples should be run in chronological order. All samples should have ionic strength adjuster added as prescribed in section III.1.d.

2. Sample Batch

a.) A sample batch consists of a deionized water blank and a calibration check, followed by ten samples. The samples should be run only after the calibration check falls within +/- 20% of the average concentration, as determined by the precision checks.

b.) Once a sample is analyzed over the five minute timed interval, the meter should be turned off and the electrodes should be rinsed with deionized water and placed in a separate deionized water rinse beaker until the mV reading reaches at least 125.

c.) The electrodes should then be rinsed again and BLOTTED dry with a Kimwipe. The electrodes can then be immersed in the next sample and the meter turned on. Once a reading is obtained on the meter the timer button should be reset for another five minute interval.

3. Storage

a.) At the end of a day of sampling the meter should be turned off and the electrodes stored with their tips submerged in deionized water. If no more analyses are to be performed on the given project, the reference electrode should be emptied of the filling solutions and rinsed. The ion selective electrode should be rinsed and capped. The meter should be unplugged.

MONITOR-WELL SAMPLING

This Standard Operating Procedure is concerned with the collection of valid and representative samples from ground-water monitor wells. Ground-water samples are collected and analyzed to determine the presence or absence and/or quantity of various contaminants as part of site characterization, remediation, and/or monitoring activities.

Equipment

The following list identifies the types of equipment that may be used for a range of ground-water sampling applications. A project-specific equipment list will be selected from this list, based on project objectives and well conditions.

- Bailer and/or pump
- pH meter
- Specific conductance meter
- Water-level measurement equipment
- Water-sampling data form
- Filtration apparatus (project-dependent)
- Sample shuttles
- Sample containers and laboratory-supplied preservatives (if any)
- Sample labels
- Custody seals
- Personal protective equipment
- Decontamination equipment
- Waterproof pens
- Field logbook
- Chain-of-custody forms
- Sample control logs

Water-Level Measurement

Before obtaining a water-level measurement, cut a slit in one side of the plastic sheet and slip it over and around the well, creating a clean surface onto which the sampling equipment can be positioned. This clean working area should be a minimum of 8 feet square. Care will be taken not to kick, transfer, drop, or in any way allow soil or other materials to fall onto this sheet, unless it comes from inside the well. Do not place meters, tools, equipment, etc. on the sheet unless they have been cleaned first.

MONITOR-WELL SAMPLING

After unlocking and/or opening a monitor well, the first task will be to obtain a water-level measurement. Water-level measurements will be made using an electronic measurement device.

Water-Level Measurement Procedures

- Unlock and/or open the monitor well. Enter a description of the condition of the security system and protective casing in the field logbook.

- Check for the measuring point for the well. The measuring point location should be clearly marked on the outermost casing or identified in previous sample-collection records. If no measuring point can be determined, a measuring point should be established. Typically, the top (highest point) of the protective or outermost well casing will be used as the measuring point. The measuring-point location should be described on the water-sampling data form and should be the same point used for all subsequent sampling efforts.

- To obtain a water-level measurement, lower the level indicator into the monitor well. Care must be taken to assure that the water-level measurement device hangs freely in the monitor well and does not adhere to the wall of the well casing. The water-level measuring tape will be lowered into the well until the sound and light on the electronic sounder are activated. At this time, the precise measurement should be determined (to a hundredth of a foot) by repeatedly raising and lowering the tape to converge on the exact measurement. The water-level measurement should be entered on the water-sampling data form.

- The measurement device will be decontaminated after use. Generally only that portion of the tape that enters the water table will be cleaned. It is important that the measuring tape is never placed directly on the ground surface.

Well Purging

Prior to sample collection, purging must be performed for all ground-water monitor wells to remove stagnant water from within the well casing and to ensure that a representative sample is obtained. Wells will be purged of at least three well volumes (moderate- to high-yield formations) or at least one well volume for low-yield formations.

Well casing volume is determined using the following equation:

$$V_{WC} = \frac{\pi D^2 h}{4}$$

where: V_W (ft^3) = well volume
D (ft) = internal diameter of the well casing
h (ft) = length of the water column in the well casing

Well casing volumes can also be determined graphically using the information presented in Figure A.8-1.

The volume of the filter pack can be determined by calculating the volume of the portion of the borehole with one filter pack, less the casing volume.

Filter pack volume is calculated using the following equation:

$$V_{FP} = \left[\frac{\pi D^2 h}{4} - V_{WC}\right](n)$$

where: V_{FP} (ft^3) = filter pack volume
D (ft) = diameter of the borehole
h (ft) = lesser of (a) length of filter pack, or (b) length of water column in the casing
n = filter pack porosity (assume 30%)
V_{WC} (ft^3) = well casing volume
Well Volume Total = $V_{FP} + V_{WC}$

Conversion: 1 ft^3 = 7.48 gal; 1 gal = 0.134 ft^3

Indicator parameters (pH, temperature, and conductivity) will be monitored and recorded for each well volume removed. Generally, well purging will continue until the pH is within 0.2 standard units, temperature is within 1°C, and electrolytic conductivity is within 10% of the three previous determinations. Very low-yield wells that are dry after removal of one well volume are considered purged and should be allowed to recharge for 24 hours before sampling.

Purged water will be placed in the project effluent tanker.

Well-Purging Methods

Three general types of equipment are used for well purging: bailers, surface pumps, or down-well submersible pumps.

Bailing

In many cases, bailing is the most convenient method for well purging. Bailers are constructed using a variety of materials; generally, PVC, stainless steel, and Teflon®. Care must be taken to select a specific type of bailer that suits a study's particular needs. Teflon® bailers are generally most "inert" and are used most frequently. It is preferable to use one bailer per well, but field decontamination is a relatively simple task if required.

Bailing presents two potential problems with well purging. First, increased suspended solids may be present in samples as a result of the turbulence caused by raising and lowering the bailer through the water column. High solids concentrations may require that total suspended solids (TDS) and the chemical character of solids be evaluated during sample analyses.

Second, bailing may not be feasible for wells which require that more than 20 gallons be removed during purging. Such bailing conditions mandate that long periods be spent during purging and sample collection, or that centrifugal pumps be used.

Surface Pumping

Ground-water withdrawal using pumps located at the ground surface is commonly performed with centrifugal or peristaltic pumps.

All applications of surface pumping will be governed by the depth to the ground-water surface. Peristaltic and centrifugal pumps are limited to conditions where ground water need only be raised through approximately 20 feet of vertical distance. The lift potential of a surface-pumping system will depend on the net positive suction head of the pump and the friction losses associated with the particular suction line, as well as the relative percentage of suspended particulates.

Surface pumping can be used for many applications of well purging and ground-water-sample collection. In all cases, pumping cannot be used for the collection of samples to be analyzed for volatile organic compounds (VOCs).

- *Peristaltic pumps* provide a low rate of flow, typically in the range of 0.02 to 0.2 gallons per minute (75 to 750 ml/min). For this reason, peristaltic pumps are not particularly effective for well purging. Peristaltic pumps are suitable for purging situations where disturbance of the water column must be kept minimal for particularly sensitive analyses. Peristaltic pumps are most often used in conjunction with field filtering of samples and therefore can be used to obtain water samples for direct filtration at the wellhead.

- *Centrifugal pumps* are designed to provide a high rate of pumping, in the range of 10 to 40 gallons per minute (gpm), depending on pump capacity. Discharge rates can also be regulated somewhat, provided the pump has an adjustable throttle.

  When centrifugal pumps are used, samples should be obtained from the suction (influent) line during pumping by an entrapment scheme. Construction of this sampling scheme is relatively simple and will not be explained as part of this SOP. It is suggested that, if samples cannot be obtained from the influent line in front of the pump, they be obtained by using a bailer once pumping has ceased. Collecting samples from the pump discharge is not recommended.

- *Submersible pumps* provide an effective means for well purging, and, in some cases, sample collection. Submersible pumps are particularly useful for situations where the depth to water table is greater than 20 to 30 feet and the depth or diameter of the well requires that a large purge volume be removed during purging.

  As with other pump-type purge/sample-collection methods, submersible pumps will not be used for the collection of samples to be analyzed for volatile organic compounds. Submersible pumps should never be used for well development, *as this can seriously damage the pump.*

Purging and Sample-Collection Procedures — Method Specific

Bailing

Obtain a clean/decontaminated bailer and a spool of polypropylene rope or equivalent bailer cord. Using the rope at the end of the spool, tie a bowline knot or equivalent through the bailer loop. Test the knot for security and the bailer itself to ensure that all parts are intact before inserting the bailer into the well.

Remove the protective wrapping from the bailer. Lower the bailer to the bottom of the monitor well and cut the cord at a proper length. Bailer rope should never touch the ground surface at any time during the purge routine.

Raise the bailer by grasping a section of cord using each hand alternately in a "rocking" action. This method requires the sampler's hands to be kept approximately 2 to 3 feet apart and the bailer rope to be alternately looped onto or off each hand as the bailer is raised and lowered. Bailed ground water is poured from the bailer into a graduated bucket to measure the purged water volume.

For slowly recharging wells, the bailer is generally lowered to the bottom of the monitor well and withdrawn slowly through the entire water column. Rapidly recharging wells should be purged by varying the level of bailer insertion to ensure that all stagnant water is removed. The water column should be allowed to recover to 70-90% of its static volume before a sample is collected. Water samples should be obtained from midpoint or lower within the water column.

Samples collected by bailing will be poured directly into sample containers from full bailers. During sample collection, bailers will not be allowed to contact the sample container.

Peristaltic Pump

Place a new suction and discharge line to the peristaltic pump. Silicon tubing must be used through the pump head. A second type of tubing may be attached to the silicon tubing to create the suction and discharge lines. Such connection is advantageous for the purpose of reducing tubing costs, but can only be used if airtight connections can be achieved. Tygon tubing will not be used when performing well purging or collecting samples for organic analysis. The suction line must be long enough to extend to the static ground-water surface and reach further, should drawdown occur during pumping.

Measure the length of the suction line and lower it down the monitor well until the end is 2 to 5 inches below the water level in the well. Start the pump and direct the discharge into a graduated bucket.

Measure the pumping rate in gallons per minute by recording the time required to fill a selected volume of a bucket. Flow measurements shall be performed three times to obtain an average rate.

The pumping shall be monitored to assure continuous discharge. If drawdown causes the discharge to stop, the suction line will be lowered very slowly further down into the well until pumping restarts.

Measurements of pH and specific conductance will be made periodically during well purging. All readings will be entered on the Ground-Water Sample Collection Record.

Samples will be collected after the required purge volume has been withdrawn and the field parameters (pH and specific conductance) have stabilized.

When the sample bottles are prepared, each shall be filled directly from the discharge line of the peristaltic pump. Care will be taken to keep the pump discharge line from contacting the sample bottles. Ground-water samples requiring filtration prior to placement in sample containers will be placed in intermediate containers for subsequent filtration, or filtered directly.

At each monitoring point, when the peristaltic pumping has been completed, all tubing including the suction line, pump head, and discharge line must be disposed of. In some cases, where sampling will be performed frequently at the same point, the peristaltic pump tubing may be retained between each use in a clean ziplock plastic bag.

Centrifugal Pump

- *Direct Connection Method.*

  Note: this method requires that the well casing be threaded at the top.

  Establish direct connection to the top of the monitor well, if possible, using pipe connections, extensions, and elbows, with Teflon® tape wrapping on all threaded connections. If the centrifugal pump will subsequently be used for sample collection, a sample isolation chamber will be placed in the suction line configuration in front of the pump.

  Prime the pump by adding tap water to the pump housing until the housing begins to overflow.

  Start the pump and direct the discharge into a graduated bucket or a bucket of known capacity (> 2.5 gallons).

Start the pump and measure the pumping rate in gallons per minute by recording the time required to fill the graduated bucket. Flow measurement should be checked periodically to determine if pumping rates are continuous, fluctuating, or diminishing. If discharge stops, the pump will be throttled back to determine if pumping will restart at a lower rate. If pumping does not restart, the pump should be shut off to allow the well to recharge.

Measurements of pH and specific conductance will be made periodically during well purging. All readings will be entered on the Ground-Water Sample Collection Record. Samples will be collected after the required purge volume has been withdrawn and the field parameters (pH and specific conductance) have stabilized. Samples should be collected from an in-line discharge valve. The pump should be properly decontaminated between wells.

- *Down-Well Suction-Line Method*

  Lower a new suction line into the well. The suction line will have a total length great enough to extend to the water table and account for a minimum of 5 feet of drawdown. It should be noted that the pump may draw the water in the well down to the depth where pumping will terminate as a result of a limitation derived from the lift potential of the pump. All connections should be made using Teflon® ferrules and Teflon® thread wrapping tape. Run the pump as for the direct connection method described above.

  At each monitor well, when use of a centrifugal pump is complete, all suction line tubing should be disposed of properly.

Submersible Pump

Before using a submersible pump, a check will be made of well diameter and alignment. If deemed necessary, a decontaminated cylindrical tube of the proper diameter should be lowered to the bottom of each monitor well to determine if the alignment or plumbness of a well is adequate to accommodate the submersible pump. All observations will be entered in the Ground-Water Sample Collection Record.

Slowly lower the submersible pump into the monitor well, taking notice of any roughness or restrictions within the riser. Stop lowering the pump when the stainless-steel motor is approximately 3 feet above the bottom of the monitor well. Secure the discharge line and power cord to the well casing.

Connect the power cord to the power source (e.g., rechargeable battery pack or auto battery monitor) and turn the pump on (forward mode). When running, the pump can usually be heard by listening near the well head.

The pump manufacturer's specified operating voltage and amperage ratings should be noted and verified, and voltage and amperage meter readings on the pump discharge should be checked continuously. The voltage reading from battery-powered pumps will decline slowly during the course of a field day, representing the use of power from the battery. Amperage readings will vary, depending on the depth to water table. Above-normal amperage readings usually indicate a high solids content in the ground water, which may cause pump clogging and serious damage. If a steady increase in amperage is observed, the pump should be shut off, allowed to stop, switched to the reverse mode, stopped again, and then placed in forward mode. If high amperage readings persist, the pump should be withdrawn and checked using an upright cylinder (e.g., a drum) and tap water. Ground-water conditions such as high solids may require that an alternate purge/sample method be used.

Drawdown must also be monitored continuously by remaining near the well at all times and listening to the pump. When drawdown to the pump intake occurs, a metallic rotary sound will be heard as the pump intake becomes exposed and ceases to discharge water, but continues to run. The pump should be lowered immediately to continue pumping water within the uppermost section of the static water column. *NOTE: the submersible pump cannot be allowed to run while not pumping, or the pump motor will burn out* .

If drawdown continues to the extent that the well may be pumped dry, the discharge rate of the pump can be reduced to slow the rate of drawdown. Care should be taken to avoid cutting the pump back below its minimum operating standard. If drawdown is such that the well is still pumped dry, the pump should be shut off and the well allowed to recharge. This on/off cycle may need to be repeated several times to purge the well properly.

Measurements of the pumping rate, pH, and specific conductance should be made periodically during well purging. All readings and respective purge volumes should be entered on the Ground-Water Sample Collection Record.

Sample bottles will be filled directly from the discharge line of the pump during pumping, taking care not to touch sample bottles to the discharge line.

At each monitor well, after pumping has been completed, the pump, discharge line, and power cord shall be decontaminated according to the procedures contained in *Standard Operating Procedures, Decontamination.*

Sample Collection Procedures — Method Independent

- Samples intended for volatile organic analysis should be collected first. Sample containers should be filled quickly and smoothly to avoid agitation, aeration, and loss of volatile components. To further avoid loss of volatile components, samples should be filled completely so that no headspace is present, and capped securely with a Teflon®-lined lid.

- Samples for semivolatile, metal, or other analyses will be collected in the proper sample containers.

- Replicate samples will be collected when QA/QC samples are needed for volatile organic analysis (VOA). VOA samples typically consist of two sample vials, referred to as the sample set. Alternating between the primary sample set and the replicate sample set, each vial will be filled completely and capped immediately in the order shown below:

  (i) fill vial #1 - primary sample set;
  (ii) fill vial #1 - replicate sample set;
  (iii) fill vial #2 - primary sample set; and
  (iv) fill vial #2 - replicate sample set.

  Duplicate samples will be collected when QA/QC samples are required for sample analyses other than VOA. Duplicates are collected by alternately filling the sample containers as in the VOA procedure, except that containers are filled incrementally instead of completely and the filling procedure continues until the sample containers are full.

- All sample containers will be labeled with the following information:

  — project name and/or number;
  — company (DE&S);
  — field sample number;
  — initials of collector;
  — date and time of collection;
  — analysis required; and
  — sample type and preservative, if any.

MONITOR-WELL SAMPLING

- Samples should be placed in the sample shuttles as soon as possible and, if required, stored and transported at <4°C (39°F), using frozen ice packs or double-bagged ice.
- The use of protective packaging will be dictated by the mode of transport.
- Sample information will be recorded in the field logbook and on the sample control log as soon as possible after sample collection.
- Chain-of-custody forms will be completed and placed in the sample shuttle for shipment to the laboratory.
- Custody seals will be placed across sample shuttle lids so that sample shuttles cannot be opened without breaking the custody seal. Custody seals will contain the following information:
  - collector's signature or initials; and
  - date of sampling.
- Samples will be shipped to the laboratory for analysis, carefully observing all minimum holding-time requirements for degradable constituents.

APPENDIX M

PITT Flow Rates and Cumulative Volume Water Levels

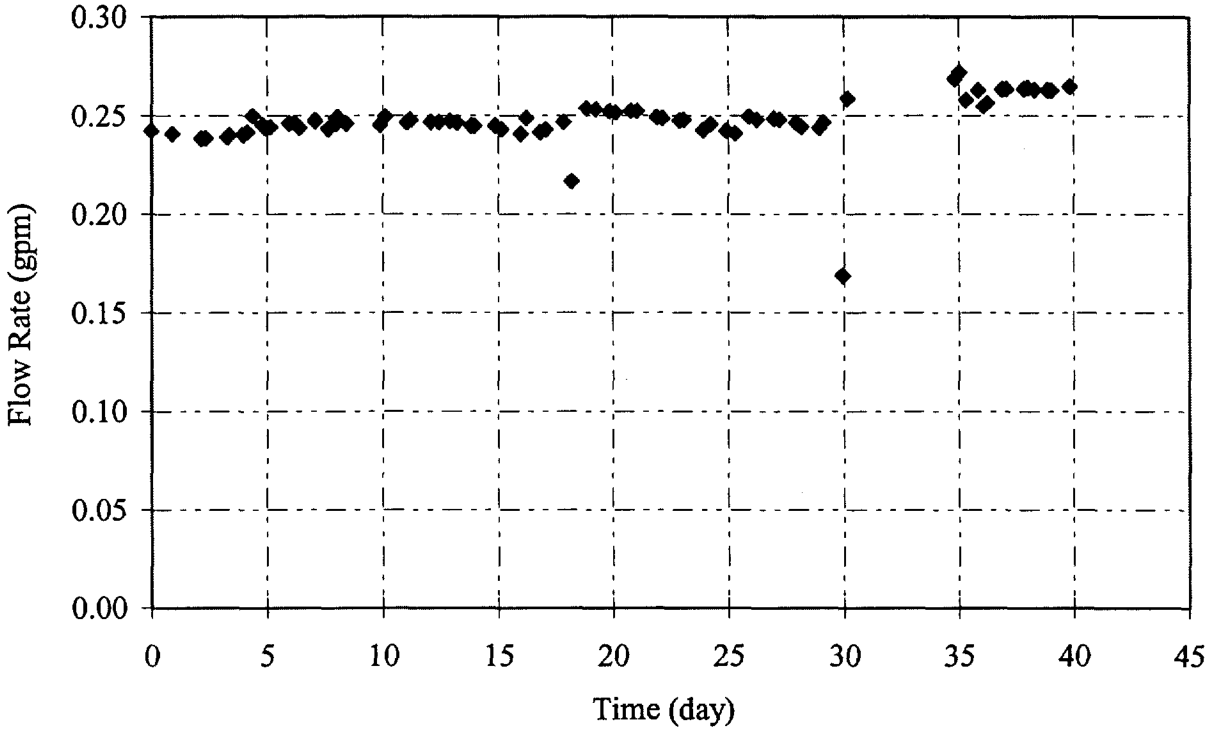


Figure M-1 Extaction well EX01 flow rate as a function of time

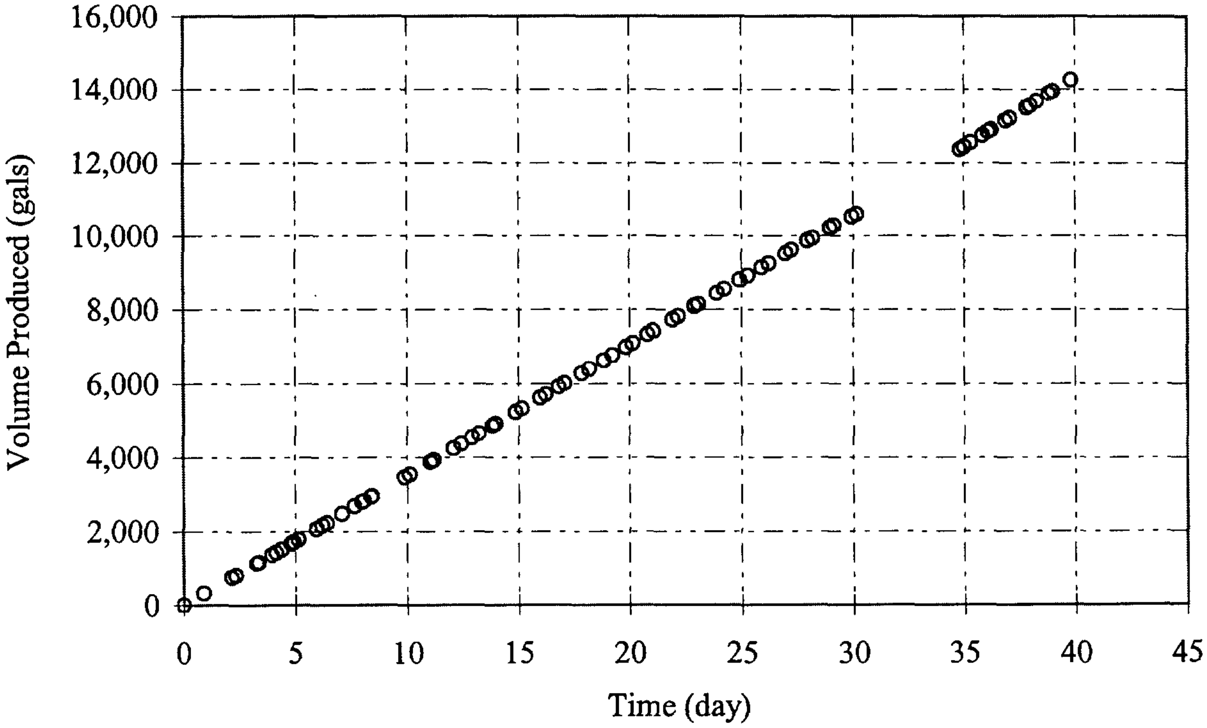


Figure M-2 Extaction well EX01 cumulative volume produced as a function of time

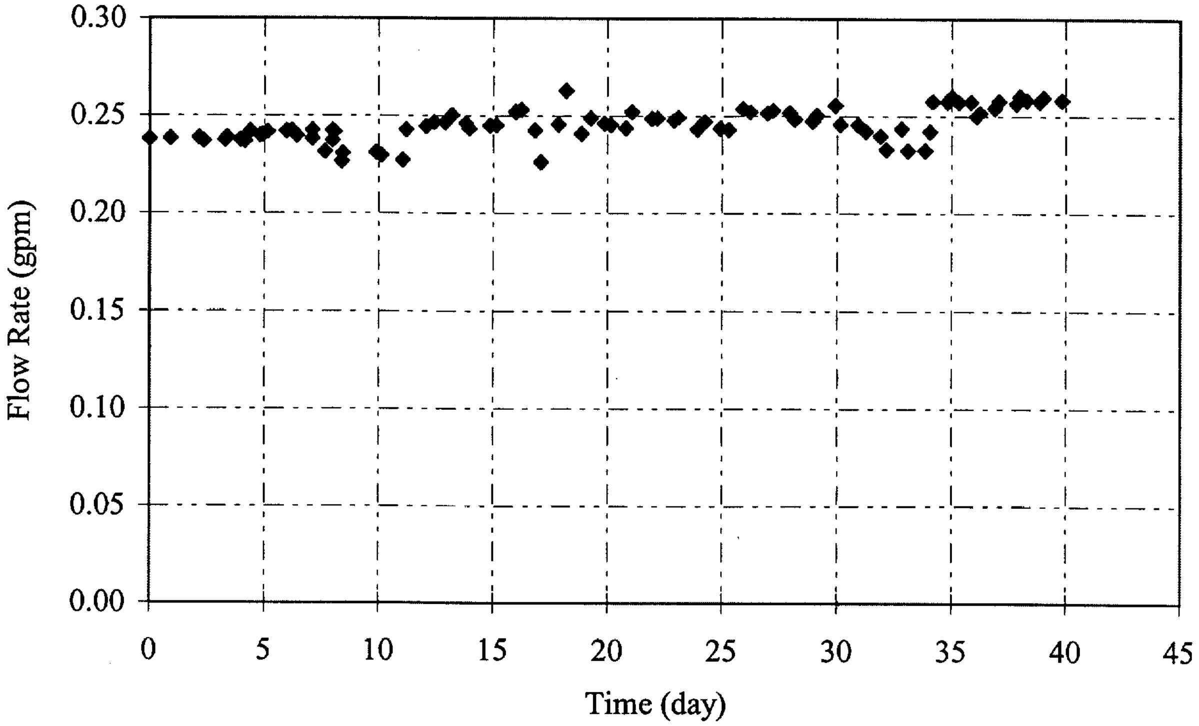


Figure M-3 Extraction well EX02 flow rate as a function of time

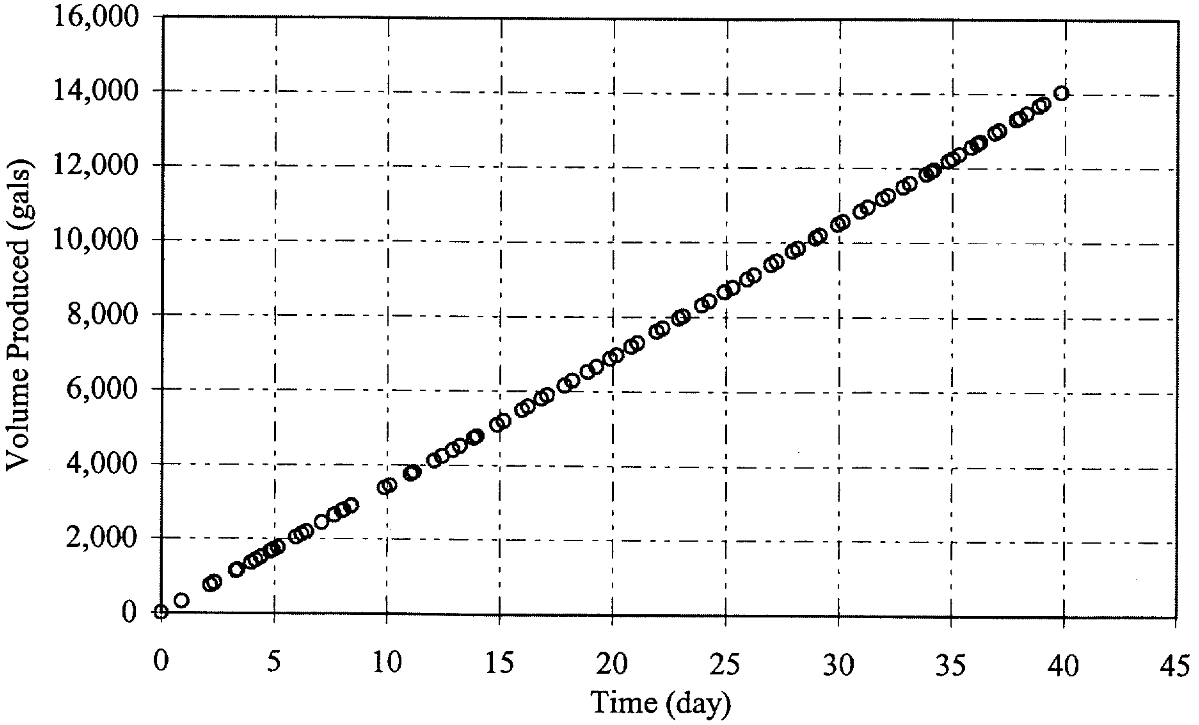


Figure M-4 Extraction well EX02 cumulative volume produced as a function of time

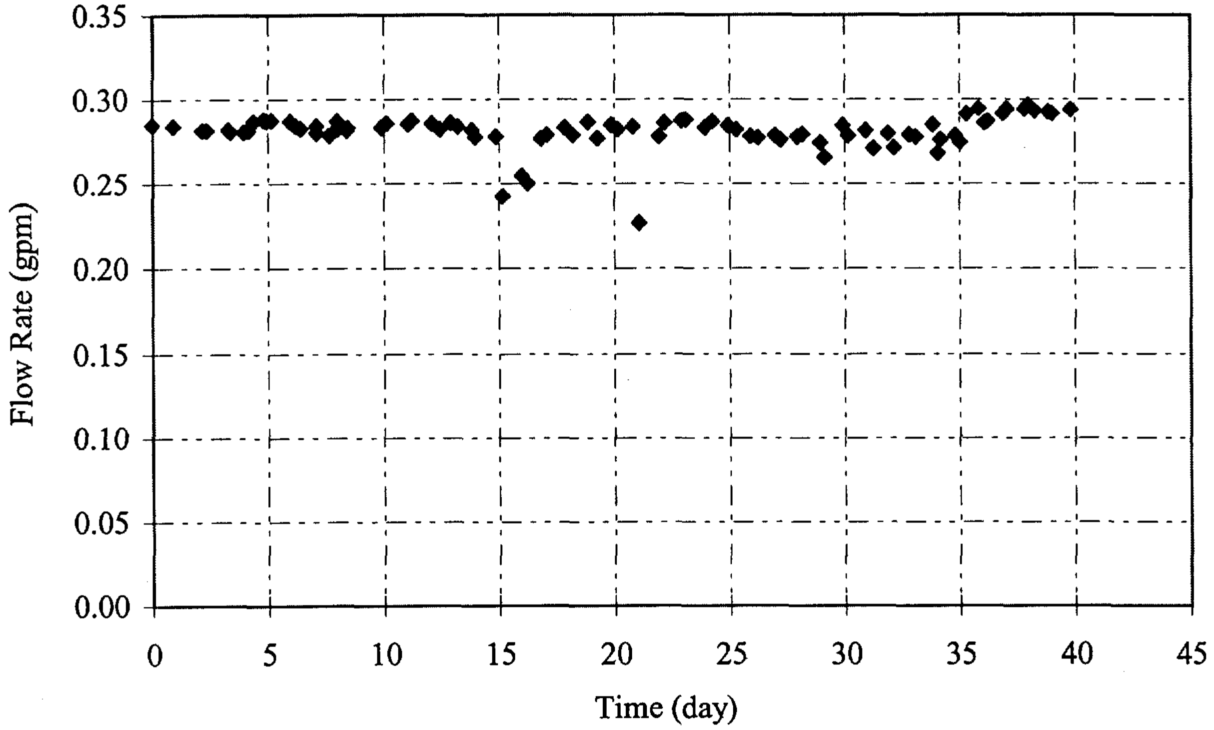


Figure M-5 Extraction well EX03 flow rate as a function of time

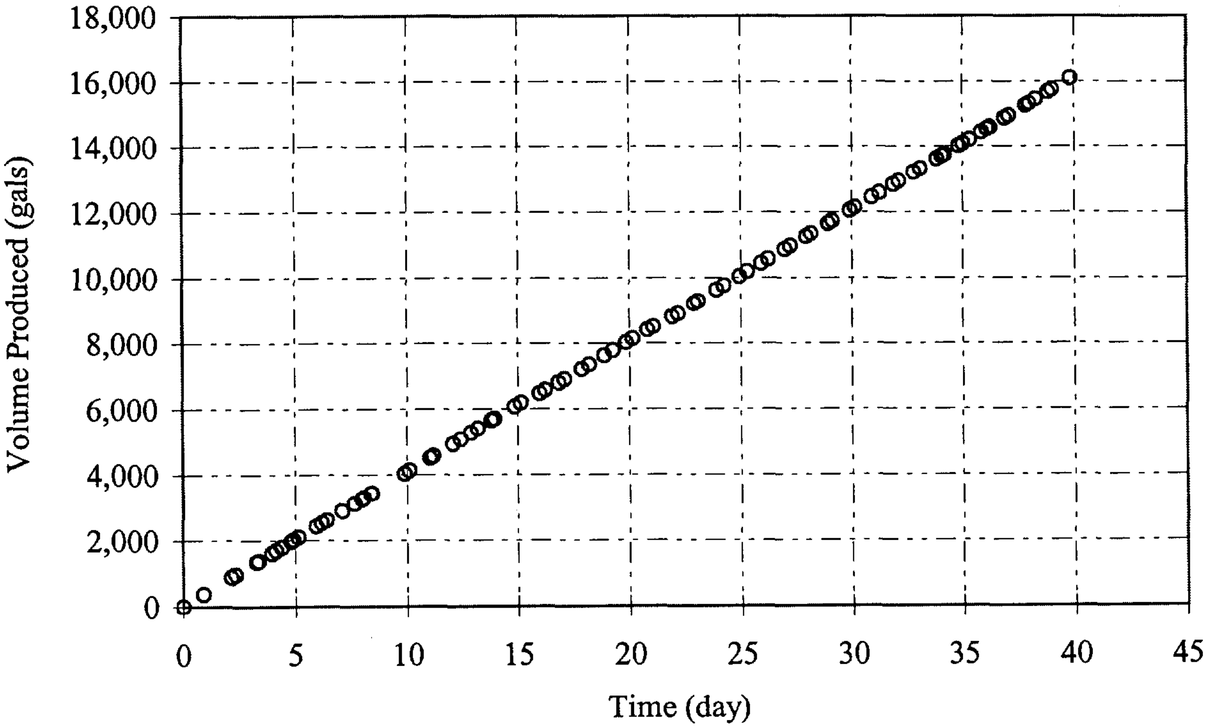


Figure M-6 Extraction well EX03 cumulative volume produced as a function of time

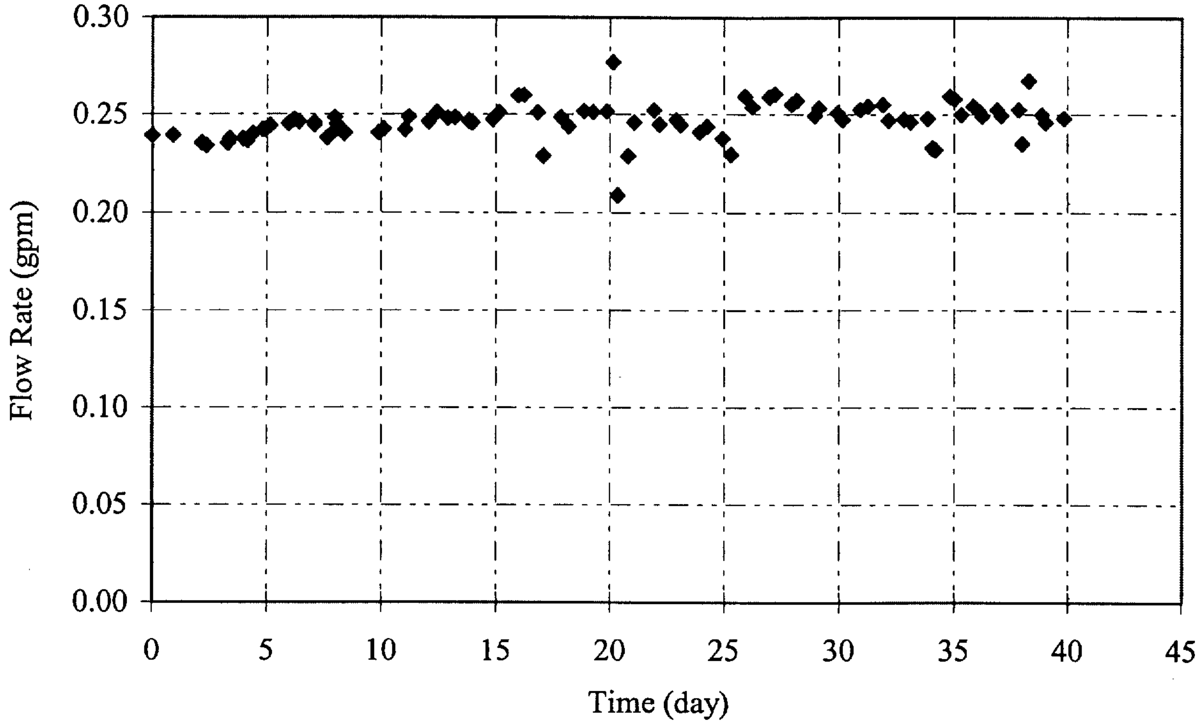


Figure M-7 Extraction well EX04 flow rate as a function of time

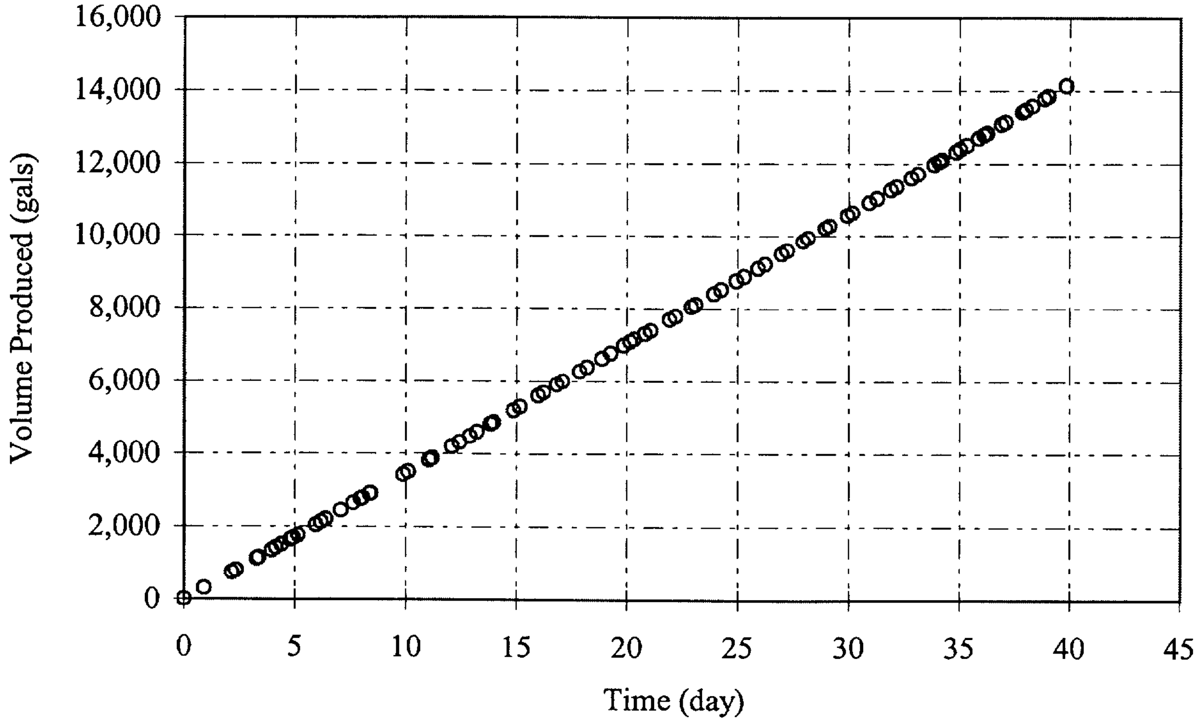


Figure M-8 Extraction well EX04 cumulative volume produced as a function of time

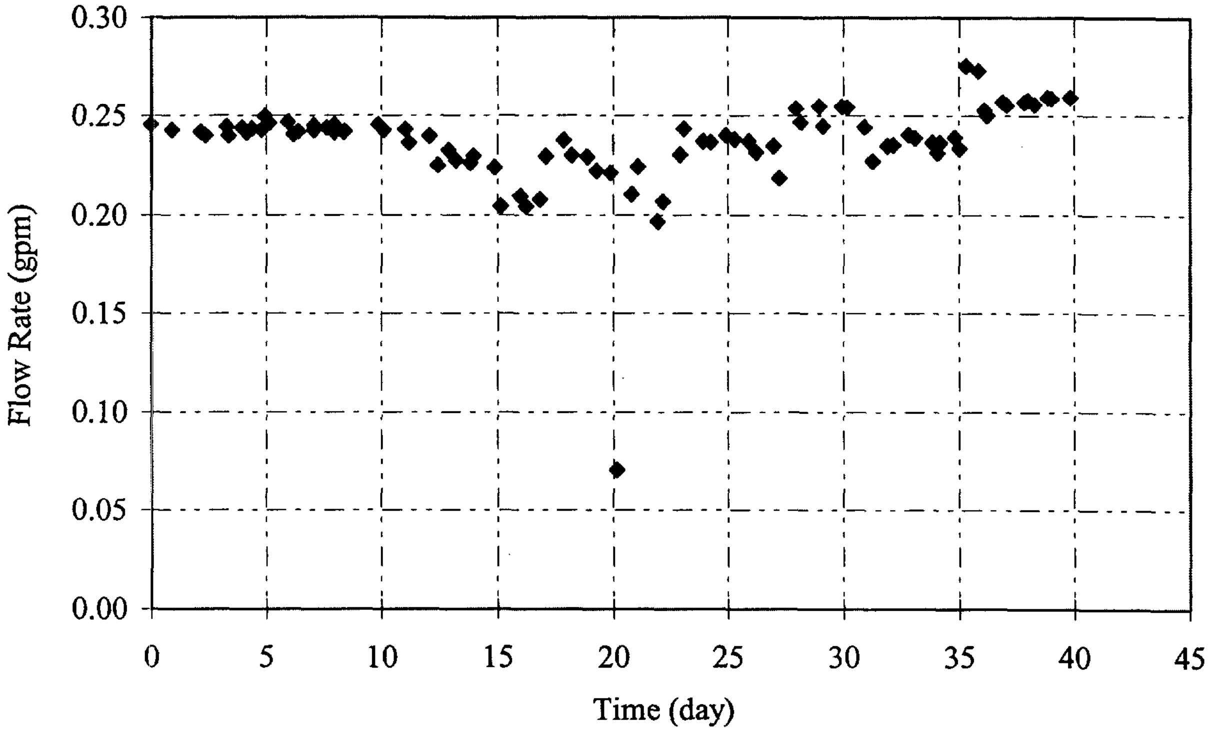


Figure M-9 Extraction well EX05 flow rate as a function of time

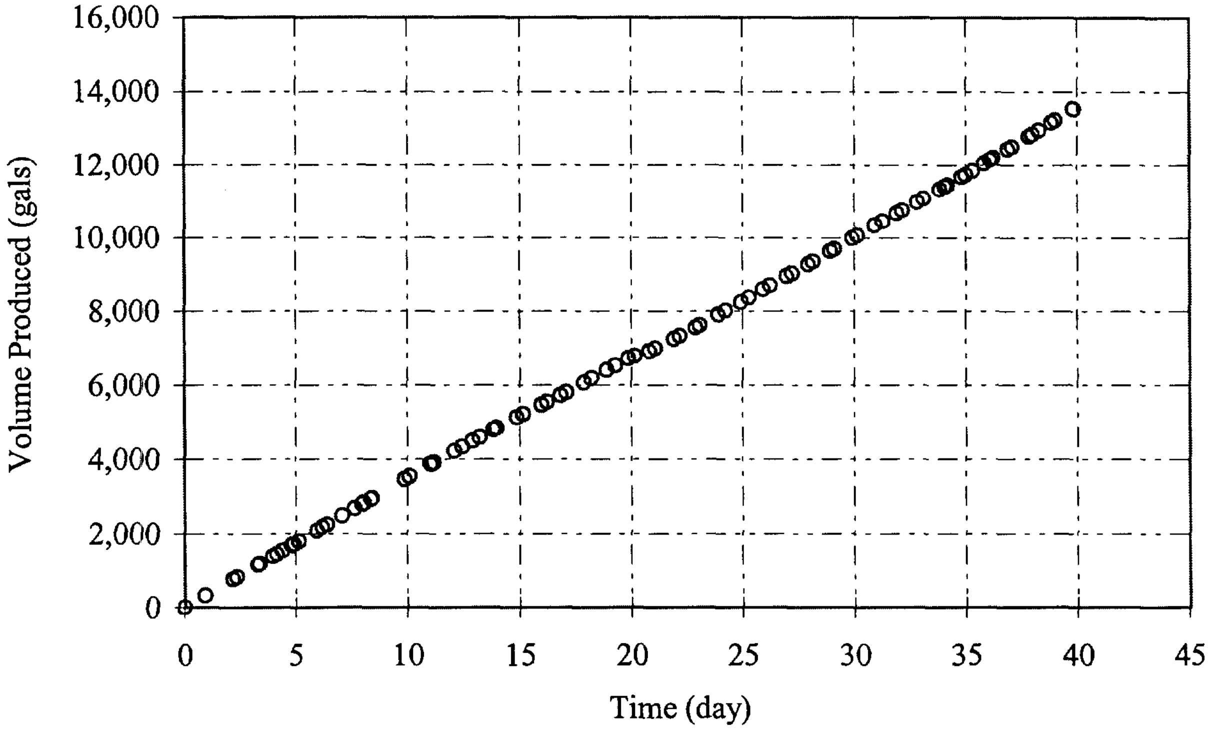


Figure M-10 Extraction well EX05 cumulative volume produced as a function of time

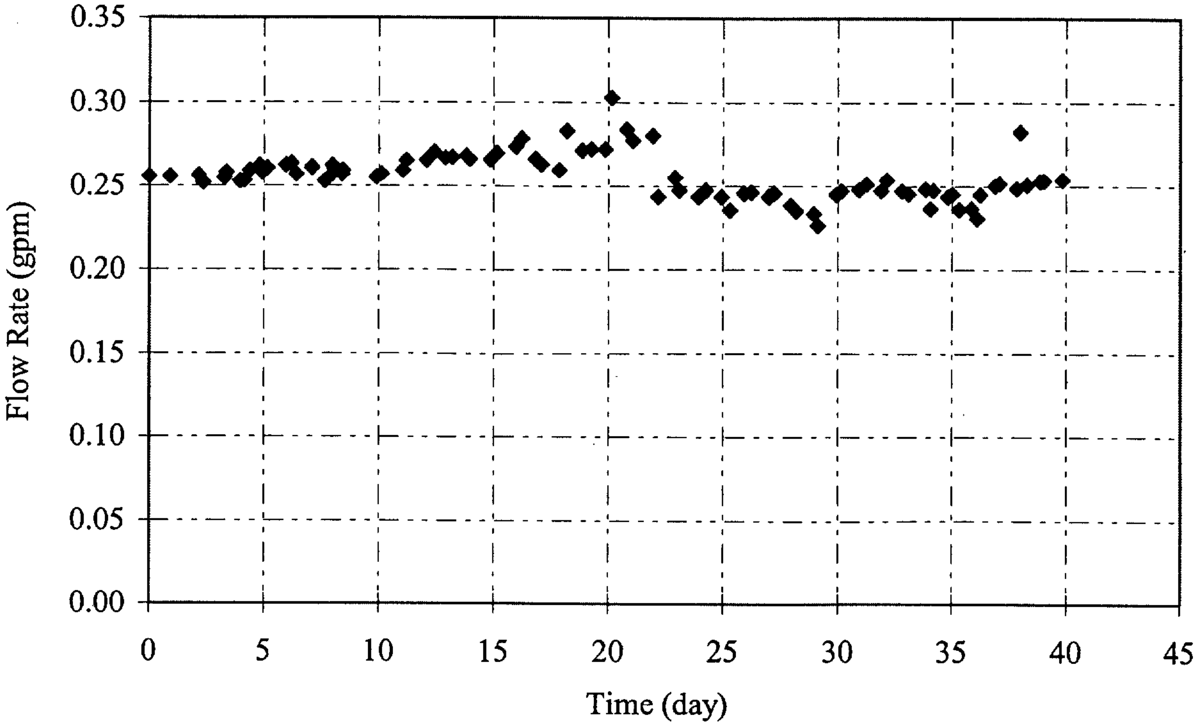


Figure M-11 Extraction well EX06 flow rate as a function of time

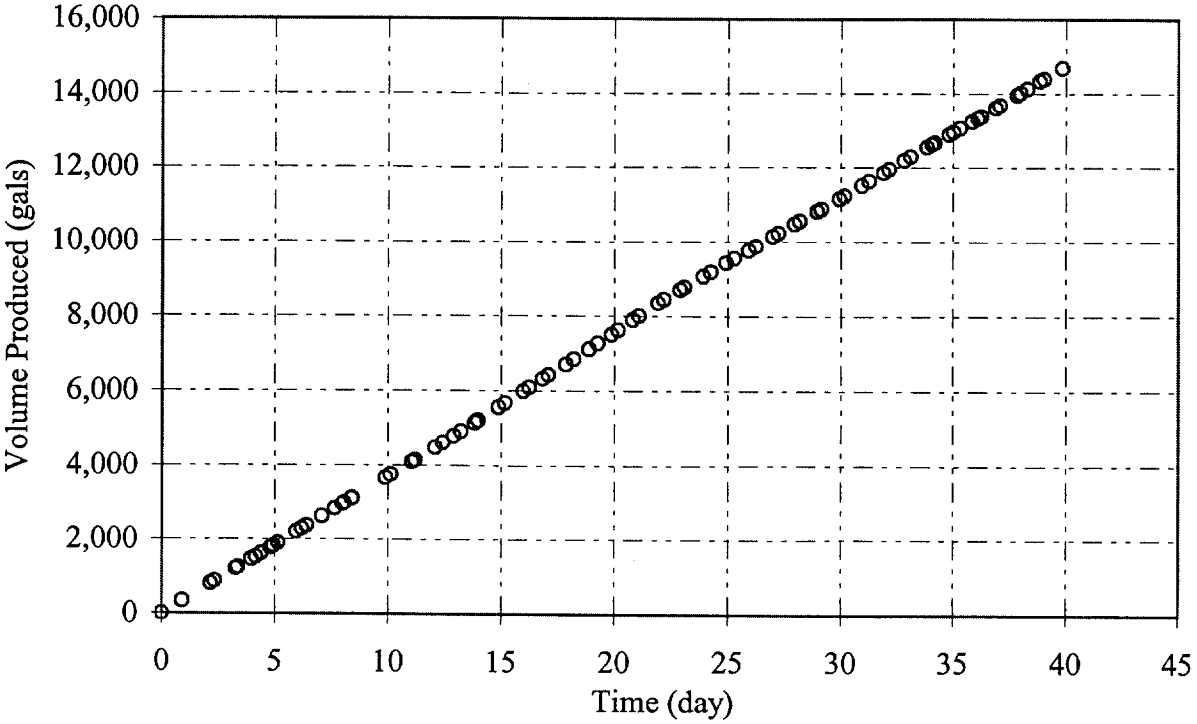


Figure M-12 Extraction well EX06 cumulative volume produced as a function of time

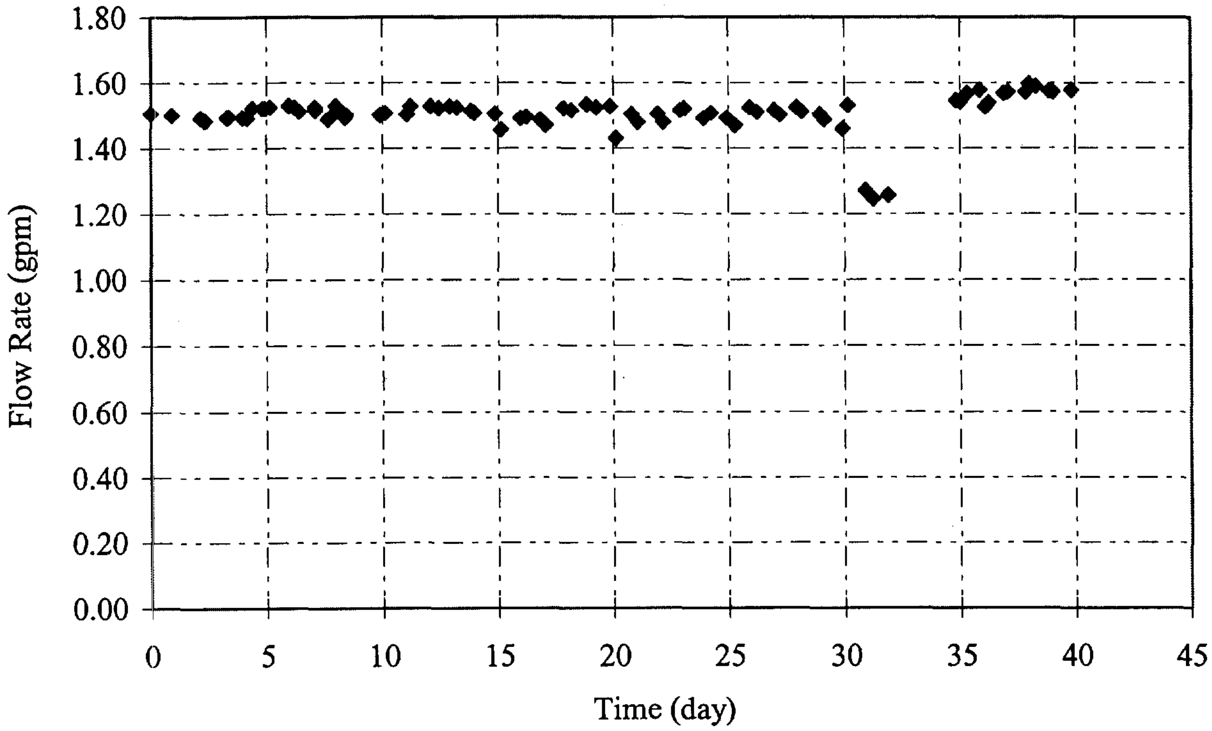


Figure M-13 Total extraction well flow rate as a function of time (sum of all EX flow rates)

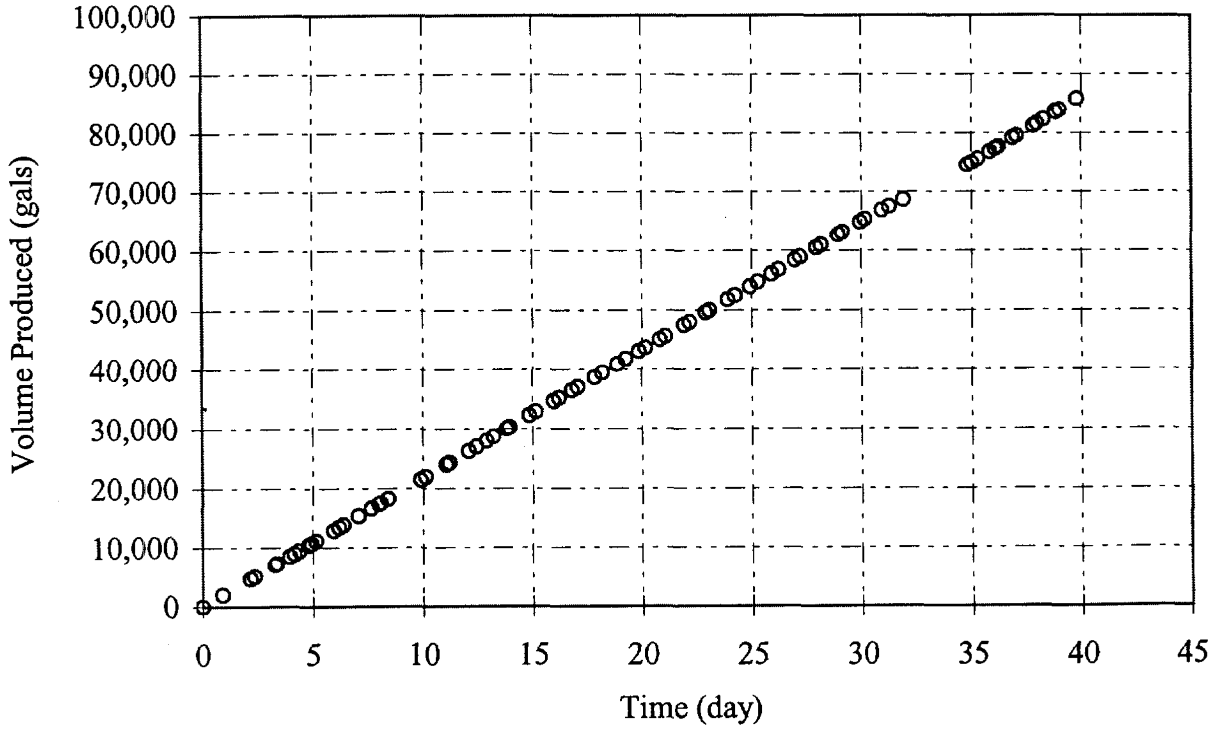


Figure M-14 Total extraction well cumulative volume produced as a function of time

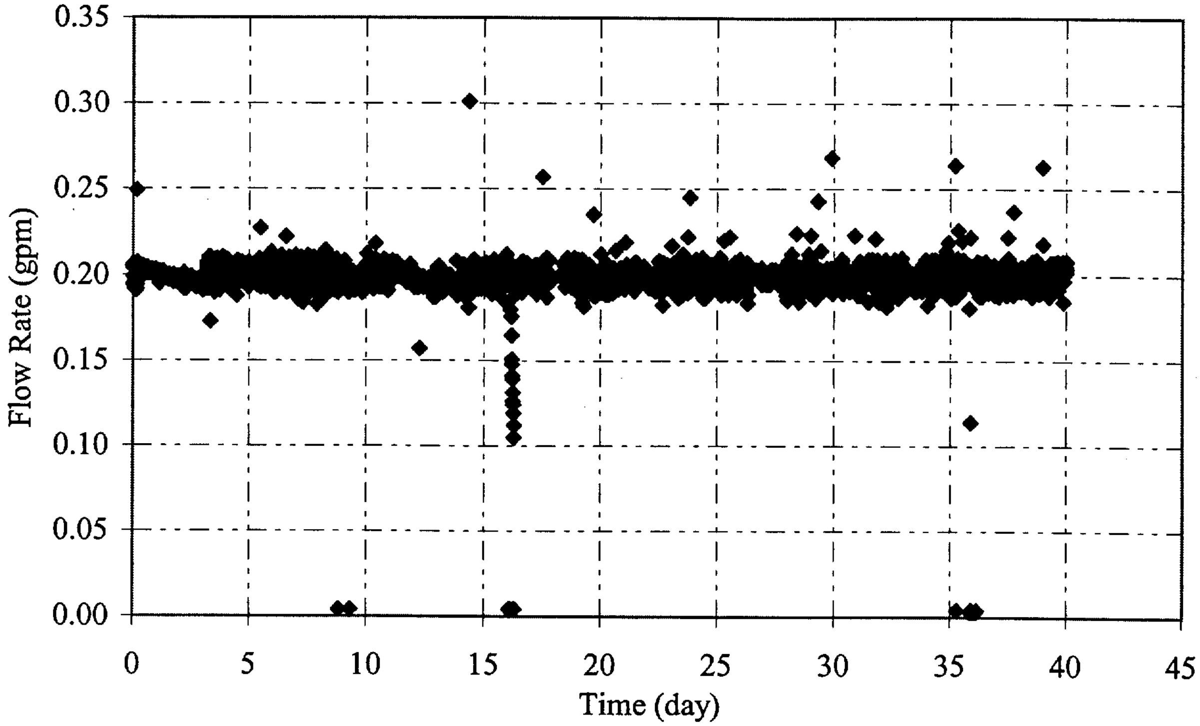


Figure M-15 Injection well IN01 flow rate as a function of time

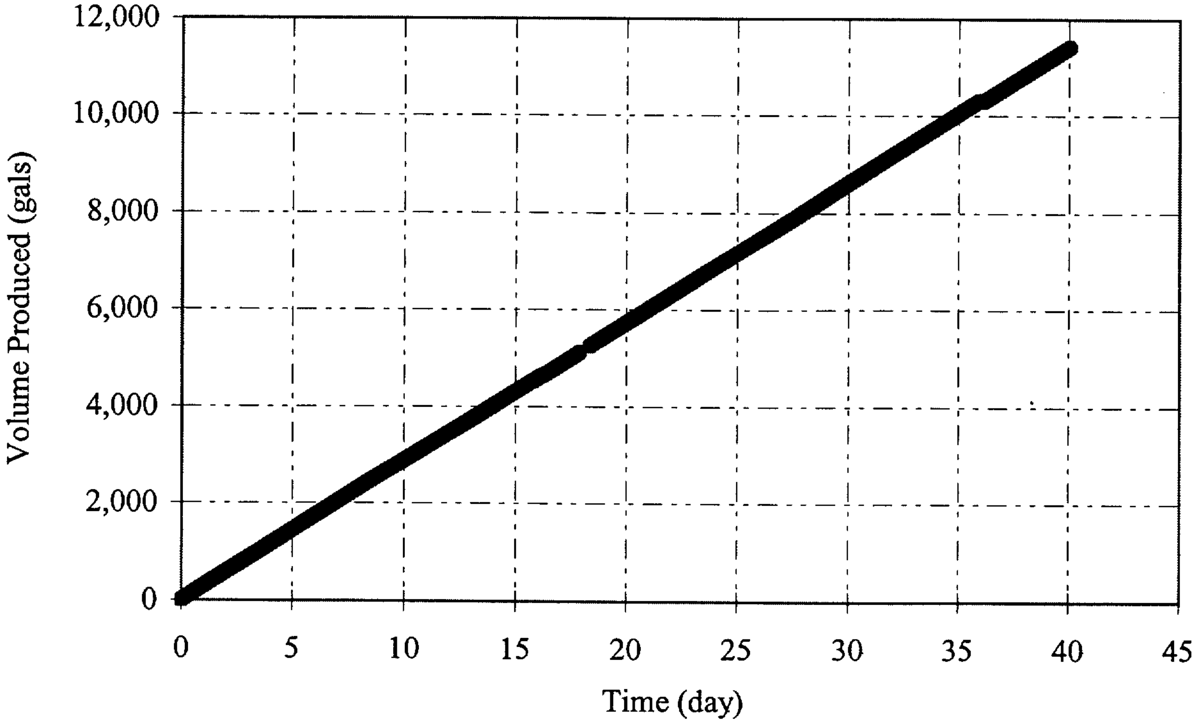


Figure M-16 Injection well IN01 cumulative volume injected as a function of time

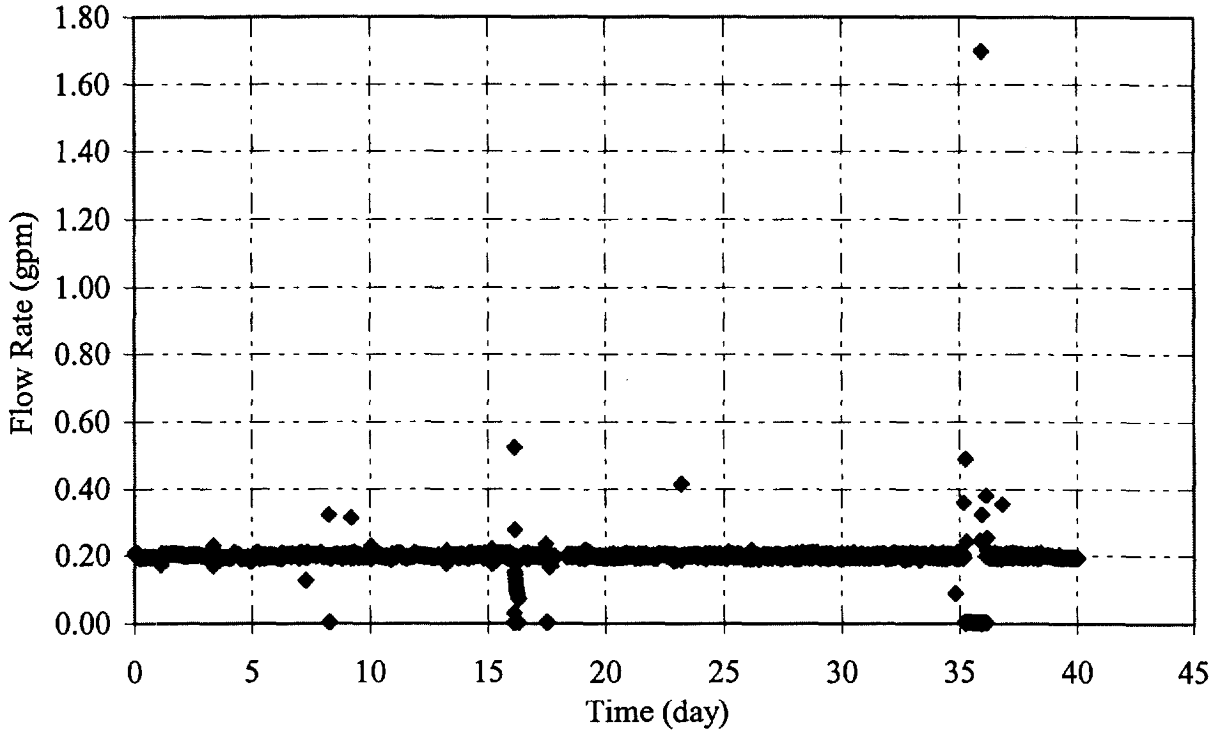


Figure M-17 Injection well IN02 flow rate as a function of time

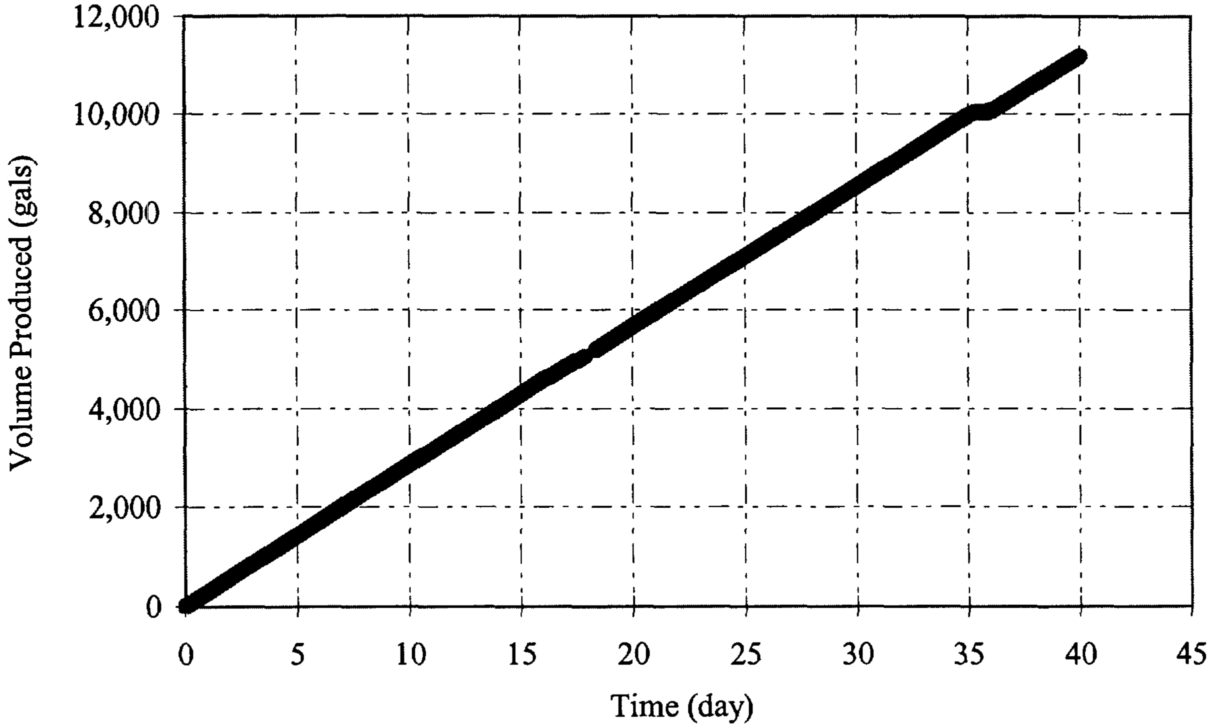


Figure M-18 Injection well IN02 cumulative volume injected as a function of time

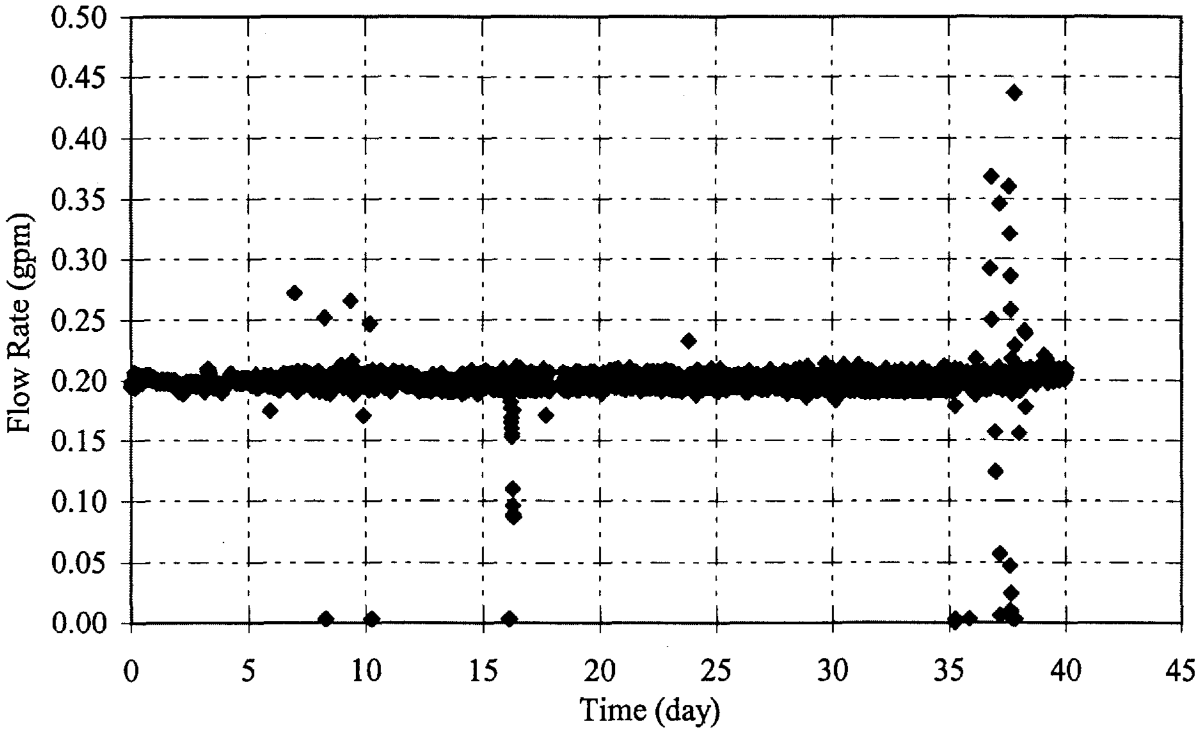


Figure M-19 Injection well IN03 flow rate as a function of time

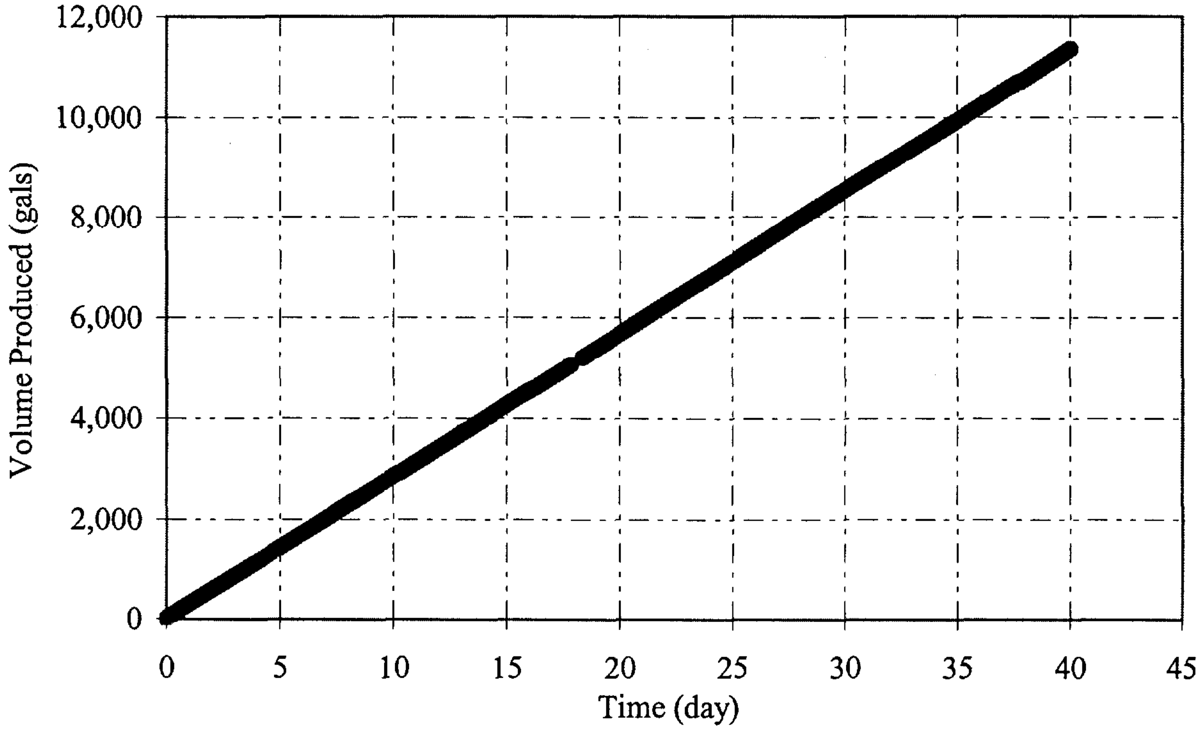


Figure M-20 Injection well IN03 cumulative volume injected as a function of time

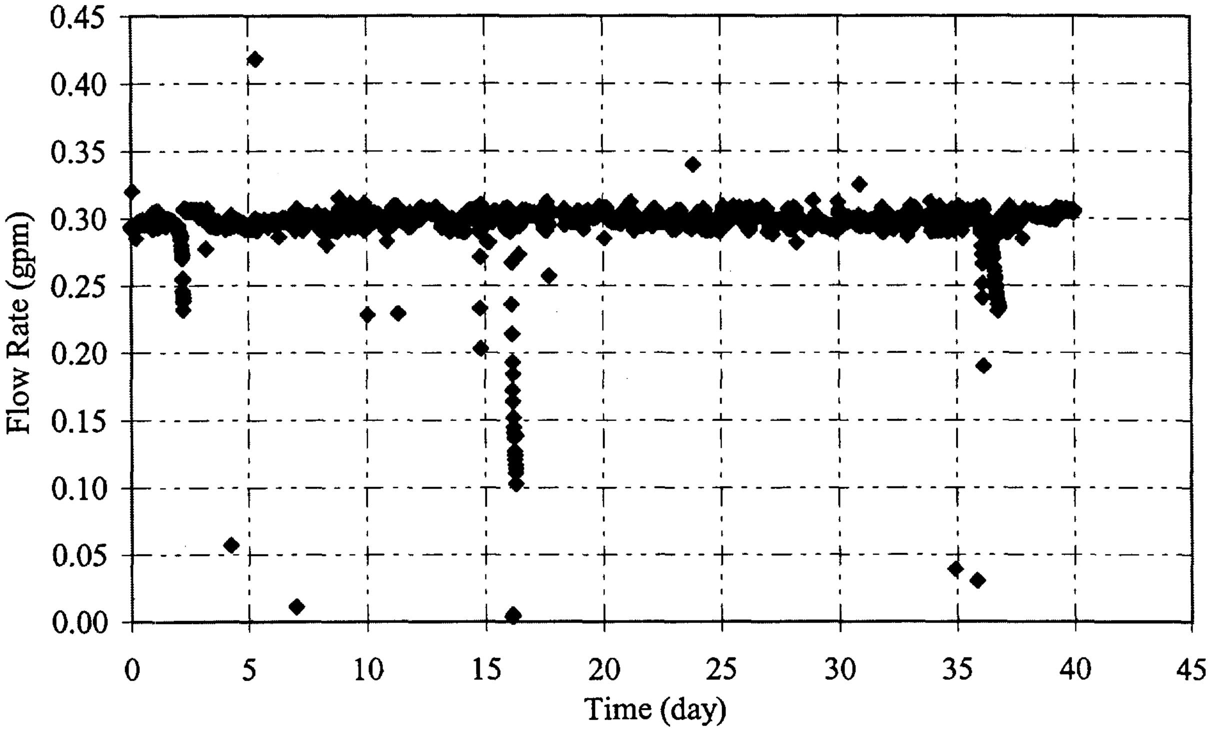


Figure M-21 Hydraulic control well HC01 injection flow rate as a function of time

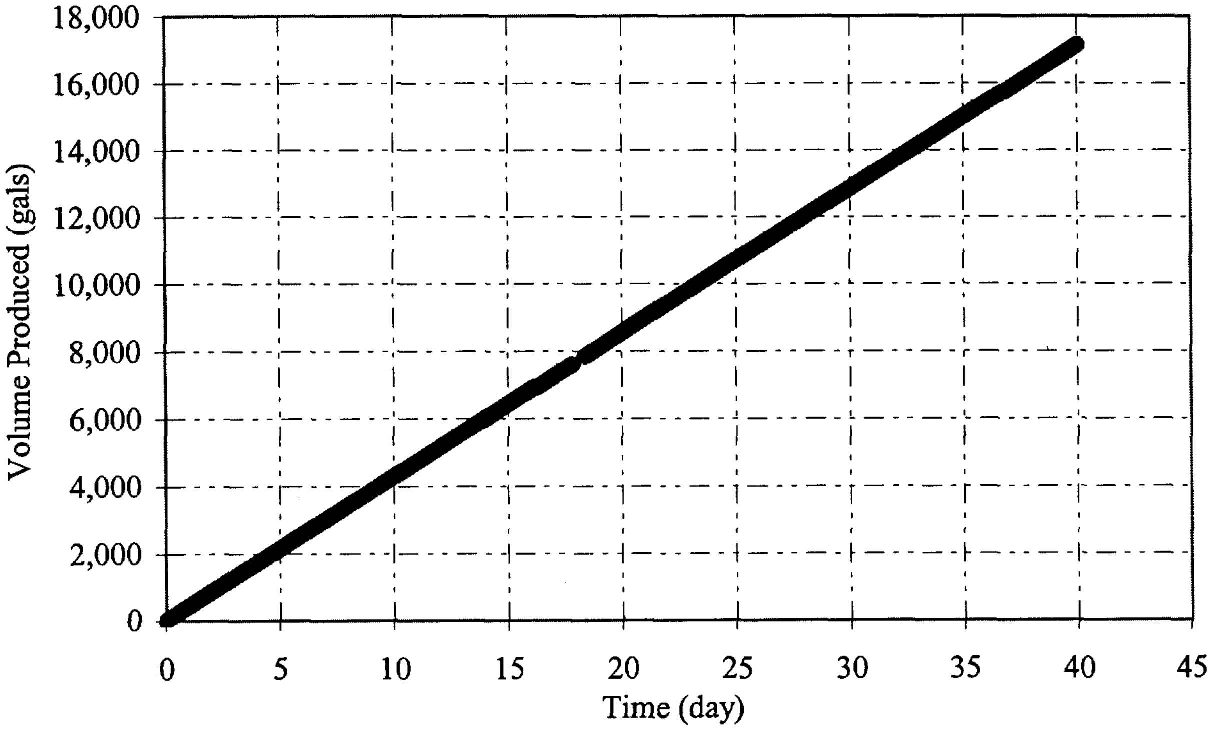


Figure M-22 Hydraulic control well HC01 cumulative volume injected as a function of time

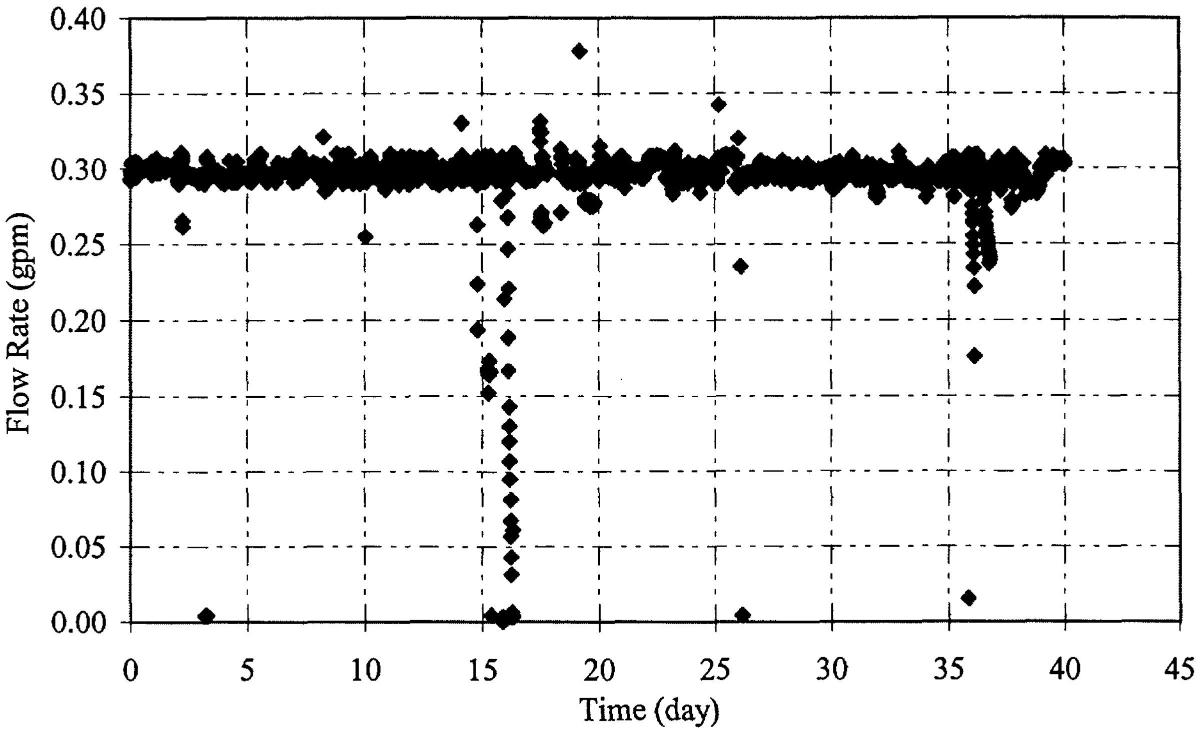


Figure M-23 Hydraulic control well HC02 injection flow rate as a function of time

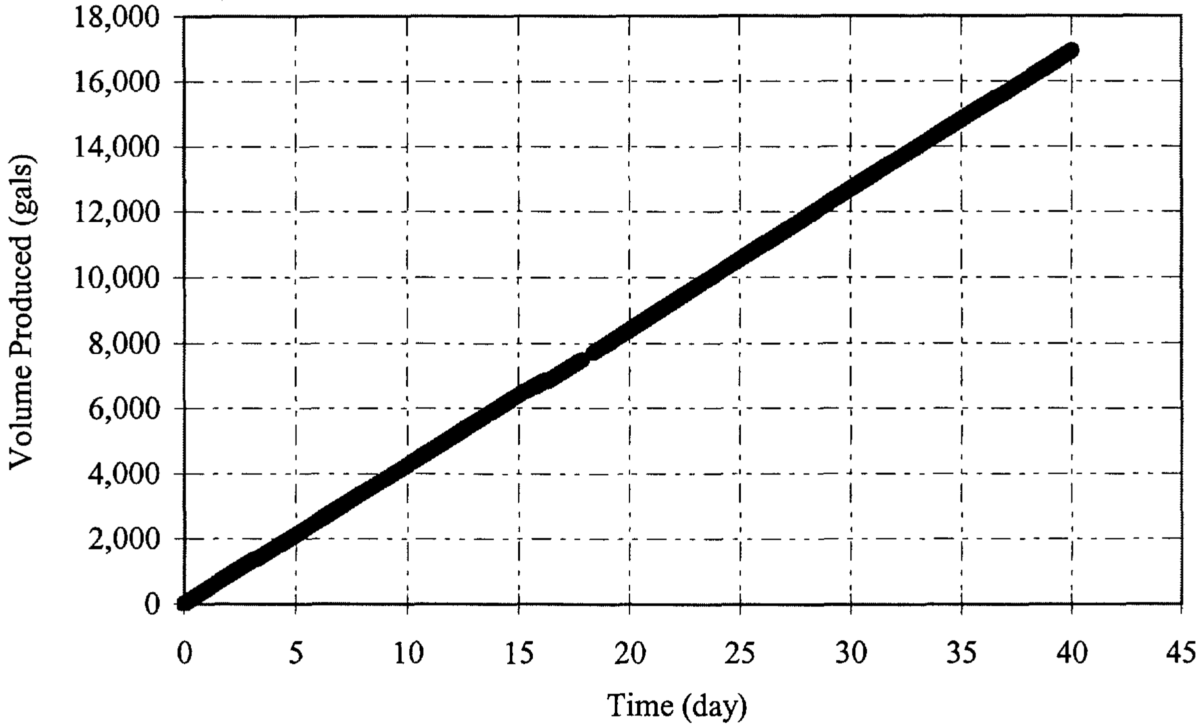


Figure M-24 Hydraulic control well HC02 cumulative volume injected as a function of time

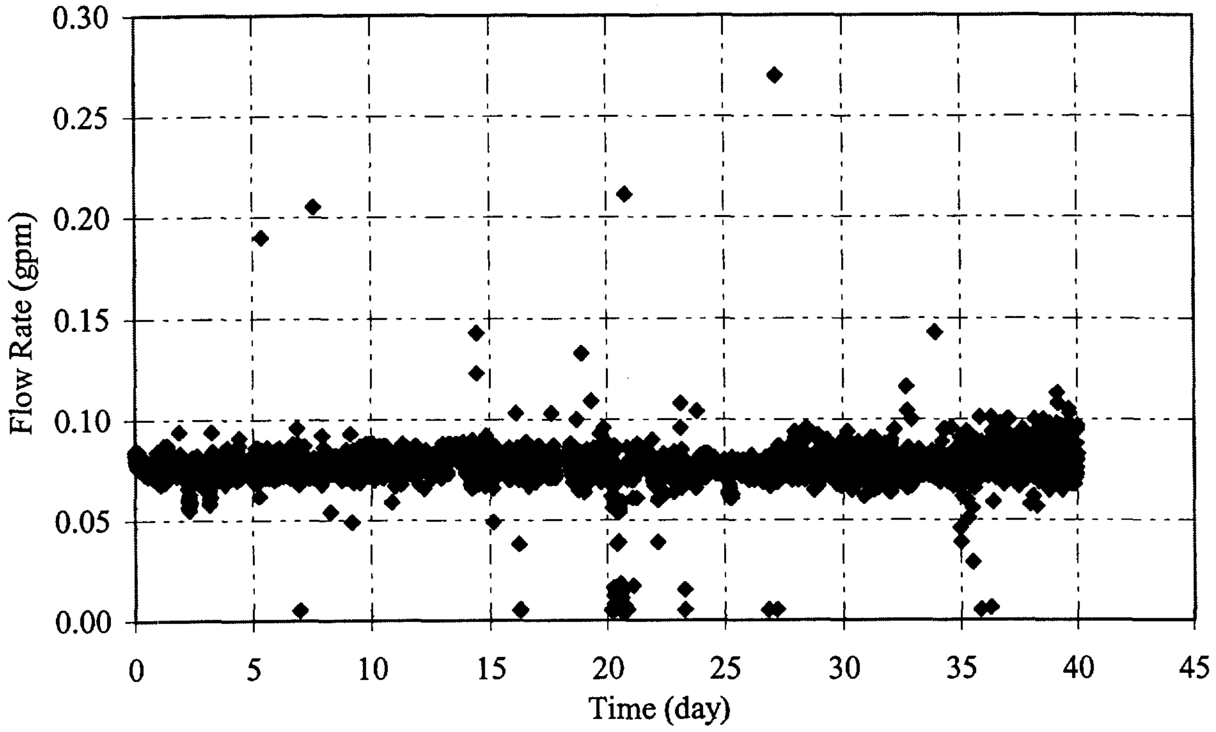


Figure M-25 Upper injection well IN01up flow rate as a function of time

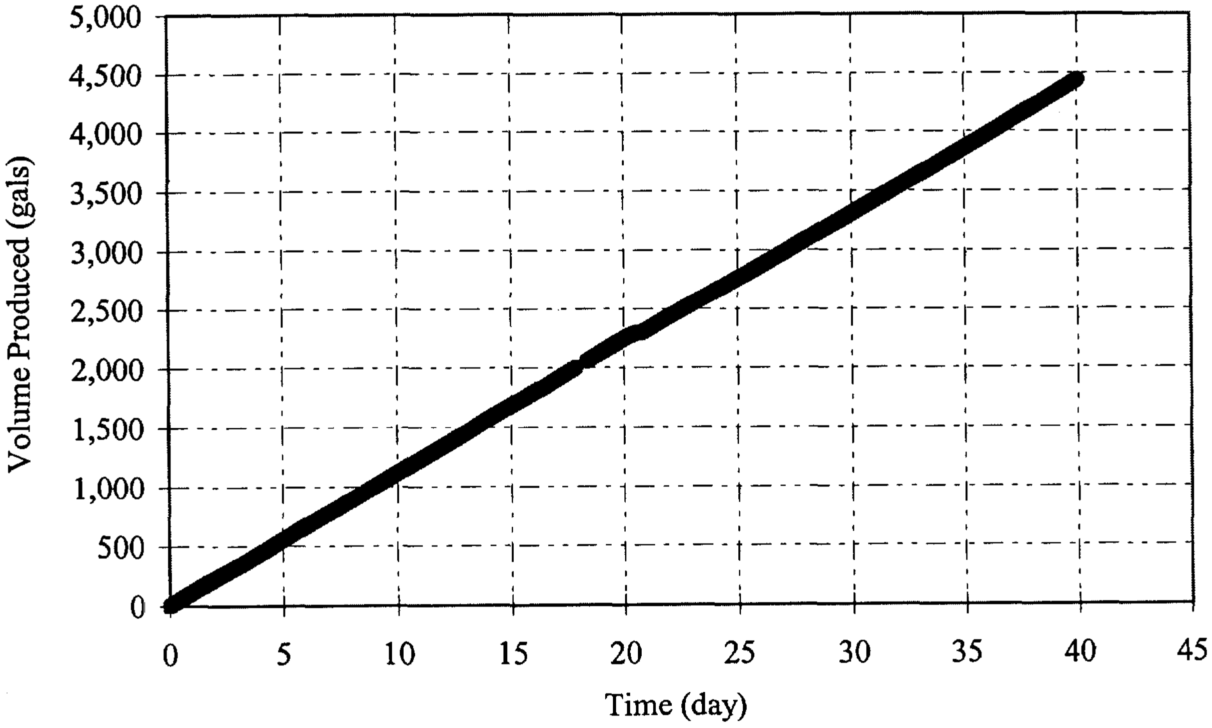


Figure M-26 Upper injection well IN01up cumulative volume injected as a function of time

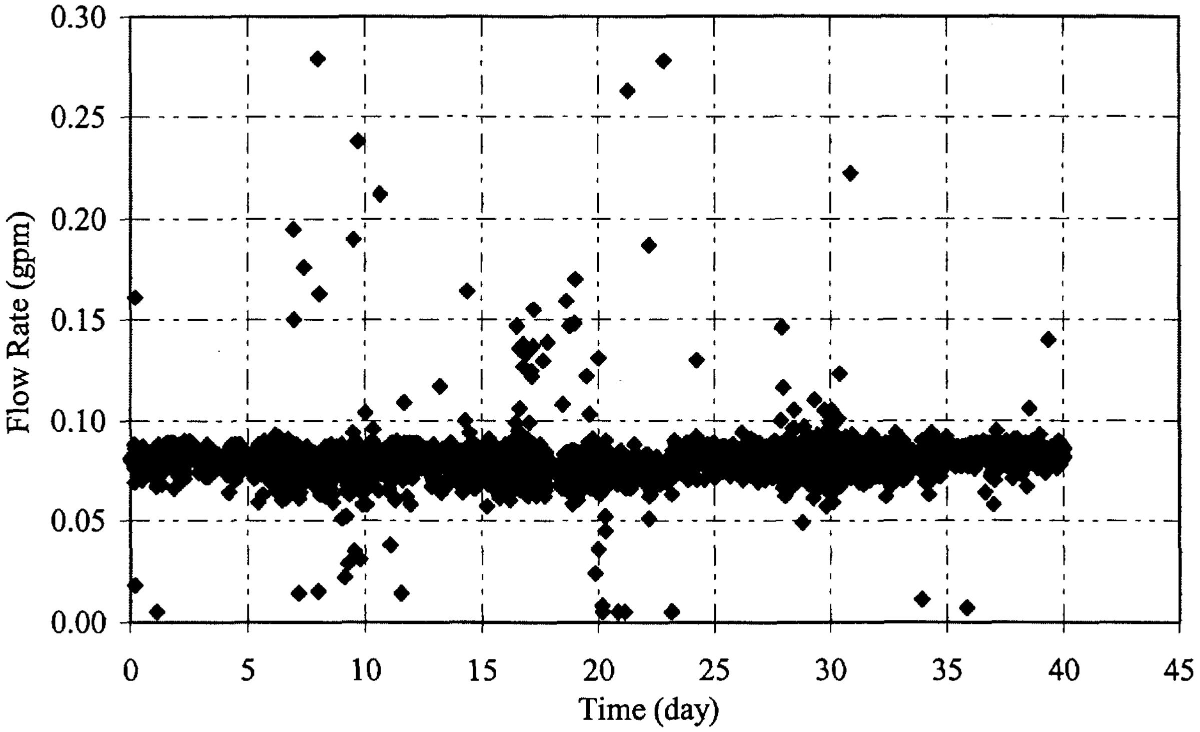


Figure M-27 Upper injection well IN02up flow rate as a function of time

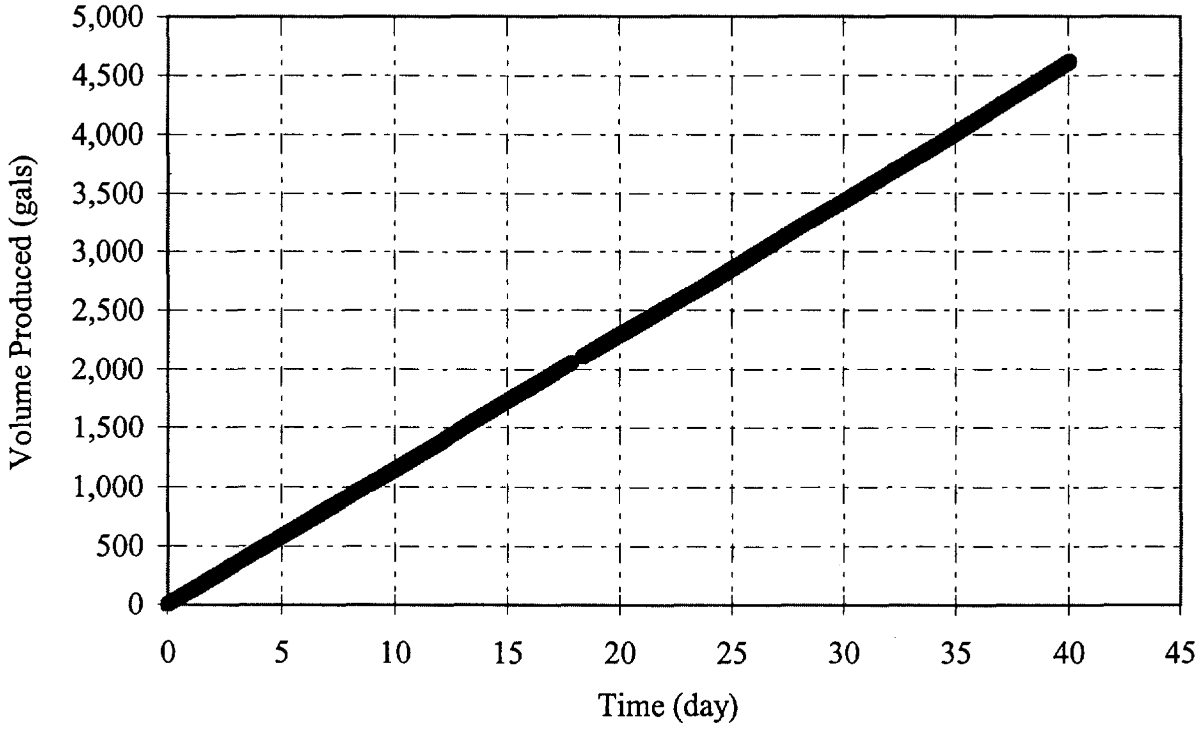


Figure M-28 Upper injection well IN02up cumulative volume injected as a function of time

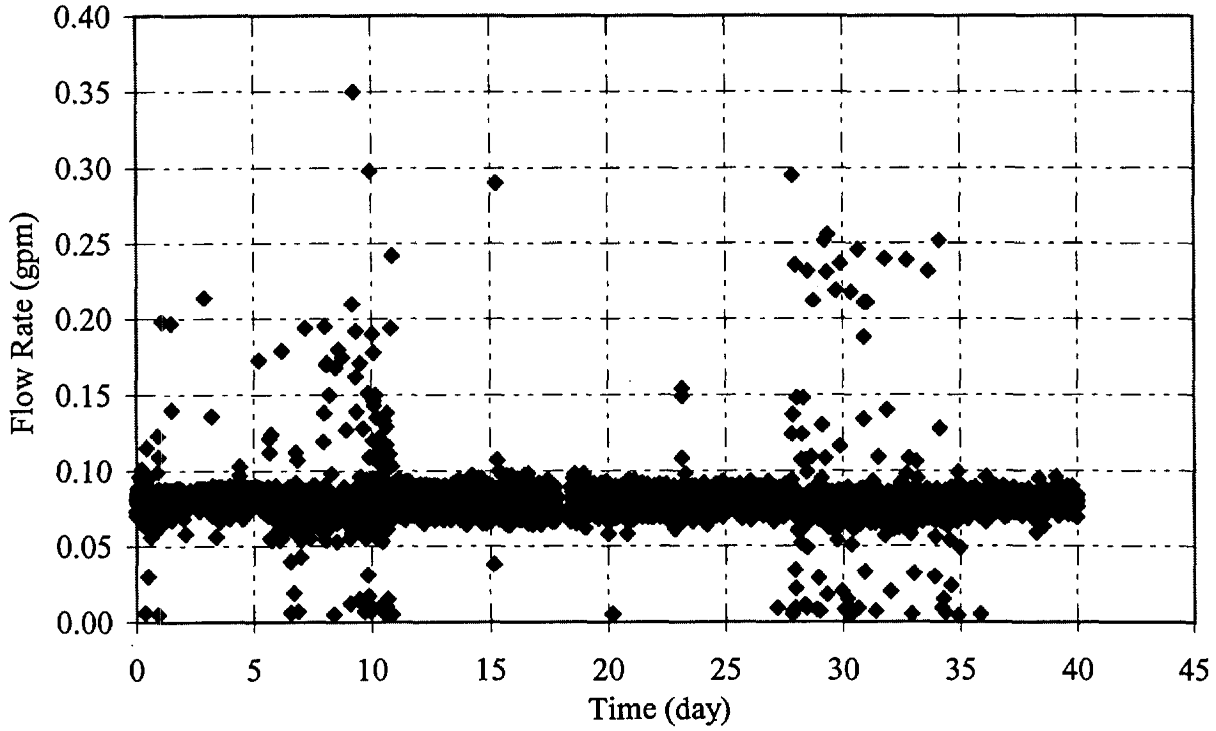


Figure M-29 Upper injection well IN03up flow rate as a function of time

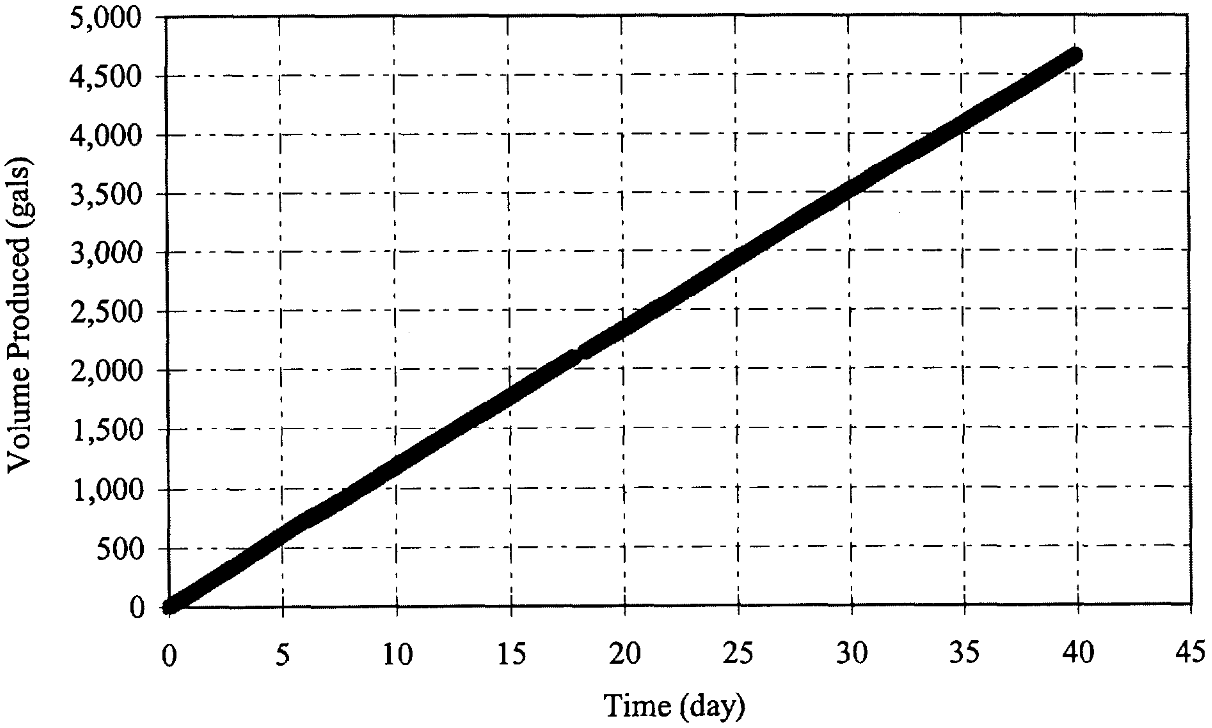


Figure M-30 Upper injection well IN03up cumulative volume injected as a function of time

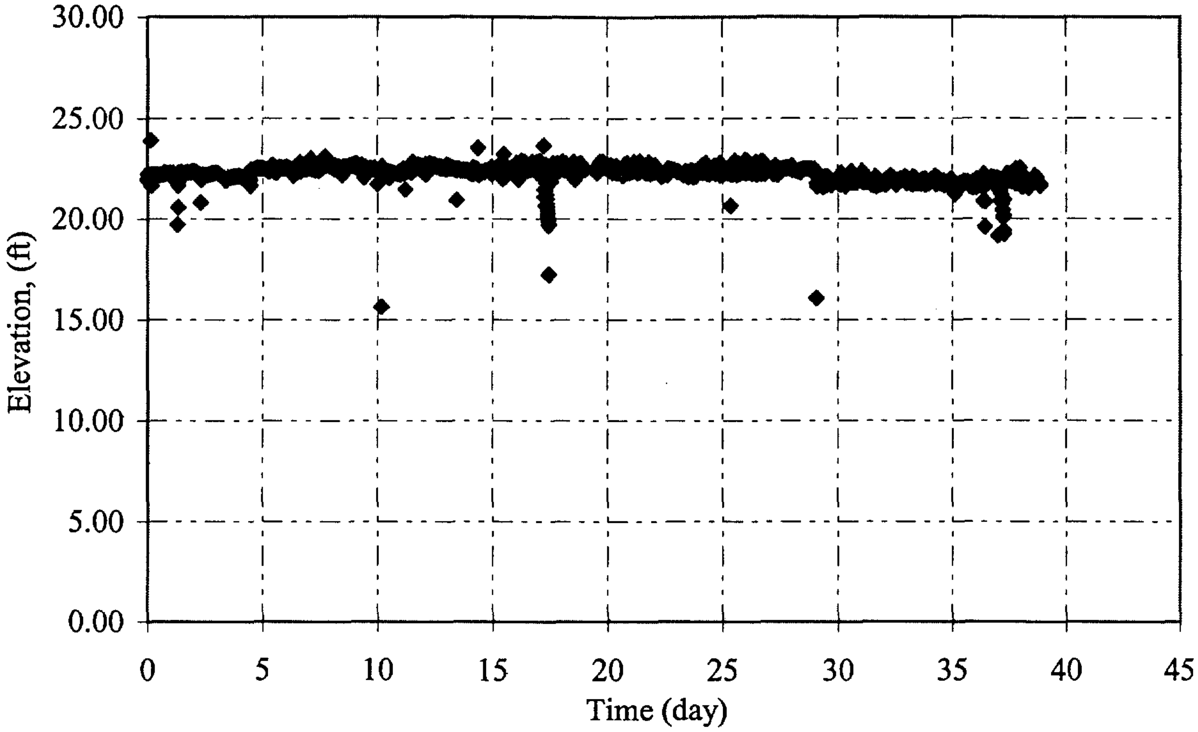


Figure M-31 Water level elevation at injection well IN01 as a function of time

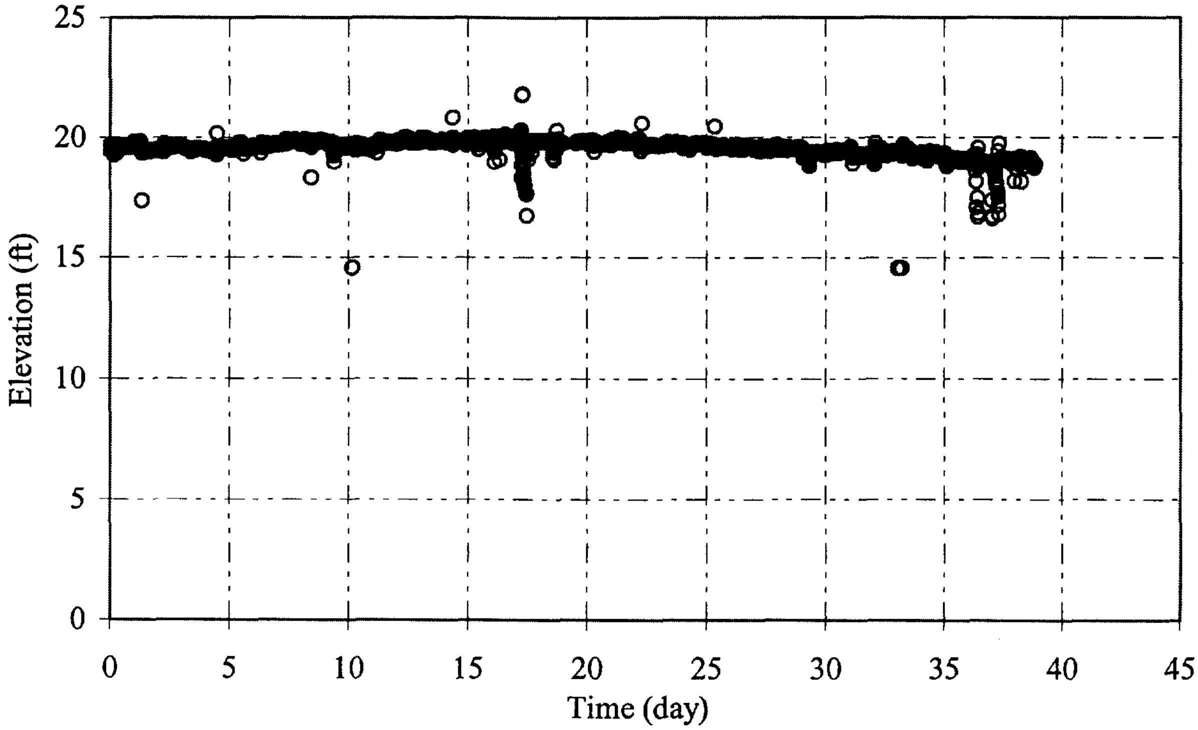


Figure M-32 Water level elevation at injection well IN02 as a function of time

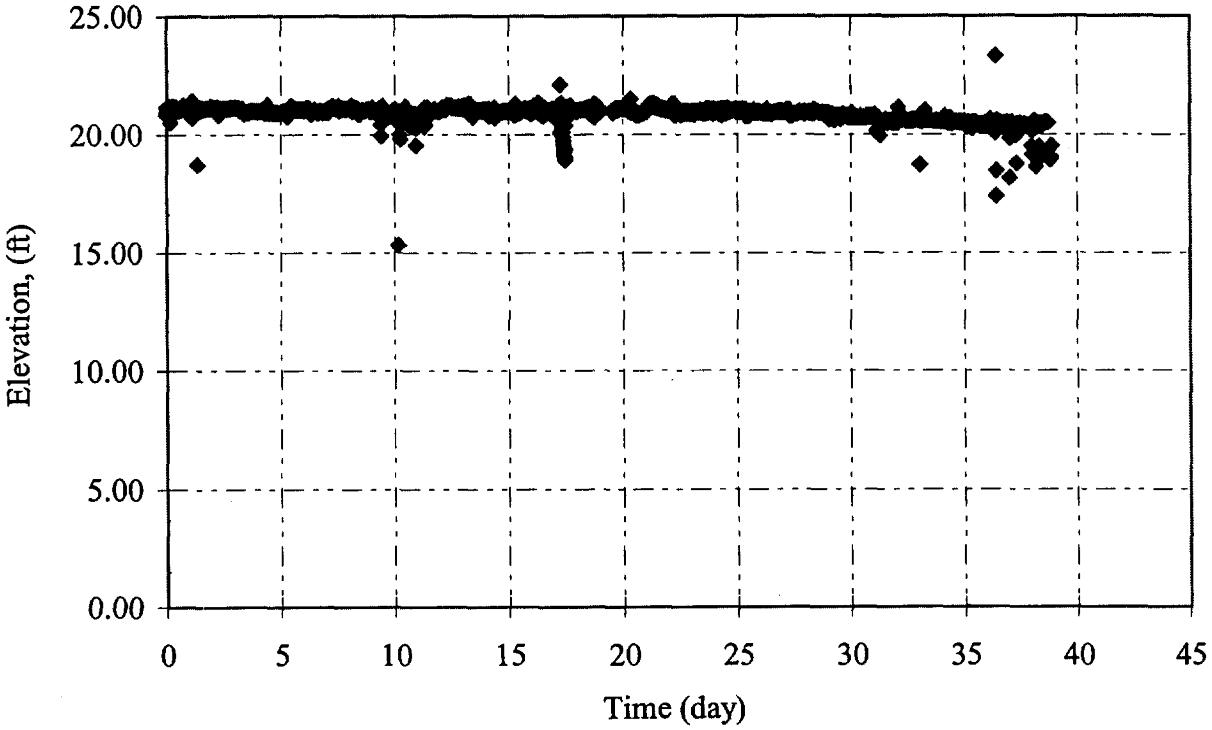


Figure M-33 Water level elevation at injection well IN03 as a function of time

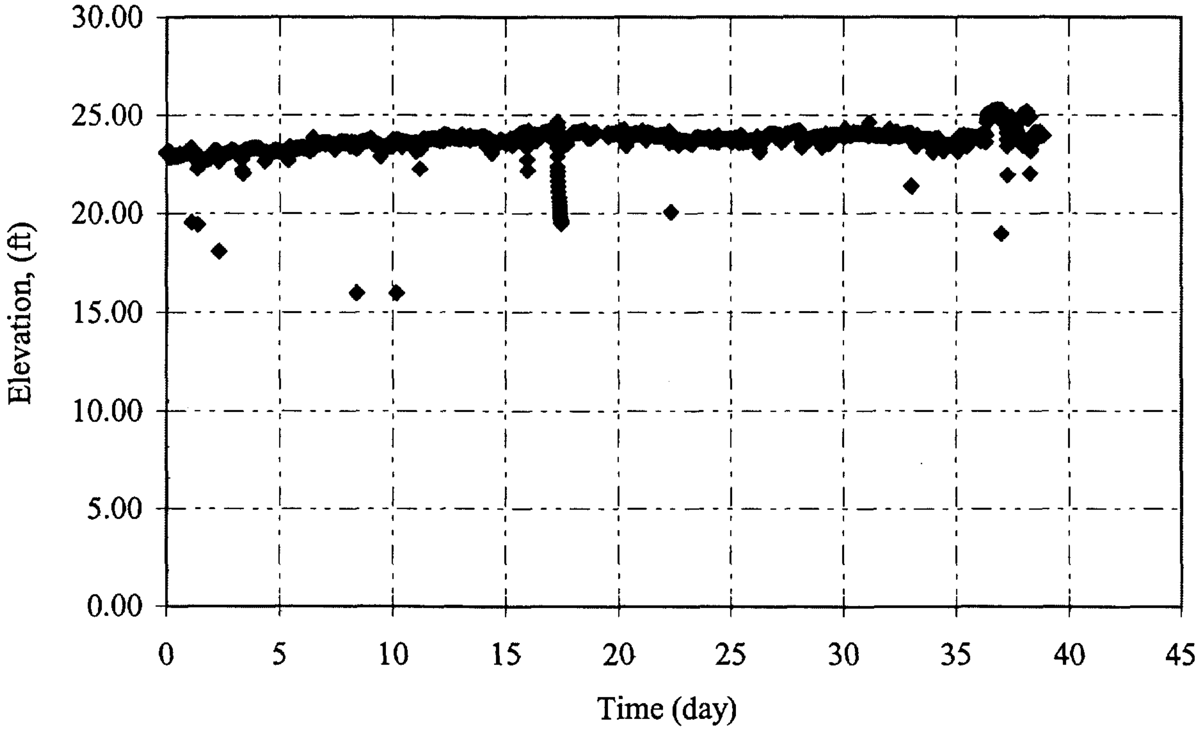


Figure M-34 Water level elevation at hydraulic control well HC01 as a function of time

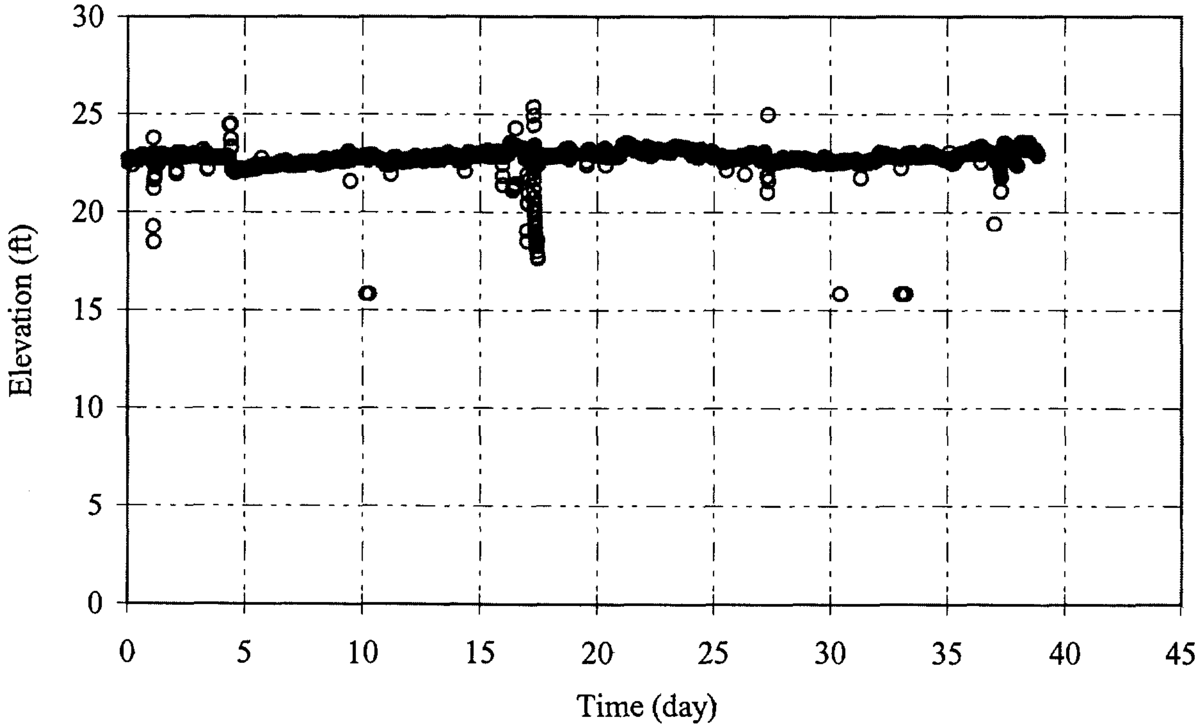


Figure M-35 Water level elevation at hydraulic control well HC02 as a function of time

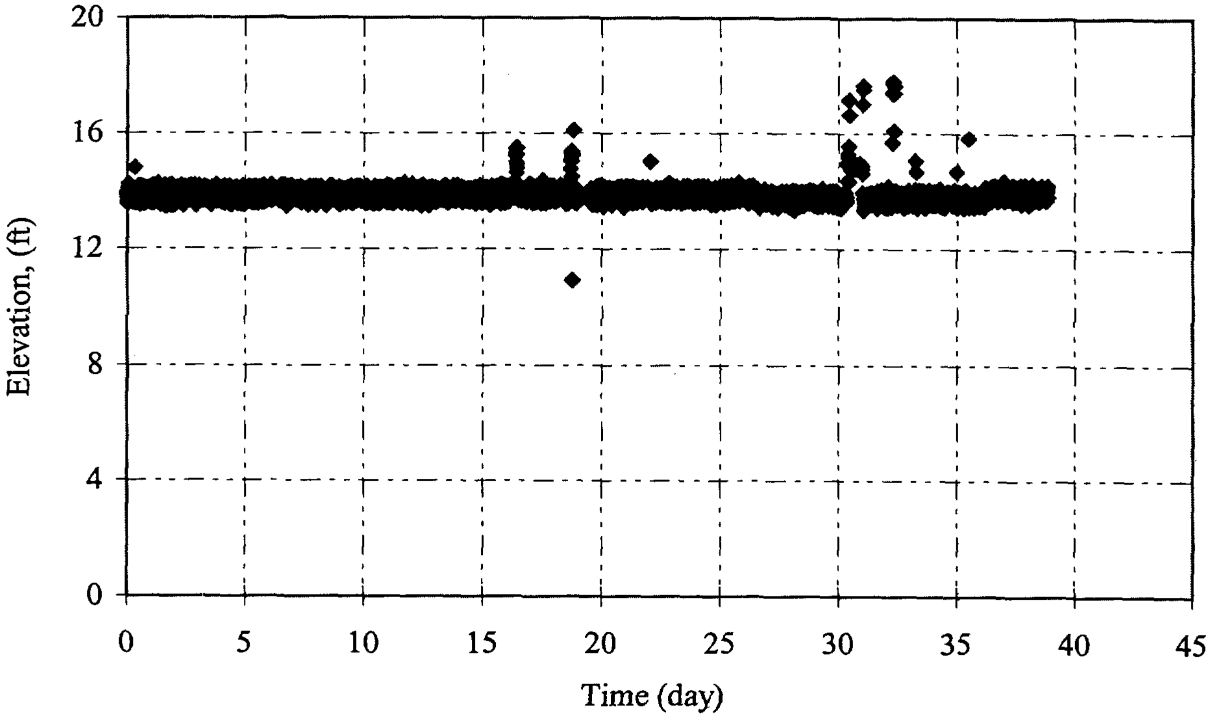


Figure M-36 Water level elevation at extraction well EX01 as a function of time

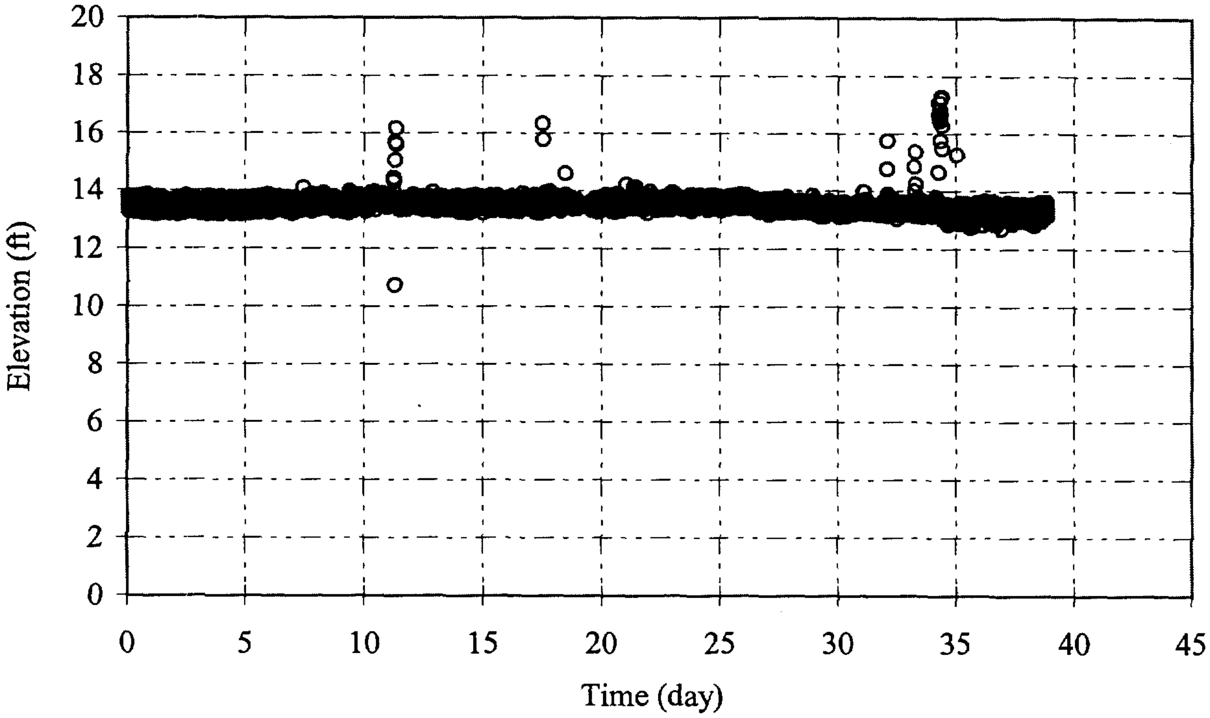


Figure M-37 Water level elevation at extraction well EX02 as a function of time

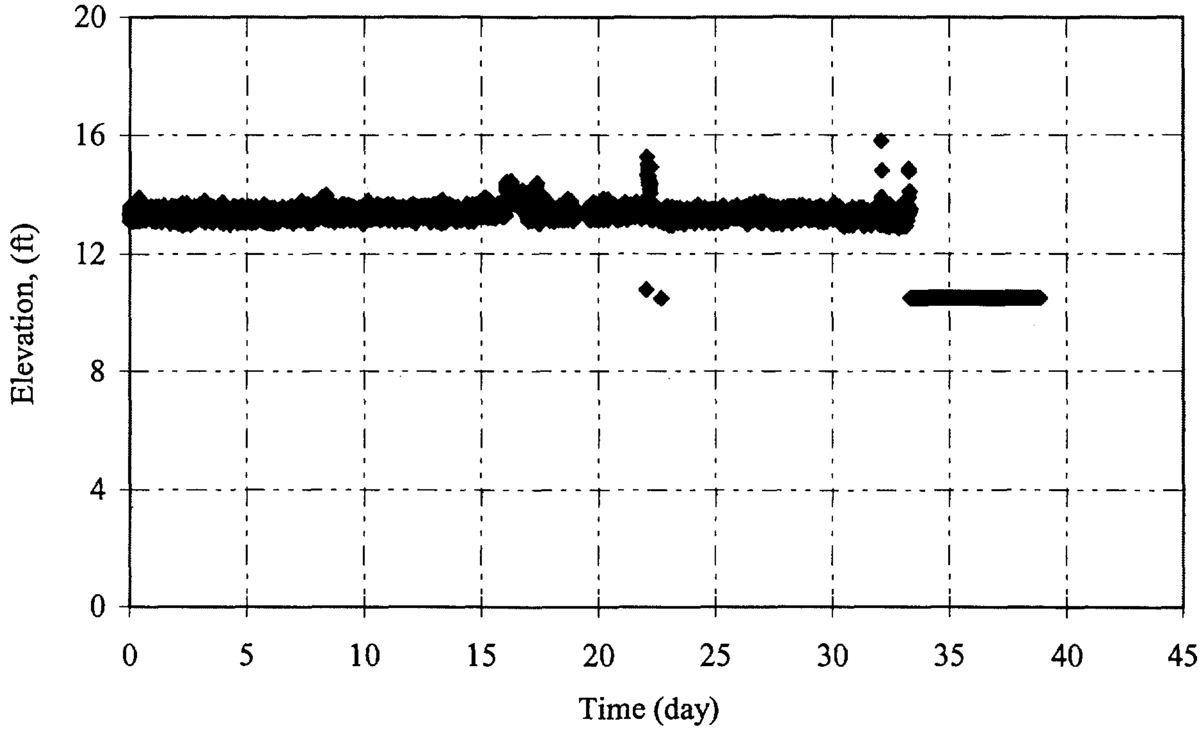


Figure M-38 Water level elevation at extraction well EX03 as a function of time

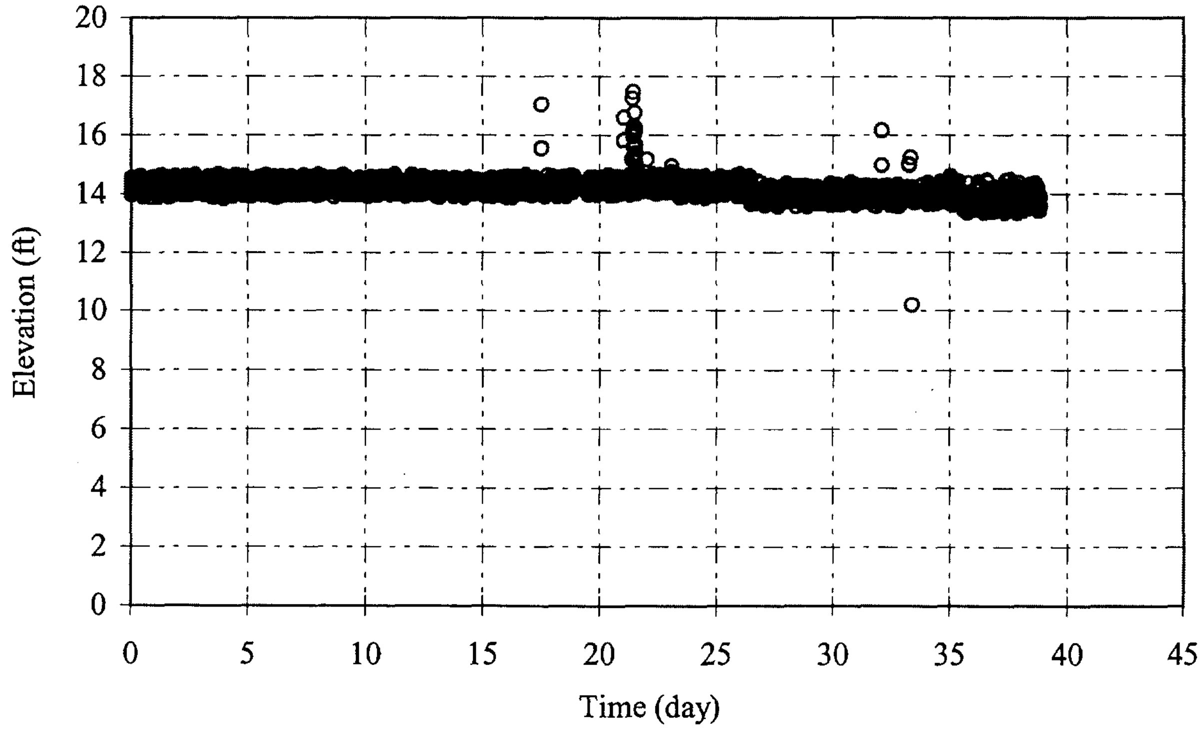


Figure M-39 Water level elevation at extraction well EX04 as a function of time

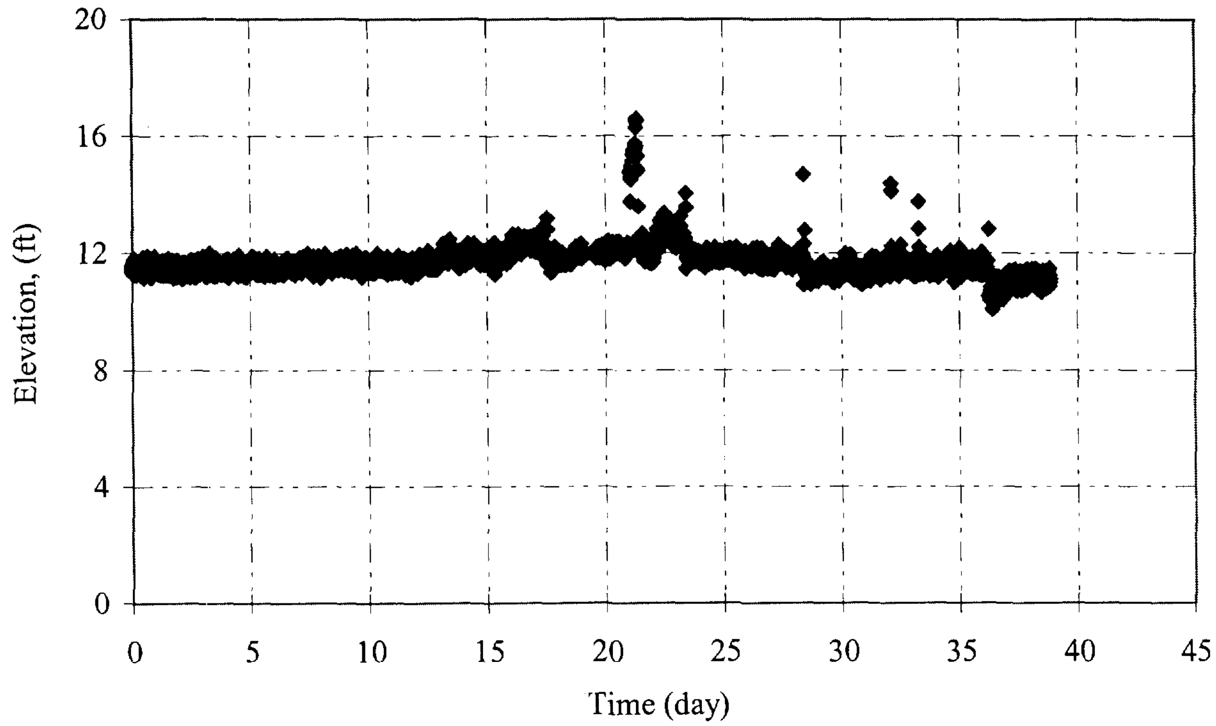


Figure M-40 Water level elevation at extraction well EX05 as a function of time

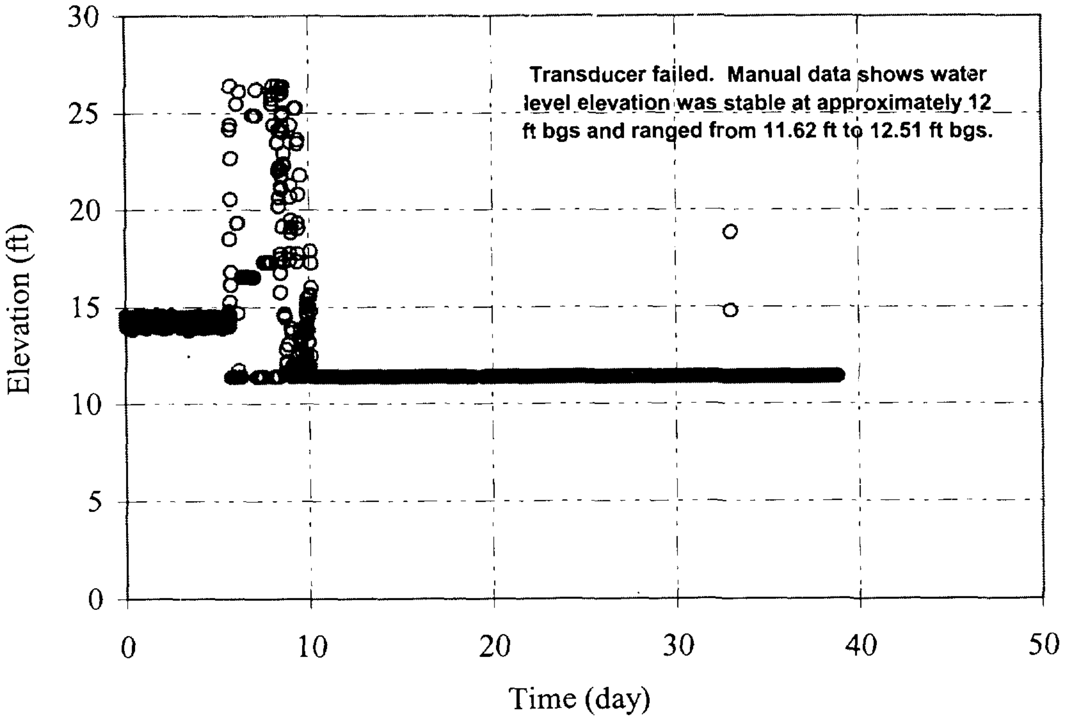


Figure M-41 Water level elevation at extraction well EX06 as a function of time

APPENDIX N

PITT Operations – Water Quality Data

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MW05 WATER QUALITY DATA & Sampling

PROJECT NAME: CAMP LESLENE PITT PROJECT NO.: TON 307

WATER QUALITY INSTRUMENT: ______

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☐°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
MW05	5/29/98	0959	3.0	24.3	119.3	5.12	GY	TD: 23.00
		1015	6.0	23.7	125	5.46		SWL: 6.63
		1032	9.0	23.0	131.9	5.55		WC: 16.37
		1040	SAmple collected for ARSNIC					1 Vol: 2.7 gAllons
	6.26.98	1310	0				JC	SWL: 7.33
	↓	1415	9.0	Collected Sample			JC	DTW: 8.26

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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WATER QUALITY DATA

PROJECT NAME: Camp Lejeune PITT PROJECT NO.: TDN-307
WATER QUALITY INSTRUMENT:

	WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☒°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
	EX01	5/12/98	15:39		23.9	1416 ms		HCL	PH Meter giving SIP E-23 Env. Messa
		5/13	1337		22.9	1447		HCL	PH Meter down
		5/14	11:40		26.4	1370		KJS	"
					[illegible]	[illegible]			
		5/18	1416		28.3	1,460	4.2	MKD	From AC manual port
		5/20	1502		27.8	1,450	3.63	MKD	From filter port
		5/22	1340		25.3	383	4.18	MKD	from wellhead
		5/27	:512		25.2	1175	4.0	GY	
		5/28	0817		24.8	418	3.91	GY	
		5/28	0910		25.2	1490	3.62	GY	Top of pump
		5/30	0750		24.6	1465	4.08	GY	
		5/31	0840		25.3	1436	3.81	GY	
		6/2	1007		26.4	1250	[illegible]	JC	3.90 PH
*		6-6-98	0815		26.7	1540	3.88	FJH	From AC filter port
*		6-11-98	0852		26.	1630	3.90	"	" "
		6-15-98	0827		26.5	1540	3.68	JC	" "
		6-18-98	1000		27.7	1530	3.65	JC	" "

* Good representative data taken in morning with minimal temp. interference (ie: sun low, overcast, ambient temp = 28.3°C), & good sample purging at AC filter port.

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/ redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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Ex02

WATER QUALITY DATA

PROJECT NAME: Camp Lejeune PITT PROJECT NO.: TDN-307
WATER QUALITY INSTRUMENT: ______

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☒°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
EX02-	5/12	1557		24.1	1219 ue	?	HCL	PH Meter giving Slope Error-2
	5/13	1341		22.6	1261		HCL	"
	5/14	11:46		26.9	1190		KJS	"
	5/18	1421		28.0	1,240	4.12	MKD	From AC manual port
	5/20	1505		27.6	1,290	3.89	MKD	From Filter port
	5/22	1348		25.9	564	4.27	MKD	from wellhead
	5/27	1517		25.3	1087	4.01	GY	
	5/28	0824		25.4	566	3.96	GY	
	5/28	0905		25.4	1085	4.05	GY	Top of pump
	5/30	0755		25.1	1163	4.13	GY	
	5/31	0845		25.5	1162	4.0	GY	
	6/2	1030		26.8	1270	[illegible]	JC	38.12d
*	6-6-98	0821		27.0	1320	4.22	FJH	From AC Filter Port
*	6-11-98	0858		26.9	1360	4.00 ~~3.96~~	"	" " " (mixed NAPL from EX 2
	6-15-98	0833		26.9	1360	3.94	JC	From AC Filter Port
	6-18-98	1005		27.6	1360	3.99	JC	" "

* See Note on EX 01

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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EX03

WATER QUALITY DATA

PROJECT NAME: Camp Lejeune PITT PROJECT NO.: TDN-307
WATER QUALITY INSTRUMENT: ____

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☒°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
EX03	5/12	1601		25.2	1144 µS		HCL	
	5/13	1346		23.3	1220		HCL	
	5/14	1150		27.5	1160		KJS	
	5/18	1426		28.8	1,190	4.08	MKD	From AC manual port
	5/20	1508		28.8	1,230	3.93	MKD	From filter port
	5/20	1406		29.2	348	4.35	MKD	from wellhead
	5/27	1523		27.4	1180	3.84	Gy	
	5/28	0829		28.1	397	3.95	Gy	
	5/28	0900		26.9	1295	3.92	Gy	Top of pump
	5/30	0800		27.5	980	3.92	Gy	
	5/31	0848		27.6	1230	3.86	Gy	
	6/2	1038		29.4	460	3.83	JC	
	6/2	1042		29.5	450	3.77	JC	
*	6·6·98	0818		28.1	1330	4.3	FJH	From AC filter port
*	6·11·98	0905		28.7	1430	3.92	"	" " "
	6·15·98	0837		28.6	1460	3.72	JC	" " "
	6·18·98	1010		29.9	1430	3.77	JC	

* Good representative data taken in morning (sun low) & overcast for minimal temp. interference, and good purging at 8 AC filter ports.

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/ redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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EX04R

WATER QUALITY DATA

PROJECT NAME: Camp Lejeune PITT
PROJECT NO.: TDN-307
WATER QUALITY INSTRUMENT:

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☑°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
EX04	5/12	1605		22.6	1274 us		HCL	
	5/13	1350	21.1	~~[illegible]~~	1307		HCL	
	5/14	1155		24.9	1260		KJS	
	5/18	1431		27.1	1,350	3.79	MKD	From AC manual port
	5/20	1512		26.6	1,360	4.10	MKD	from filter port
	5/22	1413		23.8	1,330	4.10	MKD	from wellhead
	5/27	1550		23.7	~~[illegible]~~ 1236	4.30	GY	Bottom of well
	5/28	0834		24.6	$\boxed{575}$ 510	4.14	GY	~~Mid~~ up from Bottom
	5/28	0847		23.6	1370	3.92	GY	Top of pump
	5/30	0807		24.0	1285	3.98	GY	
	5/31	0855		24.5	1370	3.92	GY	
	6/2	1057		25.8	1390	3.68	JC	
*	6·6·98	0832		25.8	1430	4.25	FJH	From AC Filter port
*	6·11·98	0910		25.9	1470	3.93	"	" " "
	6·15·98	0845		26.0	1500	3.75	JC	" " "
	6·18·98	1014		26.5	1490	3.82	JC	

* See note on EX01

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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Ex05

WATER QUALITY DATA

PROJECT NAME: Camp Lejeune PITT PROJECT NO.: TDN-307

WATER QUALITY INSTRUMENT: ____

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☑°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
EX05	5/12	1608		21.9	1184 us		HCL	PH See EX01
	5/13	1342		21.6	1227		HCL	
	5/14	1200		25.2	1150		KJS	
	5/18	1436		26.1	1,250	3.09	MKD	From AC manual port
	5/20	1515		24.0	1,250	4.17	MKD	From filter port
	5/22	1420		22.0	1,143	4.11	MKD	from wellhead
	5/27	1600		22.7	1434	4.74	GY	
	5/28	0837		22.9	145	4.77	GY	MID
	5/29	0843		22.6	1019	4.10	GY	ON TOP of pump
	5/30	0810		23.0	924	4.19	GY	
	5/31	0900		23.3	1170	4.14	GY	
	6/2	1105		25.4	1310	3.90	JC	
*	6-6-98	0837		24.8	1280	4.24	FJH	From AC Filter Port
*	6-11-98	0915		24.6	1300	4.20	FJH	" " "
	6-15-98	0849		24.5	1310	3.99	JC	" " "
	6-18-98	1019		25.2	1320	4.20	JC	" " "

* See Note on EX01

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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EX06.

WATER QUALITY DATA

PROJECT NAME: Camp Lejeune PITT PROJECT NO.: TDN-307

WATER QUALITY INSTRUMENT: ______

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☒°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
EX06	5/12	1615		21.8	1200		HCL	PH See EX01
	5/13	1355		21.5	1233		HCL	"
	5/14	1155		24.8	1180		KJS	"
	5/18	1439		25.9	1,230	4.10	MKD	From AC manual port
	5/20	1510		23.3	1,310	4.20	MKD	from filter port
	5/20	1425		21.5	847	4.50	MKD	from wellhead
	5/27	1110		22.4	1277	4.12	GY	@ bottom
	5/28	0852		22.1	1303	4.19	GY	top of pump
	5/30	0814		22.7	1252	4.24	GY	
	5/31	0904		23.1	1265	4.42	GY	
	6/1			25.3	1015	4.0	JC	
	6/2	1116		25.3	1290	4.87	JC	
*	6-5-98	0840		24.0	1330	4.28	FJH	From AC Filter Port
*	6-11-98	0921		24.1	1380	4.15	FJH	" " "
	6-15-98	0856		24.6	1390	4.00	JC	" " "
	6-18-98	1026		24.9	1400	4.09	JC	" "

* See Note on EX01

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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RW01

WATER QUALITY DATA

PROJECT NAME: Camp Lejeune PITT
PROJECT NO.: TDN307
WATER QUALITY INSTRUMENT:

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☒°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
RW01	5/18/98	1529	1.5	24.0	969	5.04	MKD	Measored at wellhead
	5/21	1601	3.0	24.4	1,009	5.15	MKD	" " "
	5/27	1753	~~5.0~~ 1.0	24.6	263	5.33	GY	
		1758	2.0	24.6	314	5.31		
		1803	3.0	24.6	425	5.26		
		1808	4.0	24.5	493	5.23		
		1812	5.0	24.6	669	5.11		
	5/28	1002	1.0	26.3	726	5.10	GY	TOP
		1007	2.0	25.1	734	5.10		
		1012	3.0	24.7	729	5.15		12" from bottom
		1018	1.0	24.7	1111	4.94		
		1023	2.0	24.8	1156	4.91		
		1027	3.0	24.8	1173	4.69		
	5/30	0825	1.0	25.1	1105	5.10	GY	
		0830	2.0	24.9	1109	5.04		
		0834	3.0	24.9	1129	4.99		
	5/31	0914	1.0	25.2	1104	4.97	GY	
		0917	2.0	25.1	1075	5.00		
		0922	3.0	24.9	1031	5.04		
	6/3	1437	1.0	27.6	1050		JC	
		1441	2.0	27.6	1020			
		1445	3.0	27.4	1020			
	6/10	1447	2.0	26.1	740	5.08	JC	2 FT. From Top • Approx 11 ft.
		1500	3.0	26.0	760	5.0		" " "
		1513	4.0	26.0	1315	4.93		13 Ft.

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/ redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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RW 01

WATER QUALITY DATA

PROJECT NAME: PITT 1: Camp Lejeune PROJECT NO.: TDN 307
WATER QUALITY INSTRUMENT:

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☐°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
RW01	6-16-98	0833	1.0	26.2	843	5.14	JC	Measured at 11Ft.
	↓	0845	2.0	26.7	857	5.10	↓	↓
		0857	3.0	26.2	1474	4.89		Measured at 15 Ft
	6.19.98	0831	1.0	26.9	896	5.12	JC	Measured at 11F
	↓	0845	2.0	27.1	901	5.16	↓	↓
		0858	3.0	26.6	1450	4.70		" " 15 Ft

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/ redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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RW02

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WATER QUALITY DATA

PROJECT NAME: Camp Lejeune PITT 1 PROJECT NO.: TDN307
WATER QUALITY INSTRUMENT:

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☒°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
RW02	5/18	1545	2.5	23.2	2,220	6.55	MKD	Measured at wellhead
	5/21	1620	2.5	24.4	2,160	6.62	MKD	" " "
	5/27	1816	3.0	24.6	1990	6.41	GY	
		1821		24.8	1940	6.48		
	↓	1825	↓	24.7	1980	6.55		
	5/28	1035	1.0	25.4	2080	6.50	GY	TOP
		1040	2.0	25.1	2090	6.36		
		1043	3.0	24.9	2085	6.42		↓
		1048	1.0	25.6	2100	6.46		Bottom
		1053	2.0	26.1	2090	6.49		
	↓	1057	3.0	26.2	2080	6.50	↓	↓
	5/30	0841	1.0	26.3	2080	6.34	GY	
		0845	2.0	25.9	2090	6.45		
		0849	3.0	25.6	2100	6.51		
	5/31	0930	1.0	25.8	2080	6.36	GY	
		0934	2.0	25.4	2090	6.45		
		0938	3.0	25.4	2090	6.51	↓	
	6/3	1420	1.0	29.1	1980		JC	
		1425	2.0	28.8	2020			
	↓	1429	3.0	28.5	2000		↓	
	6/10	1529	1.0	26.6	2100	6.57	JC	Measured 2ft. below top
		1537	2.0	26.5	2090	6.61		↓
↓	↓	1555	3.0	26.2	2080	6.75	↓	measured at 15 ft

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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RW02 WATER QUALITY DATA

ROJECT NAME: PITT 1: Camp Lejeune PROJECT NO.: TDN 307
VATER QUALITY INSTRUMENT:

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☐°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
RW02	6-16-98	0918	1.0	27.8	2110	6.50	JC	Measured at 9 FT.
	↓	0930	2.0	28.1	2110	6.54	↓	↓
		0944	3.0	27.4	2110	6.59		Measured at 13Ft
	6-19-98	0912	1.0	28.0	2140	6.50	JC	Measured at 9Ft
		0925	2.0	28.0	2120	6.60	↓	↓
		0939	3.0	28.1	2120	6.50		Measured at 13Ft

te: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/ redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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RW 04

WATER QUALITY DATA

PROJECT NAME: PITT 1 : Camp Lejeune PROJECT NO.: TDN 307
WATER QUALITY INSTRUMENT:

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☒°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
RW4	5/21	1708	3.5	24.3	235	4.36	MKD	Measured at wellhead
	5/27	1850	3.0	24.5	194	4.35	GY	
		1853		24.5	227	4.31		
	↓	1857		24.5	227	4.32		
	5/28	1135	1.0	27.1	231	4.18	GY	TOP
		1139	2.0	26.3	233	4.19		
		1144	3.0	25.2	235	4.20		↓
		1150	1.0	25.3	228	4.18		Bottom
		1154	2.0	25.5	228	4.16		
	↓	1158	3.0	25.8	229	4.16	↓	↓
	5/30	0910	1.0	26.1	229	4.19	GY	
		0914	2.0	25.6	228	4.19		
		0918	3.0	25.6	228	4.17		
		1000	1.0	25.4	233	4.20		
		1004	2.0	24.8	231	4.18		
		1008	3.0	24.9	233	4.20	↓	
	6/3	1335	1.0	28.9	230		JC	
	↓	1340	2.0	28.3	220		JC	
		1345	3.0	27.3	220		JC	
	6/10	1638	1.0	25.7	232	4.34	JC	Measured at 11 Ft.
		1644	2.0	25.8	236	4.32		
	↓	1650	3.0	25.7	231	4.30	↓	Measured at 15 Ft.

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/ redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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RW04 WATER QUALITY DATA

PROJECT NAME: PITT 1 : Camp Lejeune PROJECT NO.: TDN 307
WATER QUALITY INSTRUMENT:

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☐ C ☐ F	CONDUCTIVITY (μS)	pH	TECH	COMMENTS
RW04	6.16.98	1047	1.0	26.8	224	4.08	JC	Measured at 11Ft
	↓	1101	2.0	273	227	4.09	↓	" ↓ "
		1116	3.0	26.7	223	4.07		" " 15Ft
	6.19.98	1045	1.0	27.2	232	4.16	JC	Measured at 11Ft
	↓	1058	2.0	26.8	229	4.15	↓	↓
		1110	3.0	26.5	224	4.08		" " 15Ft

te: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/ redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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IW 01

WATER QUALITY DATA

PROJECT NAME: Camp Lejeune PITT 1 PROJECT NO.: TDN307
WATER QUALITY INSTRUMENT:

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☒°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
IW01	5/18/98	1558	2.0	22.0	2,200	4.90	MKD	Measured at well head
	5/21	1640	2.5	22.7	1,770	4.97	MKD	" " "
	5/27	1832	4.0	23.3	1620	4.74	64	
		1836		23.1	1650	4.71		
		1840		23.1	1760	4.59		
	↓	1844	↓	23.1	1810	4.55		
	5/29	1104	1.0	25.6	1700	4.53	64	TOP
		1109	2.0	24.8	1775	4.61		
		1114	3.0	25.4	1800	4.46		↓
		1120	1.0	25.4	1850	4.47		Bottom
		1124	2.0	25.4	1860	4.40		
	↓	1128	3.0	25.4	1870	4.36	↓	↓
	5/30	0855	1.0	24.6	1785	4.64	64	
		0859	2.0	24.3	1823	4.59		
		0903	3.0	24.5	1855	4.49		
	5/31	0942	1.0	24.2	1840	46		
		0946	2.0	24.0	1880	455		
	↓	0950	3.0	24.2	1880	4.51	↓	
	6/3	1401	1.0	26.8	1820		JC	
		1407	2.0	26.9	1840			
	↓	1413	3.0	26.9	1860		↓	
	6/10	1612	1.0	26.0	1943	4.44	JC	Measured at Approx. 11Ft.
		1621	2.0	25.8	1929	4.49		↓
	↓	1630	3.0	25.8	1957	4.42	↓	Measured at 15Ft.

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/ redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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WATER QUALITY DATA

PROJECT NAME: PITT 1 : Camp Lejeune PROJECT NO.: TDN 307
WATER QUALITY INSTRUMENT:

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☐°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
IW01	6-16-98	1002	1.0	26.4	1930	4.25	JC	Measured at 11Ft
	↓	1017	2.0	26.7	1910	4.24	↓	↓
		1034	3.0	26.4	1930	4.36		Measured at 15Ft
				2				
	6-19-98	1000	1.0	26.9	1920	4.49	JC	Measured at 11.Ft
	↓	1018	2.0	27.4	1930	4.47	↓	" ↓ "
		1025	3.0	27.3	1950	4.36		Measured at 15Ft

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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MW02 WATER QUALITY DATA & Sampling

PROJECT NAME: Camp Lejeune PITT 1 PROJECT NO.: TDN 307
WATER QUALITY INSTRUMENT:

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☒°C ☐°F	CONDUCTIVITY (µS)	pH	clarity ~~TECH~~	COMMENTS
MW02	5/20	1617	2.5	25.3	84.4	5.61	sl turbid	TD 23.00
	↓	1632	5.0	25.4	86.9	5.75	sl turbid	WL: 8.17
		1647	7.5	25.1	81.6	5.63	sl turbid	14.83×(0.167)
	Collected water sample (for tracer analysis, PCE)							~2.5 GAL/WELL VOL
		after the above purging.						
	5/27/98	1327	2.5	25.8	88	5.74	turbid	TD: 23.0
	↓	1337	5.0	25.7	85.6	5.60	↓	SWL 8.40
		1347	7.5	24.8	83.5	5.46		WC 14.60
		1400	10.0	24.8	82.6	5.60		2.5 gal/well Volume
		1405	Collected sample for (PCE)					
	5/29/98	1114	2.5	26.1	80.6	5.62	GY	TD: 23.00
		1126	5.0	25.6	80.9	5.34	↓	SWL: 8.22
		1138	7.5	25.7	78.6	5.28		WC: 14.78
		1145	Sample Collected for Arsenic					1 Vol: 2.4 gallons
	6-8-98	1255 ~~1238~~	3.0	23.9	89.2	5.55	JC/EH	Static WL = 8.47'
	6-8-98	1309	6.0	23.8	83.5	5.48	JC	
	↓	1323	9.0	23.9	81.9	5.36	JC	
		1327	Collected Sample				JC	
	6-16-98	1200	2.5	25.5	80.1	5.48	JC	SWL = 8.68
		1216	5.0	25.3	79.4	5.31		
	↓	1234	7.5	25.0	75.9	5.18	↓	

1413 ~~1235~~ Collected Sample

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

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MW02IW WATER QUALITY DATA & Sampling

PROJECT NAME: Camp Lejeune PITT I PROJECT NO.: TDN 307
WATER QUALITY INSTRUMENT: ____

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☒°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
MWO2IW	5/20	1725	5.8	26.1	265	11.54	clear	TD: 50.00
		1756	11.5	25.3	264	7.16	turbid	WL: 14.81
		1840	17.3	24.8	265	6.86	"	35.19 (x0.167)
	↓	1911	23.1	23.7	257	6.68	"	5.8 GAL/WELL VOL
	Collected water sample (for tracers & PCE analysis after							
		the above purging						
	5/27/98	1046	6.0	25.7	234	6.24	GY	TD: 50.0
		1115	12.0	26.2	236	6.33	"	SWL: 14.92
		1145	18.0	26.6	235	6.29	"	WC: 35.08
	↓	1150	Collected sample for (PCE)				"	5.7 gallon/per well volume
	6/8/98	1421	6.0	24.3	240	6.66	JC	Static WL: 15.19
		1451	12.0	24.5	214	6.33	"	
		1524	18.0	24.2	220	6.30	"	
	↓	1528	Collected Sample				"	
	6/16/98	1315	6.0	24.4	205	6.25	JC	SWL=15.64
		1346	12.0	24.5	210	6.19		
		1405	18.0	24.7	217	6.20		
	↓	1407	Collected Sample				↓	
	6/26/98	0915	0	–	Purging	–	JC	SWL: 15.59
	↓	1110	18.0	Collected Sample		–	↓	DTW: 15.89

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

INTERA
A Duke Engineering & Services Company

Page 1 of ____

MW03 WATER QUALITY DATA & Sampling

PROJECT NAME: CAMP LEJUENE PITT PROJECT NO.: TDN 307
WATER QUALITY INSTRUMENT: ____

WELL	DATE	TIME	TOTAL WATER PURGED (gal)	TEMP ☐°C ☐°F	CONDUCTIVITY (µS)	pH	TECH	COMMENTS
MW03	5/29/98	0835	1.5	24.9	125.5	4.92	GY	
		0845	3.0	24.4	94.8	4.88		turn pump down
		0902	4.5	25.2	90.5	4.80		TD: 15.00
		0915	6.0	25.6	89.5	4.91		SWL: 6.93
		0920	SAmple collected for ARSNIC					WC: 8.07
								1 Vol: 1.3 gAllons
	6-26-98	1150	0	-	Purging	-	JC	PTW: 8.16
	↓	1240	6.0	-	Collected Sample		↓	SWL 7.41

Note: Water quality readings listed are assumed to be final water quality readings obtained at the end of development/redevelopment, at the time of ground-water sampling, or at any other time the well was sufficiently purged.

APPENDIX O

PITT Analytical Data QA/QC Report

Appendix O
PITT Data Quality Assurance / Quality Control Report

Introduction

EPA's contract laboratory, Mantech Environmental (Mantech), was used to analyze water samples produced during the initial PITT at Site 88. The PITT data includes gas chromatograph (GC) analysis of the PITT samples for methanol, 1-propanol, 4-methyl-2-pentanol, 1-hexanol, 1-heptanol and perchloroethene (PCE). Methanol was not used in the moment analysis to determine the residual NAPL saturation, hence the Quality Assurance/Quality Control (QA/QC) addressed herein was mainly limited to the conservative tracer, 1-propanol, and the partitioning tracers, 4-methyl-2-pentanol, 1-hexanol, and 1-heptanol. Quality assurance flags relevant to the measured tracer concentration data in the effluent samples are tabulated in this appendix. Data for calibration check standards and for each sampling point (e.g. injectate, extraction wells, MLS's) are presented in separate worksheets.

Normally, analytical data generated by a laboratory using non-standard analytical procedures must meet Level II requirements. Instead, establishing a Level III, type of QA/QC, was attempted. Level III is normally applied to standard methods of analysis. No standard methods are available for GC analysis of the alcohol tracers used during the PITT. Rather, the methods used to analyze PITT samples for these alcohols had to be specifically developed to prevent analyte interferences and to reduce analytical costs. Requiring Level III QA/QC for these data demonstrates a commitment to producing high quality, defensible data.

The following QC samples were analyzed:

- calibration check standards,
- method blanks,
- field blanks,
- field duplicates, and
- trip blanks.

A summary of the analytical results of the QC samples is described in the following section.

Data from PITTs

The Mantech laboratory analyzed the effluent water samples for the conservative and partitioning tracer concentrations, and PCE during the PITT. A modified SW8015B method was used for measuring the tracer concentrations. Calibration was performed according to the calibration factor method in SW-846 8000A. A

Carbopak packed GC column with a 1% SP-1000 coating was used to analyze the partitioning tracers. The holding time for the tracers was determined to be 21 days. The reporting limit for all the tracers and the PCE was 10 mg/L and all the data below this limit are suitably flagged with a 'j' identifier. The upper calibration limit for all the data was 200 mg/L and all the data above this concentration are flagged with a 'jj' identifier. Even though most of these samples were usually diluted before analysis, some of the analyzed samples reported a concentration higher than 200 mg/L after dilution and are suitably flagged. The diluted samples were flagged with a "d" and the dilution ratios are also given with the Sample ID.

Calibrations on separate GCs based on the analysis of the same calibration standards do not ensure identical performance among the GCs. EPA guidelines were used to calibrate the GCs, but the inherent variability between individual calibration standard analyses result in imperfect, though acceptable, calibrations. As a result, duplicate analyses on different GCs will often show a systematic error, i.e., consistently higher or lower analyte concentrations may be measured on a given GC compared to another GC. Certainly this error should be within QC limits. To correct for this small potential systematic error, normalized concentrations are used in the moment analysis of the tracer breakthrough curves. Normalized concentrations, which are dimensionless, are calculated by dividing the measured sample concentrations by the average tracer concentration in the injectate measured by the same GC. In this appendix, only non-normalized concentrations are presented.

Analyzing a method blank at the beginning of every batch monitors the effect of instrument contamination. Ideally, no analyte should be detected in the method blank.. However, because of carry-over effects from samples that contain the analytes (especially at high concentrations) and potential injection port contamination, analytes are sometimes detected in method blank analyses. This is not a problem except when the concentrations detected in the method blank analysis are significant, e.g., greater than 10% of the concentrations in the subsequent samples being analyzed.

In this project, results of method blanks occasionally showed slight instrument contamination, usually due to carry-over from a preceding sample containing high concentrations of analytes. Concentration data are flagged with a "j,b" whenever the measured sample concentration is less than the reporting limit but is detected by the GC. Overall, such carry-over and other potential instrument contamination are believed to be negligible.

Control limits of 70-130% would be acceptible on the recoveries of calibration check standards, however, controls limits were set at 80-120% for this QA/QC report. These control limits were infrequently exceeded for the tracers. When a control limit for an analyte was exceeded, all data for the analyte obtained in the batch was flagged with a "jj". In no case was a GC believed to be out of calibration when such an event occurred. The poor recoveries in these cases were attributed to degradation of the batch calibration check standard and possibly erroneous injections by the autosampler.

In general field duplicates showed a reasonable degree of repeatability. Poor repeatability was generally observed when the measured concentrations were below the reporting limit.

General Comments Regarding QA/QC

The overall quality of the data analyzed by the EPA-Mantech lab is acceptable and conforms to Level II. However Level III was not attained since unforeseen problems were encountered due to the sample matrix. As a result of the unforeseen problems, a crash effort was instituted to analyze the samples before the expiration of the 21 day holding time. Hence, no matrix spikes and matrix spike duplicate samples were analyzed and no QC reference samples were run to quantify the certainty of the measured data. However since the results from a PITT is influenced more by the trends of the breakthrough curves, rather than individual points, and only requires consistent measurements (i.e., no instrument drift), it was concluded that the data was acceptable for estimating the residual NAPL saturation in the PITT test zone. For the upcoming post-SEAR PITT, the Quality Assurance Project Plan (QAPP) must be rewritten to account for possible mishaps and ensure that a higher level of QA/QC (Level III) is maintained.

MANAGEMENT
TECHNOLOGY

Ref: 98-RC12
Contract #68-C-98-138
October 15, 1998

Dr. Lynn Wood
National Risk Management Research Laboratory
Subsurface Protection & Remediation Division
U.S. Environmental Protection Agency
P.O. Box 1198
Ada, OK 74820

THRU: D.D. Fine DDFine

Dear Lynn,

In response to your request for the analytical method(s) used to analyze samples from the Camp Lejeune alcohol tracer experiment, I have compiled a sample preparation and analyses overview and two outlines describing the operating conditions of the Hewlett-Packard 5880A gas chromatograph relative to the time that either a capillary or packed column was in use in the instrument.

Capillary column analyses were performed from the beginning of analyses until the end of May 1998, while packed column analyses were performed from June 1998, until the completion of analyses in mid-July 1998.

There is not an existing SOP, as such, that details the analytical method used for either column, since they were developed and modified during the course of the aforementioned analyses. Hopefully, the outlines will provide you with the information you require. If you need more thorough or specific information pertaining to these methods, please contact me at your convenience.

Sincerely,

Randy Callaway

Randy Callaway

xc: R.L. Cosby
J.L. Seeley
G.B. Smith

ManTech Environmental Research Services Corporation

R.S. Kerr Environmental Research Center, P.O. Box 1198, 919 Kerr Research Drive
Ada, Oklahoma 74821-1198 580-436-8660 FAX 580-436-8501

RE-4-482, CAMP LEJEUNE, NC
SAMPLE PREP AND ANALYSES SCHEME FOR ALCOHOL TRACERS

Aqueous samples from Camp Lejeune, NC, were received in both 4 ml vials (MLS samples) and 20 ml vials (extraction well samples / injection well samples). Approximately 2 ml of the original sample was transferred by glass pasteur pipette to an 11 mm autosampler vial and crimp sealed. Samples were stored under refrigeration prior to analyses. In some instances, such as the injection well samples, the sample was diluted with deionized water before analysis.

Calibration standards and calibration check standards of the alcohols were prepared from a single aqueous stock solution at a concentration of 200 ppm. This concentration was determined by the solubility of 1-heptanol in water. Standards of lower concentration were prepared by serial dilution of the stock with deionized water.

Calibration standards and calibration check standards of PCE were prepared from a methanolic stock solution of PCE at a concentration of 10,000 ng/ul. Serial dilution was not used for the preparation of any PCE standards, rather, they were prepared by spiking an appropriate amount of the methanolic standard into a specific volume of deionized water.

During the time that analyses were performed using a capillary column, 0.5 ul of aqueous sample was injected directly into the inlet port liner for flash vaporization and subsequent separation in the GC column. Samples were injected at their original concentration unless a dilution was indicated. Calibration and calibration check standards were analyzed in an identical manner.

During the time that analyses were performed using a packed column, 5 ul of aqueous sample was injected directly into the steel 1/8" column adapter for flash vaporization and subsequent separation in the the GC column. As with the capillary column, samples were injected at their original concentration unless dilutions were indicated, and all standards were analyzed in a manner identical to the samples.

RE-4-482 - CAMP LEJEUNE, NC
CAPILLARY COLUMN ANALYSES

I. HP5880 GC - HARDWARE SPECIFICATIONS

A. Compressed Gasses
  1. Carrier: hydrogen @ 10 ml/min (40C)
  2. Detector Make-up: nitrogen @ 20 ml/min
  3. Split Vent: hydrogen @ 20 ml/min
  4. Purge Vent: hydrogen @ 2 ml/min
  5. Fuel: hydrogen @ 30 ml/min
  6. Oxidant: air @ 390 ml/min

B. Column
  1. Type: J&W Scientific DB-624
  2. Dimensions: 30m x 0.32mm x 1.8um film
  3. Material: fused silica
  4. Temp Limit: -20 - 260C

C. Injector
  1. Inlet Port: capillary
  2. Mode: splitless
  3. Liner: 2mm ID glass w/ fused silica wool plug
  4. Liner Seal: viton O-ring
  5. Septa: Supelco Thermogreen LB-2

D. Detector
  1. Type: flame ionization (FID)
  2. Jet: capillary
  3. Air/Fuel Ratio: 13:1

II. HP5880 GC - SOFTWARE SPECIFICATIONS

A. Instrument Control
  1. Analyses: "ALCOHOL TRACERS" (for capillary column)
  2. Calibration: none

B. Temperature Program
  1. Type: two stage ramp
  2. Initial Temp & Time: 40C for 0.00 min
  3. Level 1: rate = 8C/min to 80C, final time = 4.00 min
  4. Level 2: rate = 25C/min to 205C, final time = 0.00 min
  5. Run Time: 14.00 min
  6. Oven Equilibration Time: 1.00 min

C. Miscellaneous Integrator Parameters
  1. Peak Width: 0.02
  2. Attenuation: 2^2
  3. Chart Speed: 0.30
  4. Threshold: 3
  5. Offset: 10%

III. HP7673A AUTOINJECTOR OPERATING CONDITIONS

A. Injector Program (AUTO SEQ 2)
   1. Mode: normal
   2. Pre-Injection Sample Washes: 3
   3. Viscosity: 7
   4. Sample Pumps: 6
   5. Sample Volume: 1 (equivalent to 0.5 ul w/ 75ASN syringe)
   6. Post Injection Solvent A Washes: 3
   7. Post Injection Solvent B Washes: 3

B. Syringe Wash Solvents
   1. Solvent A: acetone
   2. Solvent B: deionized water

C. Syringe
   1. Type: Hamilton 75ASN
   2. Volume: 5 ul w/ 0.5 ul graduations
   3. Plunger: stainless steel

IV. MILLENNIUM PROCESSING METHOD PARAMETERS

A. Integration Window
   1. Peak Width: 10
   2. Minimum Area: 500
   3. Threshold: 30
   4. Minimum Height: 450
   5. Timed Events:

	Start	*Event Description*	*Value*	*Stop*
a.	11.000	Inhibit Integration		14.000

B. Component Table Window
   1. Components:
      a. methanol
      b. 1-propanol
      c. 4-methyl-2-pentanol
      d. tetrachloroethene (PCE)
      e. 1-hexanol
      f. 1-heptanol
   2. Quantified by: area
   3. Calibration Curves for Alcohols
      a. Range: 1 - 200 ppm
      b. Curve Fit: linear
      c. Weighting: 1/(X*X)
   4. Calibration Curve for PCE
      a. Range: 1 - 150 ppm
      b. Curve Fit: quadratic
      c. Weighting: 1/X

C. QuickSet Parameters for Data Acquisition
   1. Data Start: 0.28 min
   2. Run Time: 14.00 min
   3. Acquisition Rate: 5 points/sec

RE-4-482 - CAMP LEJEUNE, NC
PACKED COLUMN ANALYSES

I. HP5880 GC - HARDWARE SPECIFICATIONS

A. Compressed Gasses
  1. Carrier: hydrogen @ 20 ml/min (170C)
  2. Fuel: hydrogen @ 20 ml/min
  3. Oxidant: air @ 400 ml/min

B. Column
  1. Type: Alltech Gas Chrom 254, 80/100 mesh
  2. Dimensions: 6' x 1/8" x .085"
  3. Material: stainless steel
  4. Temp Limit: 275-310C

C. Injector
  1. Inlet Port: capillary
  2. Liner: none, 1/8" steel column adapter
  3. Septa: Supelco Thermogreen LB-2

D. Detector
  1. Type: flame ionization (FID)
  2. Jet: packed
  3. Air/Fuel Ratio: 10:1

II. HP5880 GC - SOFTWARE SPECIFICATIONS

A. Instrument Control
  1. Analyses: "ALCOHOL TRACERS" (for packed column)
  2. Calibration: none

B. Temperature Program
  1. Type: isothermal
  2. Initial Temp & Time: 170C for 25.00 min
  3. Run Time: 23.00 min
  4. Oven Equilibration Time: 3.00 min

C. Integrator Run Table
  1. 0.00 Valve 7 On: contact closure for Millennium start signal
  2. 0.10 Valve 7 Off: contact open (reset)
  3. 0.50 Valve 6 Off: septum purge flow off
  4. 22.00 Stop: end chromatogram plot

D. Miscellaneous Integrator Parameters
  1. Peak Width: 0.04
  2. Attenuation: 2^2
  3. Chart Speed: 0.30
  4. Threshold: 4
  5. Offset: 10%

III. HP7673A AUTOINJECTOR OPERATING CONDITIONS

- A. Injector Program (AUTO SEQ 2)
  - 1. Mode: normal
  - 2. Pre-Injection Sample Washes: 3
  - 3. Viscosity: 7
  - 4. Sample Pumps: 3
  - 5. Sample volume: 5 (equivalent to 5 ul w/ 175ASN syringe)
  - 6. Post Injection Solvent A Washes: 3
  - 7. Post Injection Solvent B Washes: 3
- B. Syringe Wash Solvents
  - 1. Solvent A: acetone
  - 2. Solvent B: deionized water
- C. Syringe
  - 1. Type: Hamilton 175ASN
  - 2. Volume: 5 ul w/ 1.0 ul graduations
  - 3. Plunger: teflon tipped stainless steel

IV. MILLENNIUM PROCESSING METHOD PARAMETERS

- A. Integration Window
  - 1. Peak Width: 70
  - 2. Minimum Area: 6000
  - 3. Threshold: 10
  - 4. Minimum Height: 70
  - 5. Timed Events:

	Start	*Event Description*	*Value*	*Stop*
a.	0.000	Inhibit Integration		0.866

- B. Component Table Window
  - 1. Components:
    - a. 1-propanol
    - b. 4-methyl-2-pentanol
    - c. 1-hexanol
    - d. 1-heptanol
  - 2. Quantified by: area
  - 3. Calibration Curve for Alcohols except 1-Heptanol
    - a. Range: 5 - 200 ppm
    - b. Curve Fit: linear
    - c. Weighting: 1/X
  - 4. Calibration Curve for 1-Heptanol
    - a. Range: 10 - 200 ppm
    - b. Curve Fit: linear
    - c. Weighting: 1/X
- C. QuickSet Parameters for Data Acquisition
  - 1. Data Start: 0.20 min
  - 2. Run Time: 23.00 min
  - 3. Acquisition Rate: 5 points/sec

MANTECH ENVIRONMENTAL RESEARCH SERVICES CORP.

SUBSURFACE PROTECTION AND REMEDIATION DIVISION

NATIONAL RISK MANAGEMENT RESEARCH LABORATORY, USEPA

ROBERT S. KERR ENVIRONMENTAL RESEARCH LABORATORY, ADA, OKLAHOMA

STANDARD OPERATING PROCEDURE CLEARANCE FORM

SOP Number: 201

TITLE: GC Analysis of Alcohol compounds in Water Samples.

Draft

AUTHOR(S):

Author's Signature Perry G. W Date 9/24/98

Section Supervisor ______________________ Date ________

QA Coordinator ______________________ Date ________

Program Manager ______________________ Date ________

STANDARD OPERATING PROCEDURE

GC ANALYSIS OF ALCOHOL COMPOUNDS IN WATER SAMPLES

I. Disclaimer:

This Standard Operating Procedure has been prepared for the use of the Subsurface Protection and Remediation Division of the U.S. Environmental Protection Agency and may not be specifically applicable to the activities of other organizations. **THIS IS NOT AN OFFICIAL EPA APPROVED METHOD**. This document has not been through the Agency's peer review process or ORD clearance process.

II. Purpose: (Scope and Application)

This method is a gas chromatography (GC) technique applicable to the quantitative analysis of alcohol compounds in aqueous samples. These alcohols are used in partitioning tracer tests for field studies. The alcohol compounds that can be analyzed are methanol, 1-propanol, 2-propanol, 4-methyl-2-pentanol, 1-hexanol, 1-heptanol, 2,2-dimethyl-3-pentanol, 2,4-dimethyl-3-pentanol, 2-methyl-2-propanol (TBA), 2-methyl-1-propanol (IBA), 3-heptanol, 2,6-dimethyl-2-heptanol, 2-ethyl-1-hexanol, 1-octanol, and 2-octanol. The above list is not meant to be all inclusive, as there are others that could be analyzed by this method. The calibration range for the alcohol compounds is 1 to 100 ppm or 1 to 200 ppm, depending on the solubility of the individual component.

It should be noted that the aqueous samples are analyzed with no sample clean-up or preparation. i.e. the aqueous samples are transferred into autosampler vials and directly injected into GC with capillary column and FID detector without sample clean-up.

Approximately, twenty analytical runs can be performed per eight hour day. The autoinjector sample carousel can be loaded with 100 sample vials which can be analyzed overnight, requiring about 33 hours to complete.

This method is restricted to use by or under the supervision of analysts experienced in the use of gas chromatography and in the interpretation of chromatograms.

Method detection limits (MDLs) are compound dependent. The MDLs for selected analytes are presented in Table 1. 1 ppm standards were analyzed four times, the standard deviation, SD, was determined for each analyte and MDLs were estimated as 3 times SD. Quantitation limits were estimated as 10 times SD. Also included in Table 1 are retention times for each individual alcohol compound.

III. Summary of Method:

An aqueous sample is transferred into an autosampler vial. An autoinjector withdraws a small volume (1 µL) of the aqueous sample and injects it into the GC injection port. The alcohol compounds are separated on DB624 capillary column (connected with a guard column) and detected by flame ionization detector (FID). The FID signals are processed by a computerized data system to yield concentrations of the alcohols.

IV. References:

1. HP 5880A Gas Chromatograph and HP 5880A Series GC Terminal Manuals.
2. HP 7673A Automatic Injector Manual.
3. Waters, Millennium Software User's Guide.

V. Reagents and Equipment Needed

Neat individual alcohols and MilliQ water are used to prepare calibration standards. Volumetric flasks, and graduated pipettes are used to make the standard solutions.

VI. Safety Issues:

Since some of the alcohols are toxic, the standards should be prepared in a hood, using gloves, lab coat, and safety glasses.

VII. Interferences:

Samples can be contaminated by further dilution with MilliQ H_2O. Therefore, a MilliQ H_2O blank needs to be run whenever a further dilution is required. If samples contain chlorinated ethylenes, different temperature program should be carried out to avoid coelluents [35°C (5min) at 15°C/min to 155°C (1min)]. If samples contain $CaCl_2$, a packed column should be used.

VIII. Procedures:

A. Sample Preparation

Transfer at least 1 ml of an aqueous sample into an autosampler vial. For samples less than 1 ml, a plastics insert must be used in the autosampler vial.

Table 1. Alcohol Components and Their Detection Limits

Analytes	LOD*	LOQ**	RT***	r^2****
2,2-dimethyl-3-pentanol	0.5	1.5	5.26	0.989
2,4-dimethyl-3-pentanol	0.2	0.5	5.49	0.999
2,6-dimethyl-2-heptanol	0.4	1.5	8.25	0.991
2-ethyl-1-hexanol	0.4	1.2	9.00	0.997
1-heptanol	0.1	0.2	8.10	0.999
3-heptanol	0.2	0.6	6.63	0.999
1-hexanol	0.1	0.3	6.27	0.999
methanol	0.1	0.2	0.76	0.999
4-methyl-2-pentanol	0.1	0.2	4.36	0.999
2-methyl-2-propanol (TBA)	0.4	1.5	1.38	0.999
2-methyl-1-propanol (IBA)	0.1	0.4	2.54	0.998
1-propanol	0.1	0.2	1.73	0.998
2-propanol	0.7	2.1	1.21	0.994
1-octanol	0.1	0.3	9.71	0.999
2-octanol	0.6	1.9	8.46	0.999

*	Limit of Detection, ppm
**	Limit of Quantitation, ppm
***	Retention Time, min
****	Regression Coefficient

B. GC analysis

Prepare the Millennium data system for data acquisition by conducting the following procedures: type all standard, and sample names into quick-set, click setup instrument icon and then run tray icon.

AUTOSAMPLER AND GC CONDITIONS

Gas Chromatograph	HP 5880A
Autosampler	HP 7673A Automatic Injector Syringe: gas tight syringe

Injector (2) parameters:
Mode: 0 (0=normal, 1=on column)
Pre-injection sample wash: 3
Viscosity: 5
Sample pumps: 6
Sample volume: 1 µl
Post-injection acetone wash: 3
Post-injection MilliQ H_2O wash: 3
Injections per bottle: 1

Data System	Waters, Millennium
Flame Ionization Detector	
Temperature	250°C
Carrier Gas	10.5 ml/min
Split Vent	51 ml/min
Make-up Gas w/H_2	30 ml/min
Carrier Gas + FID H_2	40 ml/min
Septum Purge	2 ml/min
Injector Temperature	175°C
Injection Volume	1 µl
Split Ratio	1:5
Column	DB-624 (123-1334), JW Scientific Length: 30 m, ID: 0.32 mm, Film: 1.8 µm
Guard Column	Connex 160-2325 (Deact Fused Silica) Length: 5 m, ID: 0.32 mm
GC Conditions	
Programmed Oven	
Oven Initial Temperature	40°C
Initial Time	1 min
Program Rate	10°C/min
Final Temperature	170°C
Final Time	1 min
Oven Temperature Equilibrium Time	1 min

Integrator

Threshold	4
Attenuation	2
Peak Width	0.04
Chart Speed	0.3 cm/min

The integrator is used only as a charting device, to provide ready access for viewing instrument output. It is not used for quantitation.

IX. Calibration Control:

Alcohol calibration standards are prepared from 100 or 200 ppm stock solution. Care should be taken that the alcohols are completely solubilized. The stock solution are prepared from neat compounds and MilliQ water. Calibration curves are set up on the GC using 1, 10, 25, 50, 100 or 1, 10, 50, 100 and 200 ppm as the data points respectively.

Analysis Scheme:

1. MilliQ water blank.
2. Calibration standards.
3. Check standards are analyzed after calibration curve, and after every 10 samples.
4. Duplicate sample.
5. Samples

X. Corrective Action:

Before analyzing any samples, organic-free water (MilliQ water) should be analyzed as a blank sample. A calibration curve should be run daily just after the blank. A check standard that represents a point on a calibration curve close to the concentration of sample should be analyzed. Additional check standards should be analyzed after every 10 samples. A duplicate sample should be run for each sample set. The QC goal for the check standards is ±10%. If the QC check standards can not meet the goal, the new calibration curve, which is run at the beginning should be used. The goal for the blank sample is that the corresponding components should be below detection limits. If some components are detectable and above the quantitation limits, a blank needs to be reanalyzed and an anomaly note should be provided in the reports. The QC goal for a duplicate is ±10%. If this goal is not met, an anomaly should be noted in the report.

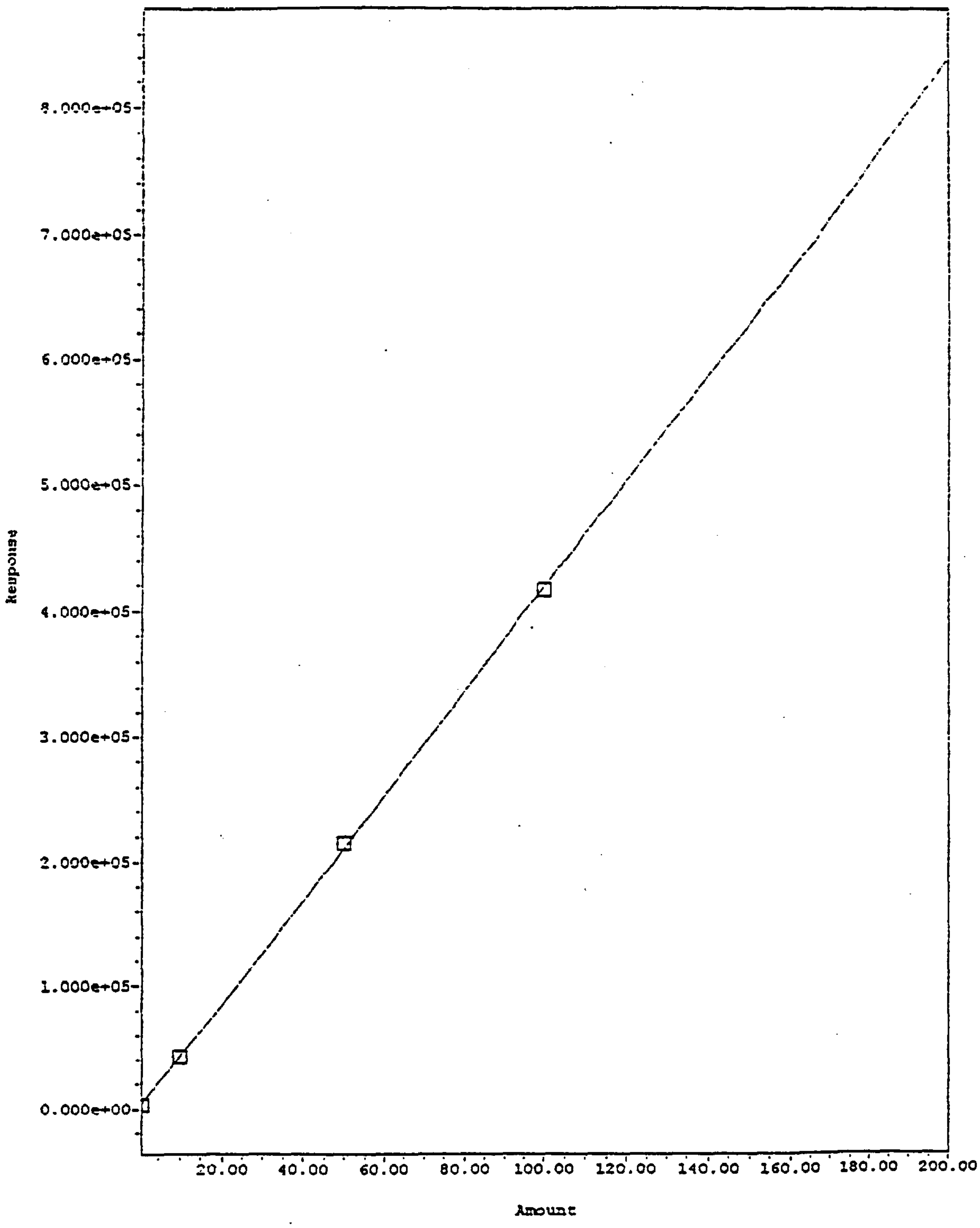
If concentration for any components in a sample is higher than calibration range, the sample needs to be reanalyzed for those components at further appropriate dilution.

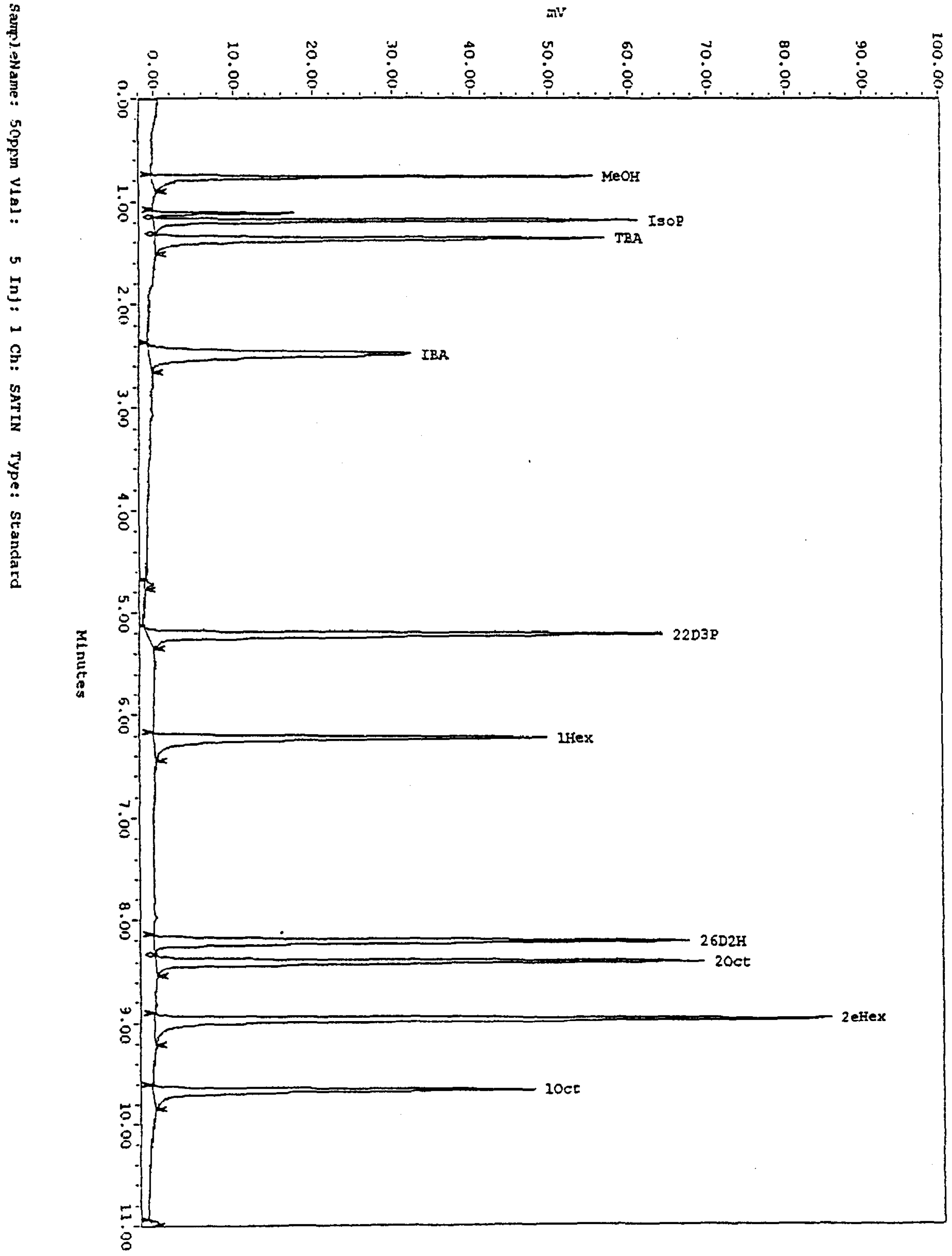
XI. Data Analysis

An external standard method is used for calibration and quantitation. Both linear and quadratic curve fits are used based on their linearity. See attached (see Table 1 for statistics of the curves).

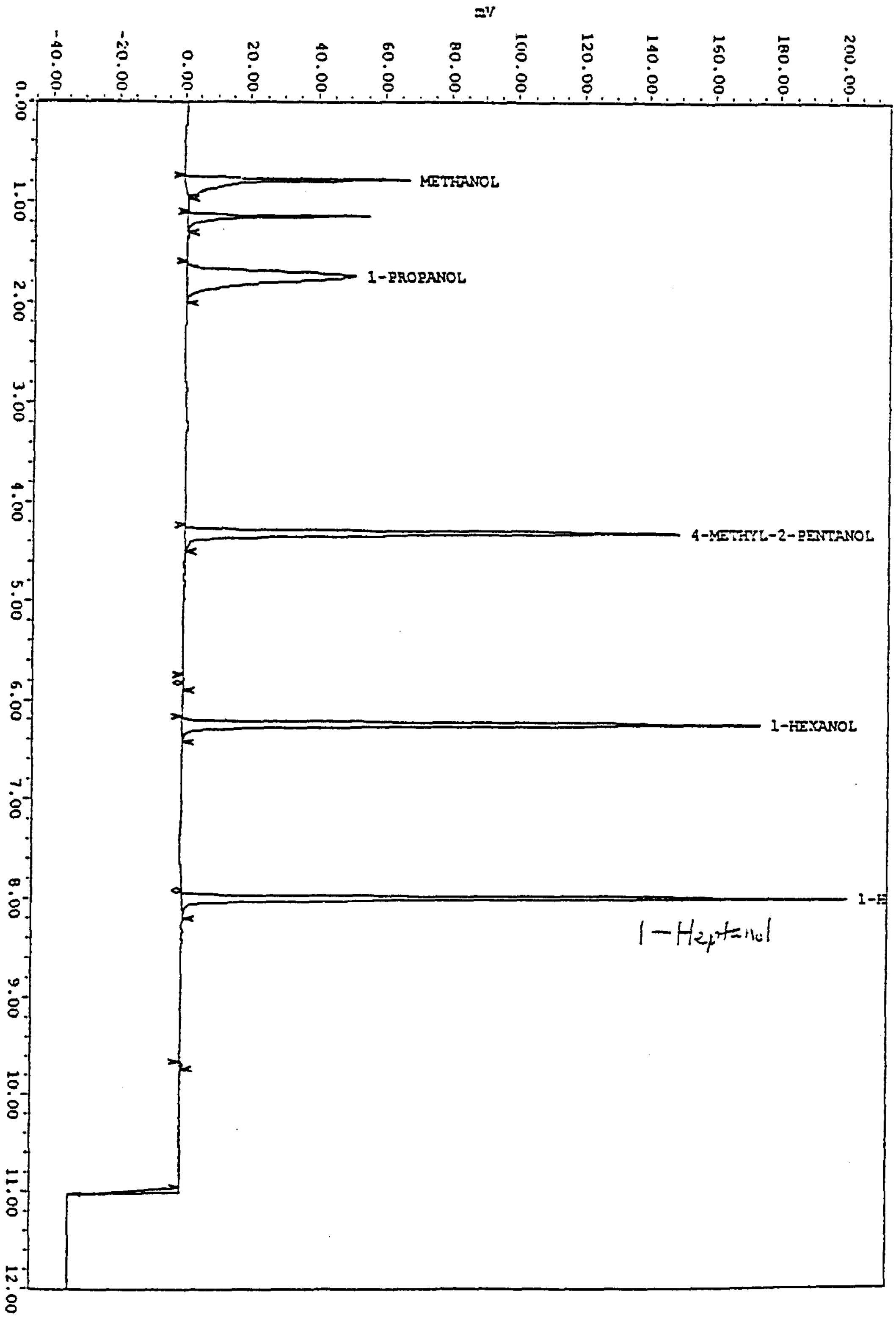
XII. Miscellaneous:

None.

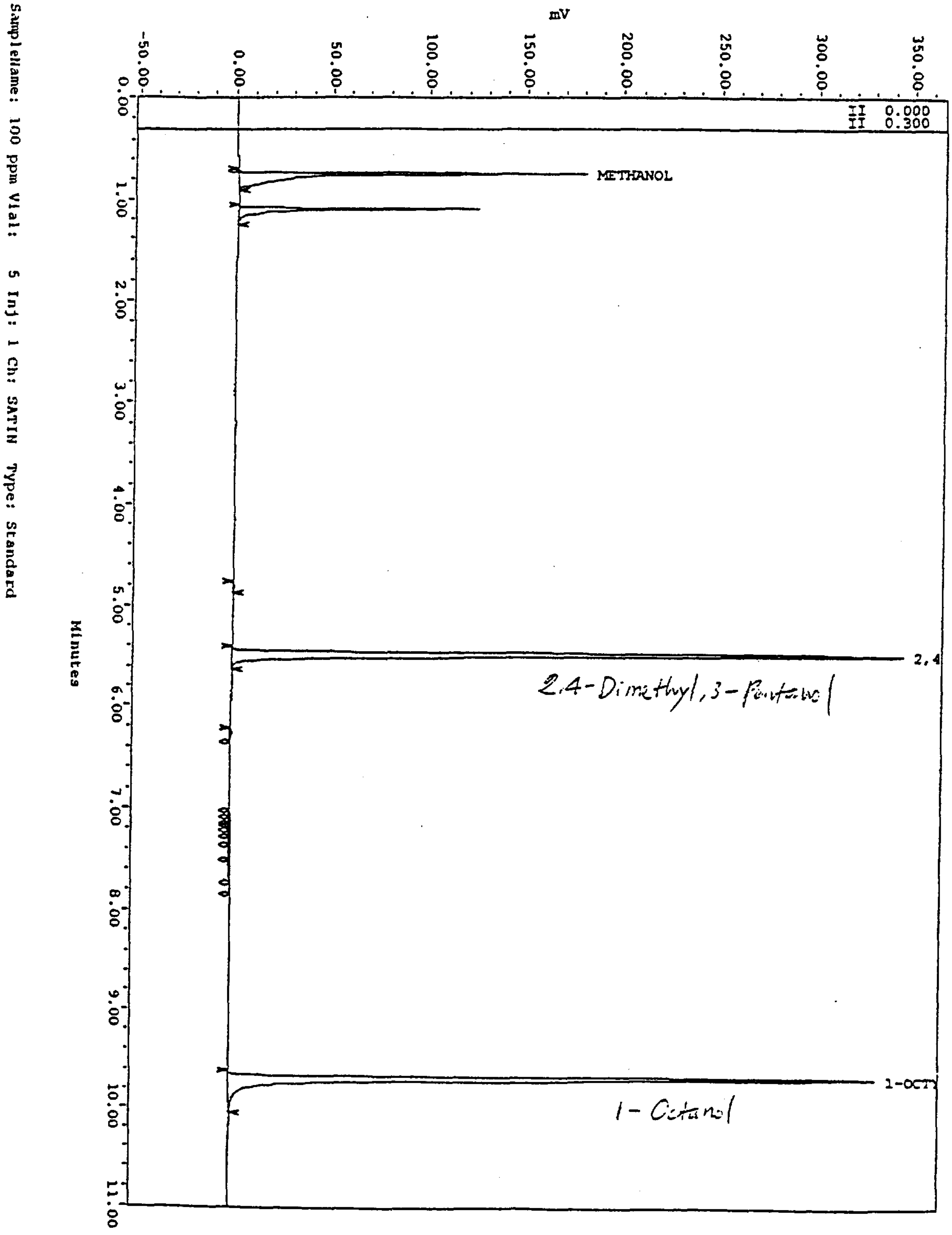

8.000e+05
7.000e+05
6.000e+05
5.000e+05
4.000e+05
3.000e+05
2.000e+05
1.000e+05
0.000e+00
Response
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
Amount

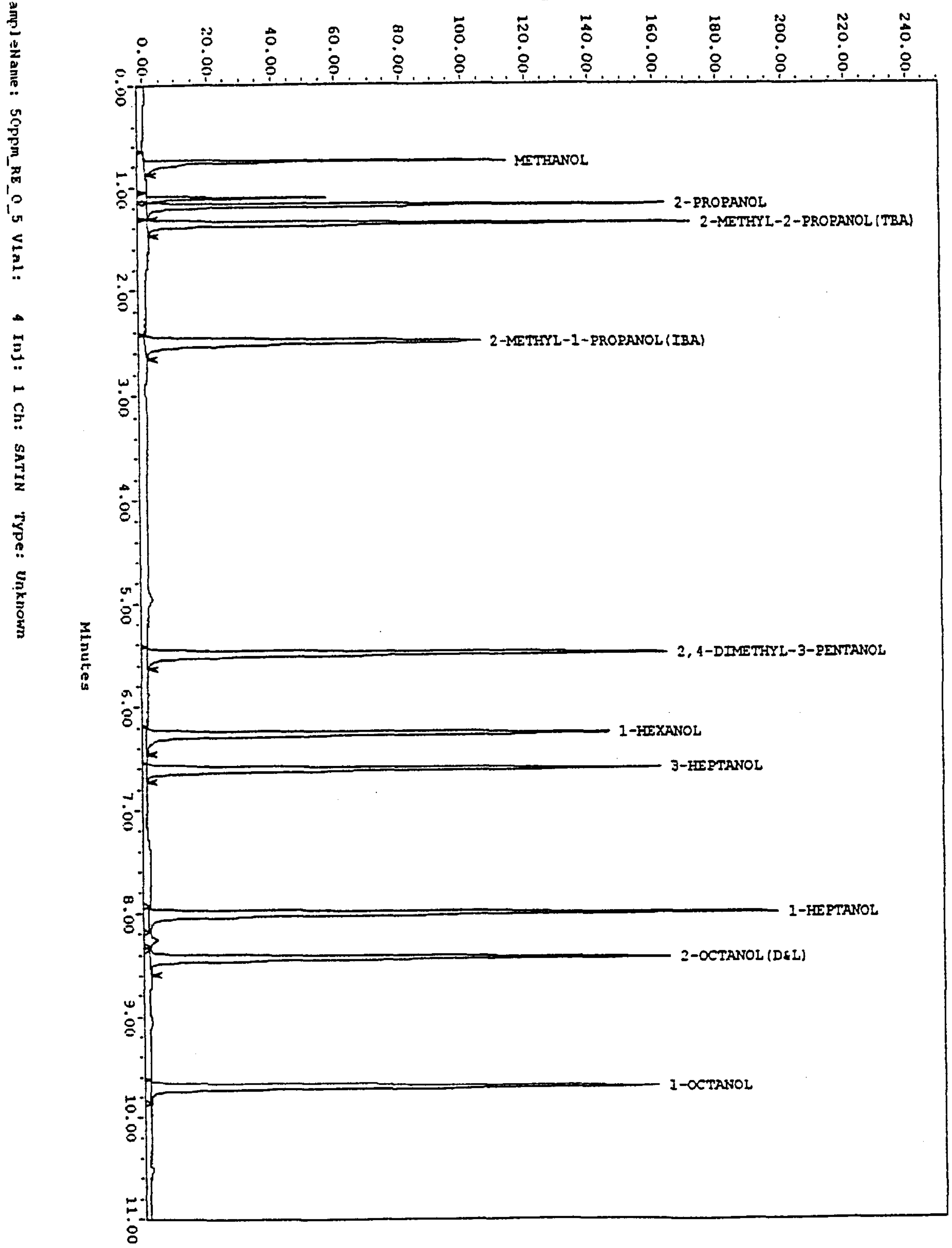


SampleName: 50ppm Vial: 5 Inj: 1 Ch: SATIN Type: Standard



SampleName: 50ppm-5Alcohols Vial: 13 Inj: 1 Ch: SATIN Type: Standard


SampleName: 100 ppm Vial: 5 Inj: 1 Ch: SATIN Type: Standard
mV
-50.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
II 0.000
II 0.300
Minutes
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
11.00
METHANOL
2,4
2,4-Dimethyl,3-Pentanol
1-OCT
1-Octanol


SampleName: 50ppm_RE_0_5 Vial: 4 Inj: 1 Ch: SATIN Type: Unknown
mV
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
220.00
240.00
Minutes
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
11.00
METHANOL
2-PROPANOL
2-METHYL-2-PROPANOL(TBA)
2-METHYL-1-PROPANOL(IBA)
2,4-DIMETHYL-3-PENTANOL
1-HEXANOL
3-HEPTANOL
1-HEPTANOL
2-OCTANOL(D&L)
1-OCTANOL

Project. PITT at ESTCP Camp Lejeune
Acceptable QA/QC limits % Recovery between 80% and 120%

Data QA/QC by DW
Date created 1/22/99
Date last modified 1/26/99

Sample Legend
CC = Calibration check
j = below reporting limit
d = diluted sample
BDL = below detection limit
NA = not applicable
jj = out of acceptable QA/QC and/or calibration limits
OK = within acceptable QA/QC limits

Calibration Check results 1 and 10 ppm tracers

Sample Type	Sample ID	Date and Time Sampled	Date Analyzed	Methanol (mg/L)	% Recovery Methanol	Flag for Methanol	1-Propanol (mg/L)	% Recovery 1 Propanol	Flag for 1-Propanol	4-Methyl-2-pentanol (mg/L)	% Recovery 4-Methyl-2-pentanol	Flag for 4-Methyl-2-pentanol	PCE (mg/L)	% Recovery PCE	Flag for PCE	1-Hexanol (mg/L)	% Recovery 1-Hexanol	Flag for 1-Hexanol	1-Heptanol (mg/L)	% Recovery 1-Heptanol	Flag for 1-Heptanol
CC	1 ppm tracer alcohols		5/19/98	1	100%	OK	1	91%	OK	1	96%	OK	nd	NA	NA	1	80%	jj	0	36%	jj
CC	10 ppm tracer alcohols		5/19/98	10	98%	OK	10	100%	OK	10	97%	OK	nd	NA	NA	9	88%	OK	8	77%	jj
CC	10 ppm tracers	N/A	5/25/98	7	71%	jj	8	83%	OK	8	82%	OK	nd	NA	NA	8	83%	OK	8	81%	OK
CC	10 ppm PCE	N/A	5/25/98	nd	NA	NA	nd	NA	NA	nd	NA	NA	9	92%	OK	nd	NA	NA	nd	NA	NA
CC	10 ppm tracers	N/A	6/4/98		NA	NA	19	195%	jj	16	164%	jj		NA	NA	15	153%	jj	15	150%	jj
CC	10 ppm tracers	N/A	6/5/98		NA	NA	10	100%	OK	10	99%	OK		NA	NA	10	96%	OK	10	101%	OK
CC	10 ppm tracers	N/A	6/8/98		NA	NA	10	101%	OK	12	124%	jj		NA	NA	12	116%	OK	9	93%	OK
CC	10 ppm tracers	N/A	6/11/98		NA	NA	10	97%	OK	9	92%	OK		NA	NA	10	103%	OK	10	104%	OK
CC	10 ppm tracers	N/A	6/11/98		NA	NA	11	108%	OK	10	101%	OK		NA	NA	11	111%	OK	10	103%	OK
CC	10 ppm tracers	N/A	6/12/98		NA	NA	10	96%	OK	11	105%	OK		NA	NA	11	108%	OK	10	101%	OK
CC	10 ppm tracers	N/A	6/15/98		NA	NA	11	110%	OK	12	115%	OK		NA	NA	12	118%	OK	10	104%	OK
CC	10 ppm tracers	N/A	6/16/98		NA	NA	10	96%	OK	11	107%	OK		NA	NA	10	99%	OK	10	104%	OK
CC	10 ppm tracers	N/A	6/17/98		NA	NA	13	126%	jj	8	82%	OK		NA	NA	7	75%	jj	8	80%	jj
CC	10 ppm tracers	N/A	6/18/98		NA	NA	10	102%	OK	10	105%	OK		NA	NA	11	106%	OK	10	100%	OK
CC	10 ppm tracers	N/A	6/20/98		NA	NA	12	124%	jj	10	103%	OK		NA	NA	10	104%	OK	10	100%	OK
CC	10 ppm tracers	N/A	6/21/98		NA	NA	10	105%	OK	11	106%	OK		NA	NA	11	111%	OK	9	92%	OK
CC	10 ppm tracers	N/A	6/22/98		NA	NA	6	56%	jj	7	71%	jj		NA	NA	8	81%	OK	4	42%	jj
CC	10 ppm tracers	N/A	6/24/98		NA	NA	9	91%	OK	8	80%	OK		NA	NA	8	83%	OK	9	92%	OK
CC	10 ppm tracers	N/A	6/24/98		NA	NA	9	89%	OK	9	92%	OK		NA	NA	11	112%	OK	11	108%	OK
CC	10 ppm tracers	N/A	6/25/98		NA	NA	9	91%	OK	12	119%	OK		NA	NA	9	95%	OK	10	99%	OK
CC	10 ppm tracers	N/A	6/26/98		NA	NA	8	79%	jj	6	56%	jj		NA	NA	7	71%	jj	9	90%	OK
CC	10 ppm tracers	N/A	6/26/98		NA	NA	12	121%	jj	13	131%	jj		NA	NA	13	126%	jj	13	132%	jj
CC	10 ppm tracers	N/A	6/27/98		NA	NA	10	96%	OK	9	94%	OK		NA	NA	8	81%	OK	8	85%	OK
CC	10 ppm tracers	N/A	6/27/98		NA	NA	10	96%	OK	9	94%	OK		NA	NA	8	81%	OK	8	85%	OK
CC	10 ppm tracers	N/A	6/30/98		NA	NA	11	106%	OK	11	107%	OK		NA	NA	10	100%	OK	10	100%	OK
CC	10 ppm tracers	N/A	7/1/98		NA	NA	8	79%	jj	7	71%	jj		NA	NA	8	83%	OK	7	72%	jj
CC	10 ppm tracers	N/A	7/8/98		NA	NA	10	97%	OK	8	78%	jj		NA	NA	9	88%	OK	10	96%	OK
CC	10 ppm tracers	N/A	7/8/98		NA	NA	10	97%	OK	8	78%	jj		NA	NA	9	88%	OK	10	96%	OK
CC	10 ppm tracers	N/A	7/9/98		NA	NA	10	100%	OK	10	97%	OK		NA	NA	10	101%	OK	10	95%	OK
CC	10 ppm tracers	N/A	7/9/98		NA	NA	10	100%	OK	10	97%	OK		NA	NA	10	101%	OK	10	95%	OK
CC	10 ppm tracers	N/A	7/14/98		NA	NA	10	102%	OK	10	96%	OK		NA	NA	9	89%	OK	10	104%	OK

Project PITT at ESTCP Camp Lejeune
Acceptable QA/QC limits % Recovery between 80% and 120%

Data QA/QC by DW
Date created 1/22/99
Date last modified 1/26/99

Sample Legend
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Calibration Check results 5 and 50 ppm tracers

Sample Type	Sample ID	Date and Time Sampled	Date Analyzed	Methanol (mg/L)	% Recovery Methanol	Flag for Methanol	1-Propanol (mg/L)	% Recovery 1-Propanol	Flag for 1-Propanol	4-Methyl-2-pentanol (mg/L)	% Recovery 4-Methyl-2-pentanol	Flag for 4-Methyl-2-pentanol	PCE (mg/L)	% Recovery PCE	Flag for PCE	1-Hexanol (mg/L)	% Recovery 1 Hexanol	Flag for 1-Hexanol	1-Heptanol (mg/L)	% Recovery 1 Heptanol	Flag for 1-Heptanol
	50 ppm tracers	N/A	5/25/98	52	103%	OK	50	99%	OK	50	100%	OK	nd	NA	NA	50	101%	OK	50	100%	OK
	50 ppm PCE	N/A	5/25/98	nd	NA	NA	nd	NA	NA	nd	NA	NA	50	101%	OK	nd	NA	NA	nd	NA	NA
	5 ppm tracers	N/A	5/26/98	5	100%	OK	5	100%	OK	5	99%	OK	nd	NA	NA	5	100%	OK	5	96%	OK
	5 ppm PCE	N/A	5/26/98	nd	NA	NA	nd	NA	NA	nd	NA	NA	5	100%	OK	nd	NA	NA	nd	NA	NA
	50 ppm tracers	N/A	5/26/98	51	102%	OK	51	103%	OK	51	103%	OK	nd	NA	NA	51	103%	OK	51	103%	OK
	50 ppm PCE	N/A	5/27/98	nd	NA	NA	nd	NA	NA	nd	NA	NA	50	100%	OK	nd	NA	NA	nd	NA	NA
	50 ppm PCE	N/A	5/27/98	nd	NA	NA	nd	NA	NA	nd	NA	NA	53	105%	OK	nd	NA	NA	nd	NA	NA
	5 ppm tracers	N/A	5/28/98	3	65%	jj	3	69%	jj	4	75%	jj	nd	NA	NA	4	74%	jj	4	72%	jj
	50 ppm PCE	N/A	5/28/98	nd	NA	NA	nd	NA	NA	nd	NA	NA	42	83%	OK	nd	NA	NA	nd	NA	NA
	50 ppm tracers	N/A	6/4/98		NA	NA	50	100%	OK	55	109%	OK		NA	NA	53	1[illegible]%	OK	50	99%	OK
	50 ppm tracers	N/A	6/6/98		NA	NA	44	89%	OK	46	92%	OK		NA	NA	48	9[illegible]%	OK	51	102%	OK
	50 ppm tracers	N/A	6/8/98		NA	NA	52	104%	OK	48	96%	OK		NA	NA	45	9[illegible]%	OK	45	91%	OK
	5 ppm tracers	N/A	6/8/98		NA	NA	5	96%	OK	5	93%	OK		NA	NA	5	1[illegible]5%	OK	3	65%	jj
	50 ppm tracers	N/A	6/8/98		NA	NA	46	93%	OK	44	89%	OK		NA	NA	45	8[illegible]%	OK	57	113%	OK
	5 ppm tracers	N/A	6/9/98		NA	NA	5	99%	OK	4	70%	jj		NA	NA	4	8[illegible]%	OK	2	42%	jj
	50 ppm tracers	N/A	6/9/98		NA	NA	54	108%	OK	49	98%	OK		NA	NA	48	9[illegible]%	OK	45	90%	OK
c	50 ppm tracers	N/A	6/9/98		NA	NA	44	89%	OK	41	82%	OK		NA	NA	41	8[illegible]%	OK	nd	NA	NA
	5 ppm tracers	N/A	6/11/98		NA	NA	5	99%	OK	6	112%	OK		NA	NA	6	114%	OK	7	136%	jj
	5 ppm tracers	N/A	6/11/98		NA	NA	5	92%	OK	5	102%	OK		NA	NA	5	103%	OK	6	127%	jj
	50 ppm tracers	NA	6/11/98		NA	NA	50	99%	OK	49	98%	OK		NA	NA	50	100%	OK	47	95%	OK
	5 ppm tracers	N/A	6/12/98		NA	NA	6	117%	OK	7	137%	jj		NA	NA	10	194%	jj	7	145%	jj
	50 ppm tracers	N/A	6/12/98		NA	NA	46	92%	OK	47	95%	OK		NA	NA	45	90%	OK	38	76%	jj
	5 ppm tracers	N/A	6/15/98		NA	NA	5	107%	OK	4	89%	OK		NA	NA	5	97%	OK	4	86%	OK
	50 ppm tracers	N/A	6/15/98		NA	NA	50	100%	OK	50	100%	OK		NA	NA	50	99%	OK	51	101%	OK
	5 ppm tracers	N/A	6/16/98		NA	NA	4	82%	OK	5	91%	OK		NA	NA	5	96%	OK	5	98%	OK
	50 ppm tracers	N/A	6/16/98		NA	NA	53	105%	OK	51	101%	OK		NA	NA	49	97%	OK	52	105%	OK
	5 ppm tracers	N/A	6/17/98		NA	NA	9	173%	jj	5	91%	OK		NA	NA	4	88%	OK	5	109%	OK
	50 ppm tracers	N/A	6/17/98		NA	NA	49	98%	OK	45	90%	OK		NA	NA	45	90%	OK	43	86%	OK
	5 ppm tracers	N/A	6/18/98		NA	NA	6	111%	OK	5	99%	OK		NA	NA	5	109%	OK	6	112%	OK
	50 ppm tracers	N/A	6/18/98		NA	NA	51	101%	OK	51	102%	OK		NA	NA	52	104%	OK	48	96%	OK
	5 ppm tracers	N/A	6/20/98		NA	NA	5	90%	OK	5	95%	OK		NA	NA	5	99%	OK	4	84%	OK
	50 ppm tracers	N/A	6/20/98		NA	NA	50	100%	OK	50	100%	OK		NA	NA	46	92%	OK	46	91%	OK
	5 ppm tracers	N/A	6/21/98		NA	NA	4	83%	OK	3	68%	jj		NA	NA	5	91%	OK	5	96%	OK
	50 ppm tracers	N/A	6/21/98		NA	NA	53	107%	OK	52	105%	OK		NA	NA	52	103%	OK	52	104%	OK
	5 ppm tracers	N/A	6/22/98		NA	NA	3	54%	jj	5	99%	OK		NA	NA	6	126%	jj	5	100%	OK
	50 ppm tracers	N/A	6/22/98		NA	NA	47	93%	OK	48	96%	OK		NA	NA	50	101%	OK	50	99%	OK
	5 ppm tracers	N/A	6/22/98		NA	NA	4	88%	OK	3	58%	jj		NA	NA	5	93%	OK	4	85%	OK

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Sample Type	Sample ID	Date and Time Sampled	Date Analyzed	Methanol (mg/L)	% Recovery Methanol	Flag for Methanol	1-Propanol (mg/L)	% Recovery 1-Propanol	Flag for 1-Propanol	4-Methyl-2-pentanol (mg/L)	% Recovery 4-Methyl-2-pentanol	Flag for 4-Methyl-2-pentanol	PCE (mg/L)	% Recovery PCE	Flag for PCE	1-Hexanol (mg/L)	% Recovery 1 Hexanol	Flag for 1-Hexanol	1-Heptanol (mg/L)	% Recovery 1 Heptanol	Flag for 1-Heptanol
	50 ppm tracers	N/A	6/22/98		NA	NA	56	112%	OK	57	115%	OK		NA	NA	55	111%	OK	58	116%	OK
	5 ppm tracers	N/A	6/22/98		NA	NA	5	100%	OK	5	97%	OK		NA	NA	5	100%	OK	5	95%	OK
	50 ppm tracers	N/A	6/23/98		NA	NA	53	106%	OK	46	92%	OK		NA	NA	49	99%	OK	47	95%	OK
	5 ppm tracers	N/A	6/23/98		NA	NA	5	94%	OK	5	91%	OK		NA	NA	4	75%	JJ	4	81%	OK
	50 ppm tracers	N/A	6/24/98		NA	NA	50	100%	OK	50	100%	OK		NA	NA	48	97%	OK	50	101%	OK
	5 ppm tracers	N/A	6/24/98		NA	NA	6	129%	JJ	4	87%	OK		NA	NA	5	103%	OK	8	156%	JJ
	50 ppm tracers	N/A	6/24/98		NA	NA	48	95%	OK	47	94%	OK		NA	NA	46	92%	OK	47	95%	OK
	5 ppm tracers	N/A	6/24/98		NA	NA	5	106%	OK	5	107%	OK		NA	NA	5	106%	OK	7	134%	JJ
	50 ppm tracers	N/A	6/24/98		NA	NA	54	108%	OK	59	117%	OK		NA	NA	56	113%	OK	57	115%	OK
	5 ppm tracers	N/A	6/25/98		NA	NA	5	106%	OK	6	120%	OK		NA	NA	5	108%	OK	7	136%	JJ
	5 ppm tracers	N/A	6/25/98		NA	NA	5	102%	OK	6	111%	OK		NA	NA	4	72%	JJ	6	119%	OK
	50 ppm tracers	N/A	6/25/98		NA	NA	51	101%	OK	53	107%	OK		NA	NA	49	97%	OK	52	103%	OK
	5 ppm tracers	N/A	6/26/98		NA	NA	5	97%	OK	6	116%	OK		NA	NA	8	165%	JJ	6	119%	OK
	50 ppm tracers	N/A	6/26/98		NA	NA	49	97%	OK	51	102%	OK		NA	NA	50	100%	OK	53	105%	OK
	5 ppm tracers	N/A	6/26/98		NA	NA	5	99%	OK	4	86%	OK		NA	NA	5	102%	OK	3	65%	JJ
	5 ppm tracers	N/A	6/27/98		NA	NA	3	67%	JJ	3	65%	JJ		NA	NA	3	50%	JJ	4	71%	JJ
	5 ppm tracers	N/A	6/27/98		NA	NA	3	67%	JJ	3	65%	JJ		NA	NA	3	50%	JJ	4	71%	JJ
	50 ppm tracers	N/A	6/27/98		NA	NA	53	105%	OK	52	103%	OK		NA	NA	52	104%	OK	49	97%	OK
	50 ppm tracers	N/A	6/27/98		NA	NA	53	105%	OK	52	103%	OK		NA	NA	52	104%	OK	49	97%	OK
	5 ppm tracers	N/A	6/30/98		NA	NA	5	101%	OK	5	98%	OK		NA	NA	4	88%	OK	6	118%	OK
	50 ppm tracers	N/A	6/30/98		NA	NA	57	114%	OK	55	111%	OK		NA	NA	54	108%	OK	51	102%	OK
	50 ppm tracers	N/A	6/30/98		NA	NA	44	89%	OK	47	95%	OK		NA	NA	45	91%	OK	47	95%	OK
	5 ppm tracers	N/A	7/1/98		NA	NA	3	60%	JJ	4	76%	JJ		NA	NA	4	73%	JJ	4	82%	OK
	50 ppm tracers	N/A	7/1/98		NA	NA	51	101%	OK	55	110%	OK		NA	NA	52	104%	OK	55	110%	OK
	5 ppm tracers	N/A	7/8/98		NA	NA	5	103%	OK	6	118%	OK		NA	NA	6	113%	OK	6	111%	OK
	50 ppm tracers	N/A	7/8/98		NA	NA	49	98%	OK	49	97%	OK		NA	NA	47	94%	OK	47	93%	OK
	5 ppm tracers	N/A	7/9/98		NA	NA	5	109%	OK	4	86%	OK		NA	NA	6	130%	JJ	5	107%	OK
	50 ppm tracers	N/A	7/9/98		NA	NA	50	99%	OK	48	96%	OK		NA	NA	47	94%	OK	46	93%	OK
a	5 ppm tracers	N/A	7/14/98		NA	NA	5	95%	OK	5	96%	OK		NA	NA	5	108%	OK	5	98%	OK
a	50 ppm tracers	N/A	7/14/98		NA	NA	51	102%	OK	51	101%	OK		NA	NA	53	105%	OK	50	100%	OK

Project PITT at ESTCP Camp Lejeune
Acceptable QA/QC limits % Recovery between 80% and 120%

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Calibration Check results 100 ppm tracers

Sample Type	Sample ID	Date and Time Sampled	Date Analyzed	Methanol (mg/L)	% Recovery Methanol	Flag for Methanol	1-Propanol (mg/L)	% Recovery 1-Propanol	Flag for 1-Propanol	4-Methyl-2-pentanol (mg/L)	% Recovery 4-Methyl-2-pentanol	Flag for 4-Methyl-2-pentanol	PCE (mg/L)	% Recovery PCE	Flag for PCE	1-Hexanol (mg/L)	% Recovery 1 Hexanol	Flag for 1-Hexanol	1-Heptanol (mg/L)	% Recovery 1 Heptanol	Flag for 1-Heptanol
CC	100 ppm tracer alcohols		5/19/98	97	97%	OK	97	97%	OK	95	95%	OK	nd	NA	NA	94	94%	OK	95		
CC	100 ppm tracers	N/A	5/26/98	98	98%	OK	99	99%	OK	100	100%	OK	nd	NA	NA	100	100%	OK	100		
CC	100 ppm PCE	N/A	5/26/98	nd	NA	NA	nd	NA	NA	nd	NA	NA	96	96%	OK	nd	NA	NA	nd		
CC	100 ppm tracers	N/A	5/27/98	98	98%	OK	97	97%	OK	97	97%	OK	nd	NA	NA	97	97%	OK	97		
CC	100 ppm tracers	N/A	6/5/98				100	100%	OK	105	105%	OK				104	104%	OK	100		
CC	100 ppm tracers	N/A	6/5/98				81	81%	OK	76	76%	jj				74	74%	jj	93		
CC	100 ppm tracers	N/A	6/9/98				99	99%	OK	100	100%	OK				99	99%	OK	130		
CC	100 ppm tracers	N/A	6/10/98				106	106%	OK	107	107%	OK				104	104%	OK	103		
CC	100 ppm tracers	N/A	6/10/98				128	128%	jj	114	114%	OK				111	111%	OK	116		
CC	100 ppm tracers	N/A	6/11/98				102	102%	OK	98	98%	OK				97	97%	OK	101		
CC	100 ppm tracers	N/A	6/12/98				100	100%	OK	104	104%	OK				100	100%	OK	95		
CC	100 ppm tracers	N/A	6/16/98				107	107%	OK	104	104%	OK				103	103%	OK	106		
CC	100 ppm tracers	N/A	6/17/98				105	105%	OK	99	99%	OK				99	99%	OK	94		
CC	100 ppm tracers	N/A	6/18/98				100	100%	OK	102	102%	OK				102	102%	OK	102		
CC	100 ppm tracers	N/A	6/20/98				105	105%	OK	103	103%	OK				107	107%	OK	113		
CC	100 ppm tracers	N/A	6/21/98				105	105%	OK	105	105%	OK				105	105%	OK	110		
CC	100 ppm tracers	N/A	6/22/98				95	95%	OK	97	97%	OK				95	95%	OK	96		
CC	100 ppm tracers	N/A	6/24/98				87	87%	OK	84	84%	OK				83	83%	OK	85		
CC	100 ppm tracers	N/A	6/25/98				106	106%	OK	109	109%	OK				102	102%	OK	111		
CC	100 ppm tracers	N/A	6/25/98				98	98%	OK	98	98%	OK				99	99%	OK	102		
CC	100 ppm tracers	N/A	6/26/98				104	104%	OK	106	106%	OK				101	101%	OK	109		
CC	100 ppm tracers	N/A	6/27/98				105	105%	OK	109	109%	OK				107	107%	OK	112		
CC	100 ppm tracers	N/A	6/27/98				105	105%	OK	109	109%	OK				107	107%	OK	112		
CC	100 ppm tracers	N/A	6/30/98				107	107%	OK	104	104%	OK				107	107%	OK	104		
CC	100 ppm tracers	N/A	7/1/98				104	104%	OK	106	106%	OK				100	100%	OK	102		
CC	100 ppm tracers	N/A	7/1/98				110	110%	OK	112	112%	OK				108	108%	OK	106		
CC	100 ppm tracers	N/A	7/8/98				102	102%	OK	104	104%	OK				105	105%	OK	104		
CC	100 ppm tracers	N/A	7/9/98				95	95%	OK	93	93%	OK				95	95%	OK	94		
CC	100 ppm tracers	N/A	7/14/98				98	98%	OK	99	99%	OK				98	98%	OK	100		
CC	50 ppm PCE	N/A	5/19/98	nd			nd	NA	NA	nd	NA	NA	39	78%	jj	nd	NA	NA	nd		

Project PITT at ESTCP Camp Lejeune
Acceptable QA/QC limits % Recovery between 80% and 120%

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Calibration Check results 200 ppm tracers and miscellaneous (2 and 150 ppm)

Sample ID	Date and Time Sampled	Date Analyzed	Methanol (mg/L)	% Recovery Methanol	Flag for Methanol	1-Propanol (mg/L)	% Recovery 1-Propanol	Flag for 1-Propanol	4-Methyl-2-pentanol (mg/L)	% Recovery 4-Methyl-2-pentanol	Flag for 4-Methyl-2-pentanol	PCE (mg/L)	% Recovery PCE	Flag for PCE	1-Hexanol (mg/L)	% Recovery 1 Hexanol	Flag for 1-Hexanol	1-Heptanol (mg/L)	% Recovery 1 Heptanol	Flag for 1-Heptanol
1-16 0 (1)	05/15/98 @ 0958	5/24/98	0	0%	jj	nd	NA	NA	nd	NA	NA	49	24%	jj	nd	NA	NA	nd	NA	NA
1-16 0 (2)	05/15/98 @ 1436	5/24/98	0	0%	jj	nd	NA	NA	nd	NA	NA	42	21%	jj	nd	NA	NA	nd	NA	NA
1-16 0 (3)	05/15/98 @ 1957	5/24/98	nd	NA	NA	nd	NA	NA	nd	NA	NA	45	22%	jj	nd	NA	NA	nd	NA	NA
2 ppm tracers	N/A	5/24/98	2	1%	jj	2	1%	jj	2	1%	jj	nd	NA	NA	2	1%	jj	2	1%	jj
2 ppm PCE	N/A	5/24/98	nd	NA	NA	nd	NA	NA	nd	NA	NA	2	1%	jj	nd	NA	NA	nd	NA	NA
200 ppm tracers	N/A	5/26/98	196	98%	OK	193	97%	OK	199	100%	OK	nd	NA	NA	199	100%	OK	201	100%	OK
150 ppm PCE	N/A	5/26/98	nd	NA	NA	nd	NA	NA	nd	NA	NA	142	71%	jj	nd	NA	NA	nd	NA	NA
200 ppm tracers	N/A	5/27/98	202	101%	OK	191	95%	OK	198	99%	OK	nd	NA	NA	199	99%	OK	197	99%	OK
150 ppm PCE	N/A	5/27/98										150	75%	jj						
2 ppm tracers	N/A	5/27/98	1	0%	jj	2	1%	jj	2	1%	jj	nd	NA	NA	2	1%	jj	2	1%	jj
2 ppm PCE	N/A	5/27/98	nd	NA	NA	nd	NA	NA	nd	NA	NA	2	1%	jj	nd	NA	NA	nd	NA	NA
200 ppm tracers	N/A	5/28/98	206	103%	OK	189	95%	OK	196	98%	OK	nd	NA	NA	199	99%	OK	204	102%	OK
200 ppm tracers	N/A	6/4/98				192	96%	OK	203	101%	OK				204	102%	OK	198	99%	OK
200 ppm tracers	N/A	6/5/98				208	104%	OK	209	104%	OK				208	104%	OK	202	101%	OK
200 ppm tracers	N/A	6/6/98				200	100%	OK	199	100%	OK				199	99%	OK	200	100%	OK
200 ppm tracers	N/A	6/6/98				211	105%	OK	210	105%	OK				206	103%	OK	207	103%	OK
200 ppm tracers	N/A	6/7/98				186	93%	OK	187	94%	OK				189	94%	OK	196	98%	OK
200 ppm tracers	N/A	6/8/98				214	107%	OK	198	99%	OK				200	100%	OK	198	99%	OK
200 ppm tracers	N/A	6/9/98				166	83%	OK	160	80%	jj				157	78%	jj	199	100%	OK
200 ppm tracers	N/A	6/10/98				194	97%	OK	194	97%	OK				193	96%	OK	196	98%	OK
200 ppm tracers	N/A	6/12/98				202	101%	OK	195	97%	OK				195	98%	OK	201	101%	OK
200 ppm tracers	N/A	6/12/98				218	109%	OK	213	107%	OK				219	110%	OK	211	106%	OK
200 ppm tracers	N/A	6/16/98				240	120%	OK	247	123%	jj				251	125%	jj	253	126%	jj
200 ppm tracers	N/A	6/17/98				198	99%	OK	189	95%	OK				191	96%	OK	192	96%	OK
200 ppm tracers	N/A	6/18/98				191	96%	OK	203	101%	OK				195	97%	OK	193	97%	OK
200 ppm tracers	N/A	6/20/98				202	101%	OK	210	105%	OK				207	104%	OK	196	98%	OK
200 ppm tracers	N/A	6/21/98				186	93%	OK	192	96%	OK				189	95%	OK	194	97%	OK
200 ppm tracers	N/A	6/22/98				191	96%	OK	194	97%	OK				203	101%	OK	195	98%	OK
200 ppm tracers	N/A	6/23/98				198	99%	OK	201	101%	OK				196	98%	OK	194	97%	OK
200 ppm tracers	N/A	6/24/98				201	101%	OK	205	103%	OK				200	100%	OK	204	102%	OK
200 ppm tracers	N/A	6/24/98				186	93%	OK	183	91%	OK				179	90%	OK	187	93%	OK
200 ppm tracers	N/A	6/25/98				211	105%	OK	211	106%	OK				213	107%	OK	211	105%	OK
200 ppm tracers	N/A	6/25/98				212	106%	OK	208	104%	OK				222	111%	OK	202	101%	OK
200 ppm tracers	N/A	6/26/98				211	106%	OK	215	107%	OK				214	107%	OK	210	105%	OK

Sample ID	Date and Time Sampled	Date Analyzed	Methanol (mg/L)	% Recovery Methanol	Flag for Methanol	1-Propanol (mg/L)	% Recovery 1-Propanol	Flag for 1-Propanol	4-Methyl-2-pentanol (mg/L)	% Recovery 4-Methyl-2-pentanol	Flag for 4-Methyl-2-pentanol	PCE (mg/L)	% Recovery PCE	Flag for PCE	1-Hexanol (mg/L)	% Recovery 1 Hexanol	Flag for 1-Hexanol	1-Heptanol (mg/L)	% Recovery 1 Heptanol	Flag for 1-Heptanol
200 ppm tracers	N/A	6/27/98				179	90%	OK	170	85%	OK				176	88%	OK	169	85%	OK
200 ppm tracers	N/A	6/27/98				179	90%	OK	170	85%	OK				176	88%	OK	169	85%	OK
200 ppm tracers	N/A	6/30/98				210	105%	OK	224	112%	OK				218	109%	OK	220	110%	OK
200 ppm tracers	N/A	7/1/98				194	97%	OK	202	101%	OK				199	99%	OK	185	93%	OK
200 ppm tracers	N/A	7/1/98				221	111%	OK	241	120%	JJ				236	118%	OK	241	120%	JJ
200 ppm tracers	N/A	7/8/98				199	100%	OK	197	99%	OK				198	99%	OK	198	99%	OK
200 ppm tracers	N/A	7/9/98				196	98%	OK	192	96%	OK				198	99%	OK	194	97%	OK
200 ppm tracers	N/A	7/14/98				202	101%	OK	199	100%	OK				202	101%	OK	200	100%	OK
200 ppm tracer alcohols		5/19/98	198	99%	OK	200	100%	OK	199	99%	OK	nd			201	101%	OK	201	101%	OK

Project: PITT at ESTCP Camp Lejeune
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nd = not detected
DUP = Duplicate
d,DUP = diluted duplicate
j,b = carrover in method blanks

Blank Results

Sample ID	Date and Time	Date Analyzed	Methanol	Flag for Methanol	1-Propanol	Flag for 1-Propanol	4-Methanol-2 pentanol	Flag for 4-Methanol-2-pentanol	PCE	Flag for PCE	1-Hexanol	Flag for 1-Hexanol	1-Heptanol	Flag for 1-Heptanol
blank (Milli-Q)	N/A	5/19/98	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
blk H2O	N/A	5/24/98	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
blk H2O	N/A	5/27/98	0	j,b	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
blk H2O	N/A	5/27/98	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
blk	N/A	6/4/98			4	j,b	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/6/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/6/98			1	j,b	1	j,b			2	j,b	5	j,b
blk H2O	N/A	6/8/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/8/98			2	j,b	2	j,b			nd	BDL	nd	BDL
blk H2O	N/A	6/9/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/11/98			nd	BDL	2	j,b			3	j,b	nd	BDL
blk H2O	N/A	6/11/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/16/98			1	j,b	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/20/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/22/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/24/98			2	j,b	2	j,b			nd	BDL	4	j,b
blk H2O	N/A	6/25/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/26/98			1	j,b	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/26/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/26/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	6/30/98			nd	BDL	nd	BDL			nd	BDL	5	j,b
blk H2O	N/A	7/8/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	7/8/98			nd	BDL	1	j,b			5	j,b	6	j,b
blk H2O	N/A	7/9/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	7/9/98			1	j,b	1	j,b			4	j,b	6	j,b
blk H2O	N/A	7/14/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
blk H2O	N/A	7/14/98			nd	BDL	1	j,b			4	j,b	4	j,b

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Sample Point: MLS-3 @ 17.5 ft BGS

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
3-17.5	5/13/98 20:20	5/19/98	nd	BDL	nd	BDL	nd	BDL	~221	jj	nd	BDL	nd	BDL
3-17.5 (1)	5/14/98 9:15	5/19/98	nd	BDL	nd	BDL	nd	BDL	~213	jj	nd	BDL	nd	BDL
3-17.5 (1)	5/15/98 9:20	5/24/98	0	j	nd	BDL	nd	BDL	55	OK	nd	BDL	nd	BDL
3-17.5 (2)	5/15/98 15:12	5/24/98	0	j	nd	BDL	nd	BDL	78	OK	nd	BDL	nd	BDL
3-17.5 (2) D	5/15/98 15:12	5/24/98	0	j	nd	BDL	nd	BDL	80	OK	nd	BDL	nd	BDL
3-17.5 (3)	5/15/98 20:20	5/24/98	0	j	nd	BDL	nd	BDL	66	OK	nd	BDL	nd	BDL
3-17.5 (1)	5/16/98 8:31	5/24/98	nd	BDL	nd	BDL	nd	BDL	49	OK	nd	BDL	nd	BDL
3-17.5/011	5/16/98 19:50	5/26/98	nd	BDL	nd	BDL	nd	BDL	7	j	nd	BDL	nd	BDL
3-17.5/012	5/17/98 8:50	5/26/98	nd	BDL	nd	BDL	nd	BDL	20	OK	nd	BDL	nd	BDL
3-17.5/013	5/17/98 13:23	5/26/98	nd	BDL	nd	BDL	nd	BDL	14	OK	nd	BDL	nd	BDL
3-17.5/014	5/17/98 19:03	5/27/98	nd	BDL	nd	BDL	nd	BDL	14	OK	nd	BDL	nd	BDL
3-17.5/014 [dup]	5/17/98 19:03	5/27/98	nd	DUP	nd	DUP	nd	DUP	11	DUP	nd	DUP	nd	DUP
3-17.5/015	5/18/98 9:15	6/4/98			nd	BDL	nd	BDL			4	j	nd	BDL
3-17.5/015 [dup]	5/18/98 9:15	6/4/98			nd	DUP	nd	DUP			4	DUP	nd	DUP
3-17.5/015 A	5/18/98 13:54	6/5/98			nd	BDL	nd	BDL			4	j	nd	BDL
3-17.5/016	5/18/98 19:50	6/5/98			nd	BDL	nd	BDL			5	j	nd	BDL
3-17.5/017	5/19/98 8:28	6/5/98			nd	BDL	nd	BDL			1	j	nd	BDL
3-17.5/018	5/19/98 19:17	6/6/98			1	j	1	j			0	j	nd	BDL
3-17.5/018 [dup]	5/19/98 19:17	6/6/98			2	DUP	2	DUP			1	DUP	nd	DUP
3-17.5/019	5/20/98 9:43	6/7/98			3	j	1	j			nd	BDL	nd	BDL
3-17.5/020	5/20/98 19:48	6/7/98			4	j	1	j			nd	BDL	nd	BDL
3-17.5/021	5/21/98 10:55	6/7/98			20	OK	11	OK			7	j	nd	BDL
3-17.5/022	5/21/98 19:47	6/7/98			26	OK	16	OK			10	OK	5	j
3-17.5/023	5/22/98 8:15	6/8/98			31	OK	19	OK			14	OK	6	j
3-17.5/024	5/22/98 19:42	6/8/98			71	OK	48	OK			40	OK	12	OK
3-17.5/024D	5/22/98 19:42	6/8/98			89	OK	61	OK			52	OK	16	OK
3-17.5/022 [dup]	5/22/98 19:47	6/7/98			31	DUP	20	DUP			13	DUP	5	DUP
3-17.5/025	5/23/98 9:06	6/9/98			84	OK	65	OK			59	OK	26	OK
3-17.5/026	5/23/98 18:38	6/9/98			81	OK	58	OK			47	OK	25	OK

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
3-17.5/026 [dup]	5/23/98 18:38	6/9/98			82	DUP	57	DUP			48	DUP	19	DUP
3-17.5/027	5/24/98 9:26	6/9/98			98	OK	74	OK			60	OK	24	OK
3-17.5/028	5/24/98 19:20	6/9/98			130	OK	97	OK			83	OK	34	OK
3-17.5/029	5/25/98 8:17	6/9/98			90	OK	67	OK			56	OK	nd	BDL
3-17.5/029 (1:10)	5/25/98 8:17	7/1/98			118	d	82	d			84	d	40	d
3-17.5/030	5/25/98 21:00	6/9/98			85	OK	62	OK			50	OK	nd	BDL
3-17.5/030	5/25/98 21:00	6/10/98			299	jj	198	OK			170	OK	75	OK
3-17.5/031	5/26/98 7:40	6/11/98			208	jj	147	OK			134	OK	59	OK
3-17.5/032	5/27/98 7:50	6/11/98			188	OK	139	OK			118	OK	55	OK
3-17.5/033	5/28/98 7:30	6/11/98			176	OK	142	OK			126	OK	60	OK
3-17.5/034	5/29/98 7:30	6/12/98			180	OK	169	OK			154	OK	77	OK
3-17.5/035	5/30/98 7:30	6/12/98			199	OK	159	OK			154	OK	79	OK
3-17.5/036	5/31/98 7:20	6/12/98			186	OK	160	OK			141	OK	60	OK
3-17.5/037	6/1/98 10:05	6/15/98			208	jj	195	OK			188	OK	108	OK
3-17.5/038	6/2/98 7:50	6/15/98			193	OK	189	OK			179	OK	110	OK
3-17.5/038	6/2/98 7:50	6/15/98			193	OK	202	jj			179	OK	110	OK
3-17.5/038 [dup]	6/2/98 7:50	6/15/98			192	DUP	184	DUP			180	DUP	107	DUP
3-17.5/039	6/3/98 7:45	6/21/98			144	OK	136	OK			140	OK	75	OK
3-17.5/040	6/4/98 8:12	6/21/98			153	OK	152	OK			150	OK	94	OK
3-17.5/041	6/5/98 8:50	6/21/98			105	OK	105	OK			107	OK	75	OK
3-17.5/042	6/6/98 8:37	6/22/98			80	OK	74	OK			75	OK	52	OK
3-17.5/043	6/7/98 9:02	6/18/98			79	OK	76	OK			73	OK	51	OK
3-17.5/043 [dup]	6/7/98 9:02	6/18/98			71	DUP	68	DUP			67	DUP	46	DUP
3-17.5/044	6/8/98 9:02	6/18/98			75	OK	70	OK			68	OK	46	OK
3-17.5/045	6/9/98 8:33	6/18/98			66	OK	64	OK			59	OK	40	OK
3-17.5/046	6/10/98 9:07	6/18/98			62	OK	59	OK			58	OK	36	OK
3-17.5/047	6/11/98 9:32	6/18/98			62	OK	56	OK			56	OK	36	OK
3-17.5/048	6/12/98 9:26	6/18/98			64	OK	61	OK			58	OK	38	OK
3-17.5/049	6/13/98 9:22	6/18/98			55	OK	55	OK			49	OK	31	OK
3-17.5/050	6/14/98 10:25	6/24/98			42	OK	41	OK			37	OK	26	OK
3-17.5/051	6/15/98 9:30	6/24/98			48	OK	43	OK			41	OK	25	OK
3-17.5/052	6/16/98 7:53	6/24/98			47	OK	46	OK			44	OK	26	OK
3-17.5/053	6/17/98 11:31	6/23/98			49	OK	46	OK			41	OK	29	OK
3-17.5/054	6/17/98 11:35	6/23/98			41	OK	43	OK			33	OK	24	OK
3-17.5/055	6/19/98 7:50	6/25/98			37	OK	42	OK			39	OK	25	OK
3-17.5/056	6/20/98 8:20	6/25/98			28	OK	32	OK			29	OK	20	OK
3-17.5/057	6/21/98 8:20	6/26/98			26	OK	31	OK			31	OK	18	OK
3-17.5/058	6/22/98 7:45	6/26/98			26	OK	35	OK			27	OK	22	OK
3-17.5/058	6/22/98 7:45	6/26/98			26	OK	35	OK			27	OK	22	OK

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j = below reporting limit
d = diluted sample
BDL = below detection limit
NA = not applicable
jj = out of acceptable QA/QC and/or calibration limits
OK = within acceptable QA/QC limits
nd = not detected
DUP = Duplicate
d,DUP = diluted duplicate

Sample Point: MLS-2 @ 18.5 ft BGS

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
2-18.5	5/13/98 20:05	5/19/98	nd	BDL	nd	BDL	nd	BDL	*~243*	jj	nd	BDL	nd	BDL
2-18.5 (1)	5/14/98 8:50	5/19/98	nd	BDL	nd	BDL	nd	BDL	*~236*	jj	nd	BDL	nd	BDL
2-18.5 (2)	5/14/98 14:30	5/21/98	nd	BDL	nd	BDL	nd	BDL	49	OK	nd	BDL	nd	BDL
2-18.5 (3)	5/14/98 19:58	5/22/98	nd	BDL	nd	BDL	nd	BDL	108	OK	nd	BDL	nd	BDL
2-18.5 (1)	5/15/98 9:46	5/24/98	0	j	nd	BDL	nd	BDL	84	OK	nd	BDL	nd	BDL
2-18.5 (2)	5/15/98 15:06	5/24/98	0	j	nd	BDL	nd	BDL	139	OK	nd	BDL	nd	BDL
2-18.5 (3)	5/15/98 20:14	5/24/98	0	j	nd	BDL	nd	BDL	61	OK	nd	BDL	nd	BDL
2-18.5 (1)	5/16/98 8:45	5/24/98	0	j	nd	BDL	nd	BDL	157	OK	nd	BDL	nd	BDL
2-18.5/011 (1:1)	5/16/98 19:58	5/26/98	nd	d	nd	d	nd	d	212	d	nd	d	nd	d
2-18.5/012 (1:3)	5/17/98 8:35	5/26/98	nd	d	nd	d	nd	d	67	d	1	d	nd	d
2-18.5/013 (1:3)	5/17/98 13:42	5/26/98	nd	d	nd	d	nd	d	71	d	1	d	nd	d
2-18.5/014 (1:3)	5/17/98 19:15	5/27/98	nd	d	nd	d	nd	d	64	d	1	d	nd	d
2-18.5/015 (1/3)	5/18/98 9:06	6/4/98			12	d	19	d			37	d	32	d
2-18.5/015 A (1/3)	5/18/98 13:47	6/4/98			12	d	18	d			24	d	25	d
2-18.5/016 (1/3)	5/18/98 19:46	6/5/98			13	d	20	d			51	d	45	d
2-18.5/017 (1/3)	5/19/98 8:20	6/5/98			nd	d	nd	d			10	d	1	d
2-18.5/024	5/22/98 19:52	6/8/98			nd	BDL	nd	BDL			nd	BDL	0	j
2-18.5/025	5/23/98 9:01	6/9/98			nd	BDL	nd	BDL			nd	BDL	1	j
2-18.5/026	5/23/98 18:52	6/9/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
2-18.5/027	5/24/98 9:17	6/9/98			0	j	nd	BDL			nd	BDL	nd	BDL
2-18.5/028	5/24/98 19:33	6/9/98			2	j	nd	BDL			nd	BDL	nd	BDL
2-18.5/029	5/25/98 8:11	6/9/98			4	j	45	OK			nd	BDL	nd	BDL
2-18.5/029 [dup]	5/25/98 8:11	6/9/98			3	DUP	40	DUP			nd	DUP	nd	DUP
2-18.5/030	5/25/98 20:53	6/9/98			7	j	26	OK			nd	BDL	nd	BDL
2-18.5/030	5/25/98 20:53	6/10/98			18	OK	2	j			nd	BDL	5	j
2-18.5/031	5/26/98 7:35	6/11/98			16	OK	nd	BDL			nd	BDL	nd	BDL
2-18.5/032	5/27/98 8:05	6/11/98			39	OK	11	OK			nd	BDL	nd	BDL

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
2-18.5/032 [dup]	5/27/98 8:05	6/11/98			37	DUP	7	DUP			nd	DUP	nd	DUP
2-18.5/033	5/28/98 7:50	6/11/98			63	OK	12	OK			2	j	nd	BDL
2-18.5/034	5/29/98 7:50	6/12/98			81	OK	18	OK			4	j	nd	BDL
2-18.5/035	5/30/98 7:50	6/12/98			114	OK	31	OK			9	j	nd	BDL
2-18.5/035 [dup]	5/30/98 7:50	6/12/98			118	DUP	32	DUP			9	DUP	nd	DUP
2-18.5/036	5/31/98 7:40	6/12/98			136	OK	50	OK			15	OK	nd	BDL
2-18.5/037	6/1/98 10:00	6/15/98			163	OK	71	OK			30	OK	18	OK
2-18.5/038	6/2/98 7:45	6/15/98			200	OK	105	OK			46	OK	nd	BDL
2-18.5/039	6/3/98 7:40	6/21/98			153	OK	93	OK			46	OK	nd	BDL
2-18.5/040	6/4/98 8:07	6/21/98			144	OK	109	OK			56	OK	nd	BDL
2-18.5/041	6/5/98 8:44	6/21/98			153	OK	127	OK			72	OK	nd	BDL
2-18.5/042	6/6/98 8:50	6/22/98			112	OK	100	OK			67	OK	nd	BDL
2-18.5/043	6/7/98 8:55	6/17/98			128	OK	123	OK			84	OK	nd	BDL
2-18.5/044	6/8/98 8:55	6/17/98			107	OK	107	OK			80	OK	nd	BDL
2-18.5/045	6/9/98 8:23	6/17/98			112	OK	100	OK			98	OK	0	j
2-18.5/046	6/10/98 9:02	6/18/98			112	OK	119	OK			103	OK	1	j
2-18.5/047	6/11/98 9:26	6/18/98			98	OK	94	OK			80	OK	nd	BDL
2-18.5/048	6/12/98 9:16	6/18/98			97	OK	87	OK			84	OK	nd	BDL
2-18.5/049	6/13/98 9:16	6/18/98			84	OK	87	OK			77	OK	2	j
2-18.5/055	6/19/98 7:45	6/25/98			65	OK	65	OK			68	OK	16	OK
2-18.5/056	6/20/98 8:15	6/25/98			55	OK	57	OK			52	OK	16	OK
2-18.5/057	6/21/98 8:30	6/26/98			47	OK	42	OK			44	OK	12	OK
2-18.5/058	6/22/98 7:35	6/26/98			54	OK	54	OK			59	OK	20	OK

Project: PITT at ESTCP Camp Lejeune
Acceptable QA/QC limits: % Recovery between 80% and 120%

Data QA/QC by DW
Date created 1/22/99
Date last modified 1/26/99

Sample Legend
CC = Calibration check
j = below reporting limit
d = diluted sample
BDL = below detection limit
NA = not applicable
jj = out of acceptable QA/QC and/or calibration limits
OK = within acceptable QA/QC limits
nd = not detected
DUP = Duplicate
d,DUP = diluted duplicate

Sample Point: MLS-2 @ 17.0 ft BGS

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
2-17.0	5/13/98 19:58	5/19/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
2-17.0 (1)	5/14/98 8:35	5/19/98	nd	BDL	nd	BDL	nd	BDL	73	OK	nd	BDL	nd	BDL
2-17.0 (1) D	5/14/98 8:40	5/19/98	nd	BDL	nd	BDL	nd	BDL	69	OK	nd	BDL	nd	BDL
2-17.0 (1)	5/15/98 9:39	5/24/98	0	j	nd	BDL	nd	BDL	74	OK	nd	BDL	nd	BDL
2-17.0 (2)	5/15/98 14:47	5/24/98	nd	BDL	nd	BDL	nd	BDL	71	OK	nd	BDL	nd	BDL
2-17.0 (3)	5/15/98 20:03	5/24/98	nd	BDL	nd	BDL	nd	BDL	72	OK	nd	BDL	nd	BDL
2-17.0 (1)	5/16/98 9:01	5/24/98	4	j	4	j	1	j	60	OK	0	j	nd	BDL
2-17.0/011	5/16/98 19:53	5/26/98	516	jj	601	jj	473	jj	4	j	350	jj	33	OK
2-17.0/012	5/17/98 8:25	5/26/98	930	jj	1050	jj	940	jj	nd	BDL	849	jj	309	jj
2-17.0/013	5/17/98 13:38	5/26/98	999	jj	1100	jj	1010	jj	38	OK	945	jj	420	jj
2-17.0/014	5/17/98 19:10	5/26/98	914	jj	964	jj	890	jj	15	OK	840	jj	435	jj
2-17.0/015	5/18/98 8:54	6/4/98			>200	jj	>200	jj			>200	jj	>200	jj
2-17.0/015 (1:10)	5/18/98 8:54	7/8/98			1000	d	895	d			815	d	380	d
2-17.0/015 A	5/18/98 13:39	6/4/98			>200	jj	>200	jj			>200	jj	>200	jj
2-17.0/015 A (1:10)	5/18/98 13:39	7/8/98			947	d	798	d			751	d	336	d
2-17.0/016	5/18/98 19:40	6/5/98			>200	jj	>200	jj			>200	jj	>200	jj
2-17.0/016 (1:10)	5/18/98 19:40	7/8/98			968	d	856	d			782	d	433	d
2-17.0/017	5/19/98 8:14	6/5/98			>200	jj	>200	jj			>200	jj	>200	jj
2-17.0/017 (1:10)	5/19/98 8:14	7/8/98			981	d	829	d			765	d	386	d
2-17.0/018	5/19/98 19:20	6/5/98			>200	jj	>200	jj			>200	jj	>200	jj
2-17.0/018 (1:10)	5/19/98 19:20	7/8/98			1020	d	863	d			839	d	444	d
2-17.0/019 (1:10)	5/20/98 9:20	6/30/98			1050	d	991	d			901	d	529	d
2-17.0/020 (1:10)	5/20/98 19:57	6/30/98			1070	d	997	d			910	d	539	d
2-17.0/021 (1:10)	5/21/98 10:43	7/1/98			973	d	838	d			846	d	432	d
2-17.0/021 (1:10) [dup]	5/21/98 10:43	7/1/98			1050	d,DUP	1020	d,DUP			963	d,DUP	606	d,DUP
2-17.0/022 (1:10)	5/21/98 19:36	7/1/98			566	d	633	d			750	d	453	d
2-17.0/023 (1:10)	5/22/98 8:22	7/1/98			67	d	90	d			183	d	309	d
2-17.0/025	5/23/98 8:56	6/9/98			19	OK	20	OK			44	OK	163	OK
2-17.0/026	5/23/98 18:46	6/9/98			7	j	17	OK			33	OK	143	OK
2-17.0/027	5/24/98 9:05	6/9/98			3	j	6	j			16	OK	89	OK

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
2-17.0/028	5/24/98 19:28	6/9/98			39	OK	2	j			6	j	37	OK
2-17.0/029	5/25/98 8:05	6/9/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
2-17.0/029	5/25/98 8:05	6/9/98			40	OK	55	OK			71	OK	34	OK
2-17.0/030	5/25/98 20:48	6/10/98			nd	BDL	3	j			8	j	41	OK
2-17.0/031	5/26/98 7:28	6/10/98			nd	BDL	nd	BDL			nd	BDL	17	OK
2-17.0/032	5/27/98 7:55	6/11/98			nd	BDL	nd	BDL			nd	BDL	23	OK
2-17.0/033	5/28/98 7:40	6/11/98			nd	BDL	nd	BDL			nd	BDL	7	j
2-17.0/034	5/29/98 7:40	6/12/98			nd	BDL	nd	BDL			nd	BDL	2	j
2-17.0/035	5/30/98 7:40	6/12/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
2-17.0/036	5/31/98 7:30	6/12/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
2-17.0/036 [dup]	5/31/98 7:30	6/12/98			nd	DUP	nd	DUP			nd	DUP	nd	DUP
2-17.0/037	6/1/98 9:50	6/13/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
2-17.0/038	6/2/98 7:35	6/15/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
2-17.0/039	6/3/98 7:35	6/21/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
2-17.0/040	6/4/98 8:00	6/21/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
2-17.0/041	6/5/98 8:37	6/21/98			nd	BDL	1	j			nd	BDL	nd	BDL
2-17.0/042	6/6/98 8:45	6/22/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
2-17.0/043	6/7/98 8:48	6/17/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
2-17.0/044	6/8/98 8:48	6/17/98			0	j	nd	BDL			nd	BDL	nd	BDL
2-17.0/045	6/9/98 8:14	6/17/98			0	j	1	j			3	j	4	j
2-17.0/046	6/10/98 8:55	6/17/98			2	j	nd	BDL			nd	BDL	nd	BDL
2-17.0/046D	6/10/98 8:55	6/17/98			2	j	nd	BDL			nd	BDL	nd	BDL
2-17.0/047	6/11/98 9:20	6/17/98			1	j	nd	BDL			nd	BDL	nd	BDL
2-17.0/047 [dup]	6/11/98 9:20	6/17/98			1	DUP	nd	DUP			nd	DUP	0	DUP
2-17.0/048	6/12/98 9:00	6/17/98			2	j	nd	BDL			nd	BDL	nd	BDL
2-17.0/049	6/13/98 9:07	6/17/98			1	j	nd	BDL			nd	BDL	nd	BDL
2-17.0/055	6/19/98 7:40	6/25/98			nd	BDL	2	j			nd	BDL	nd	BDL
2-17.0/056	6/20/98 8:06	6/25/98			nd	BDL	nd	BDL			2	j	nd	BDL
2-17.0/057	6/21/98 8:40	6/26/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
2-17.0/058	6/22/98 7:20	6/26/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL

Project: PITT at ESTCP Camp Lejeune
Acceptable QA/QC limits: % Recovery between 80% and 120%

Data QA/QC by DW
Date created 1/22/99
Date last modified 1/26/99

Sample Legend
CC = Calibration check
j = below reporting limit
d = diluted sample
BDL = below detection limit
NA = not applicable
jj = out of acceptable QA/QC and/or calibration limits
OK = within acceptable QA/QC limits
nd = not detected
DUP = Duplicate
d,DUP = diluted duplicate

Sample Point: Extraction Well EX1

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX1/004 A	5/13/98 17:30	5/19/98	nd	BDL	nd	BDL	nd	BDL	107	OK	nd	BDL	nd	BDL
EX1/003 M	5/14/98 7:33	5/19/98	nd	BDL	nd	BDL	nd	BDL	156	OK	nd	BDL	nd	BDL
EX1/005 A	5/14/98 7:40	5/19/98	nd	BDL	nd	BDL	nd	BDL	129	OK	nd	BDL	nd	BDL
EX1/010 A	5/14/98 13:30	5/19/98	nd	BDL	nd	BDL	nd	BDL	~204	jj	nd	BDL	nd	BDL
EX1/011 A	5/14/98 19:30	5/19/98	nd	BDL	nd	BDL	nd	BDL	~227	jj	nd	BDL	nd	BDL
EX1/006 M	5/14/98 19:47	5/19/98	nd	BDL	nd	BDL	nd	BDL	~239	jj	nd	BDL	nd	BDL
EX1/012 A	5/15/98 1:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	~220	jj	nd	BDL	nd	BDL
EX1/013 A	5/15/98 7:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	~232	jj	nd	BDL	nd	BDL
EX1/014 A	5/15/98 13:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	~235	jj	nd	BDL	nd	BDL
EX1/015 A	5/15/98 19:30	5/20/98	0	j	0	j	0	j	~221	jj	0	j	nd	BDL
EX1/016 AD	5/15/98 19:40	5/20/98	0	j	0	j	0	j	~230	jj	0	j	nd	BDL
EX1/008 M	5/15/98 19:54	5/20/98	0	j	0	j	0	j	~217	jj	0	j	nd	BDL
EX1/017 A	5/16/98 1:30	5/20/98	1	j	1	j	1	j	~198	jj	0	j	0	j
EX1/018 A	5/16/98 7:30	5/20/98	3	j	3	j	2	j	~216	jj	1	j	0	j
EX1/009 M	5/16/98 7:42	5/20/98	3	j	3	j	2	j	~232	jj	2	j	0	j
EX1/019 EB	5/16/98 10:40	5/24/98	nd	BDL	nd	BDL	nd	BDL	~264	jj	nd	BDL	nd	BDL
EX1/019 EB	5/16/98 10:40	5/24/98	nd	BDL	nd	BDL	nd	BDL	183	OK	0	j	nd	BDL
EX1/019 EB	5/16/98 10:40	5/24/98	nd	BDL	nd	BDL	nd	BDL	~264	jj	nd	BDL	nd	BDL
EX1/019 EB	5/16/98 10:40	5/24/98	nd	BDL	nd	BDL	nd	BDL	183	OK	0	j	nd	BDL
EX1/022 A	5/16/98 13:30	5/25/98	6	j	7	j	5	j	150	OK	4	j	1	j
EX1/023 A	5/16/98 19:40	5/25/98	11	OK	12	OK	9	j	93	OK	6	j	1	j
EX1/020 M	5/16/98 20:20	5/25/98	13	OK	16	OK	11	OK	~239	jj	8	j	2	j
EX1/024 A	5/17/98 7:05	5/26/98	34	OK	39	OK	27	OK	~276	jj	18	OK	4	j
EX1/021 M	5/17/98 7:40	5/26/98	36	OK	38	OK	27	OK	~270	jj	19	OK	4	j
EX1/029 A	5/17/98 13:40	5/26/98	50	OK	53	OK	37	OK	~309	jj	26	OK	7	j
EX1/030 A	5/17/98 19:40	5/26/98	69	OK	75	OK	51	OK	~220	jj	37	OK	8	j
EX1/031 A	5/18/98 1:40	5/27/98	82	OK	84	OK	60	OK	~217	jj	43	OK	10	OK
EX1/032 A	5/18/98 7:40	5/27/98	90	OK	93	OK	67	OK	~234	jj	50	OK	12	OK
EX1/033 AD	5/18/98 7:50	5/27/98	87	OK	90	OK	66	OK	~207	jj	50	OK	12	OK

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX1/026 M	5/18/98 8:00	6/4/98			97	OK	64	OK		j	54	OK	16	OK
EX1/035 A	5/18/98 13:40	5/27/98	99	OK	103	OK	75	OK	~222	jj	57	OK	15	OK
EX1/036 A	5/18/98 19:40	5/27/98	116	OK	120	OK	83	OK	~227	jj	63	OK	17	OK
EX1/037 A	5/19/98 1:40	6/5/98			136	OK	78	OK		j	68	OK	15	OK
EX1/028 M	5/19/98 7:37	6/5/98			146	OK	76	OK		j	57	OK	18	OK
EX1/038 A	5/19/98 7:40	6/5/98			145	OK	88	OK		j	77	OK	15	OK
EX1/034 EB	5/19/98 10:39	6/5/98			nd	BDL	nd	BDL		j	5	j	nd	BDL
EX1/040 A	5/19/98 13:40	6/5/98			183	OK	114	OK		j	96	OK	20	OK
EX1/041 A	5/19/98 19:40	6/5/98			228	jj	129	OK		j	106	OK	24	OK
EX1/039 M	5/19/98 19:53	6/5/98			187	OK	95	OK		j	66	OK	20	OK
EX1/042 A	5/20/98 1:50	6/6/98			>200	jj	172	OK		j	134	OK	33	OK
EX1/042 A (1:10)	5/20/98 1:50	6/30/98			181	OK	138	OK		j	125	OK	60	OK
EX1/043 A	5/20/98 7:50	6/6/98			>200	jj	182	OK		j	143	OK	39	OK
EX1/043 A (1:10)	5/20/98 7:50	6/30/98			204	jj	155	OK		j	111	OK	32	OK
EX1/045 A	5/20/98 21:00	6/6/98			>200	jj	191	OK		j	148	OK	37	OK
EX1/045 A (1:10)	5/20/98 21:00	6/30/98			224	jj	153	OK		j	104	OK	30	OK
EX1/044 M	5/20/98 21:40	6/7/98			228	jj	152	OK		j	120	OK	30	OK
EX1/046 A	5/21/98 9:00	6/7/98			>200	jj	167	OK		j	131	OK	28	OK
EX1/046 A (1:10)	5/21/98 9:00	6/30/98			215	jj	157	OK		j	125	OK	40	OK
EX1/048 A	5/21/98 21:00	6/7/98			215	jj	171	OK		j	149	OK	47	OK
EX1/048 A (1:10)	5/21/98 21:00	7/1/98			210	jj	141	OK		j	148	OK	55	OK
EX1/047 M	5/21/98 21:01	6/7/98			227	jj	165	OK		j	134	OK	40	OK
EX1/049 A	5/22/98 9:00	6/7/98			214	jj	181	OK		j	153	OK	53	OK
EX1/051 A	5/22/98 21:00	6/7/98			196	OK	172	OK		j	150	OK	48	OK
EX1/050 M	5/22/98 21:01	6/8/98			200	OK	163	OK		j	140	OK	47	OK
EX1/052 A	5/23/98 8:50	6/8/98			175	OK	178	OK		j	167	OK	62	OK
EX1/053 M	5/23/98 19:06	6/8/98			154	OK	156	OK		j	161	OK	63	OK
EX1/055 A	5/23/98 21:00	6/8/98			117	OK	118	OK		j	114	OK	50	OK
EX1/056 A	5/24/98 9:00	6/9/98			90	OK	104	OK		j	97	OK	37	OK
EX1/057 A	5/24/98 21:00	6/9/98			86	OK	116	OK		j	113	OK	47	OK
EX1/058 A	5/25/98 9:00	6/9/98			74	OK	104	OK		j	106	OK	42	OK
EX1/058 A [dup]	5/25/98 9:00	6/9/98			60	OK	84	OK		j	87	OK	40	OK
EX1/054 M	5/25/98 10:30	6/9/98			47	OK	63	OK		j	60	OK	nd	BDL
EX1/059 A	5/25/98 21:00	7/14/98			67	OK	105	OK		j	134	OK	56	OK
EX1/060 A	5/26/98 8:50	6/10/98			36	OK	55	OK		j	65	OK	nd	BDL
EX1/060 A	5/26/98 8:50	6/10/98			112	OK	145	OK		j	198	OK	85	OK
EX1/061 AD	5/26/98 9:00	6/10/98			0	j	8	j		j	nd	BDL	nd	BDL
EX1/061 AD	5/26/98 9:00	6/10/98			66	OK	86	OK		j	120	OK	52	OK
EX1/062	5/26/98 9:20	6/10/98			>200	jj	>200	jj		j	181	OK	88	OK
EX1/062 EB	5/26/98 9:20	6/10/98			nd	BDL	2	j		j	5	j	nd	BDL
EX1/063 M	5/26/98 12:10	6/10/98			57	OK	68	OK		j	108	OK	49	OK

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX1/064A	5/27/98 11:00	6/11/98			34	OK	47	OK		j	107	OK	53	OK
EX1/067 A	5/28/98 10:50	6/11/98			20	OK	26	OK		j	47	OK	35	OK
EX1/065 A	5/28/98 11:00	6/11/98			28	OK	40	OK		j	73	OK	48	OK
EX1/066 M	5/28/98 12:35	6/11/98			27	OK	34	OK		j	67	OK	36	OK
EX1/068 M	5/29/98 20:40	6/12/98			16	OK	18	OK		j	34	OK	nd	BDL
EX1/070 A	5/30/98 11:00	6/12/98			16	OK	19	OK		j	34	OK	37	OK
EX1/069 M	5/30/98 11:24	6/12/98			16	OK	21	OK		j	31	OK	25	OK
EX1/071 A	5/31/98 11:00	6/12/98			12	OK	17	OK		j	25	OK	29	OK
EX1/072 M	5/31/98 11:31	6/12/98			12	OK	17	OK		j	25	OK	22	OK
EX1/073 A	6/1/98 10:50	6/12/98			11	OK	14	OK		j	20	OK	24	OK
EX1/074 M	6/1/98 11:29	6/15/98			13	OK	18	OK		j	27	OK	35	OK
EX1/075 A	6/2/98 11:00	6/15/98			9	j	11	OK		j	15	OK	26	OK
EX1/076 A	6/3/98 11:00	6/20/98			7	j	10	OK		j	17	OK	32	OK
EX1/077 M	6/3/98 11:39	6/21/98			6	j	8	j		j	12	OK	24	OK
EX1/078 M	6/4/98 11:37	6/21/98			6	j	8	j		j	16	OK	34	OK
EX1/079 A	6/5/98 11:00	6/21/98			6	j	8	j		j	14	OK	30	OK
EX1/080 M	6/5/98 11:08	6/21/98			5	j	7	j		j	11	OK	33	OK
EX1/081 A	6/6/98 11:00	6/21/98			4	j	9	j		j	14	OK	36	OK
EX1/082 A	6/7/98 10:50	6/24/98			7	j	7	j		j	13	OK	30	OK
EX1/083 M	6/7/98 11:19	6/24/98			5	j	7	j		j	6	j	25	OK
EX1/084 A	6/8/98 11:00	6/24/98			5	j	5	j		j	8	j	26	OK
EX1/085 A	6/9/98 11:00	6/24/98			5	j	8	j		j	9	j	28	OK
EX1/086 M	6/9/98 11:05	6/25/98			6	j	7	j		j	12	OK	29	OK
EX1/086 M [dup]	6/9/98 11:05	6/25/98			6	DUP	9	DUP		DUP	10	DUP	39	DUP
EX1/087 A	6/10/98 10:50	6/16/98			3	j	4	j		j	7	j	18	OK
EX1/089 A	6/11/98 11:00	6/16/98			4	j	4	j		j	5	j	20	OK
EX1/089 A	6/11/98 11:00	6/16/98			6	j	4	j		j	5	j	20	OK
EX1/088 M	6/11/98 11:16	6/16/98			5	j	4	j		j	7	j	22	OK
EX1/090 M/A	6/12/98 11:56	6/16/98			3	j	3	j		j	4	j	14	OK
EX1/091 M/A	6/13/98 11:07	6/17/98			4	j	4	j		j	5	j	18	OK
EX1/092 M	6/13/98 11:08	6/17/98			3	j	3	j		j	3	j	15	OK
EX1/092 M [dup]	6/13/98 11:08	6/17/98			5	DUP	3	DUP		DUP	3	DUP	16	DUP
EX1/093 M/A	6/14/98 11:03	6/23/98			6	j	3	j		j	5	j	14	OK
EX1/094 M/A	6/15/98 11:10	6/23/98			6	j	2	j		j	3	j	10	OK
EX1/095 M	6/15/98 11:32	6/23/98			6	j	3	j		j	4	j	5	j
EX1/096 A	6/16/98 10:50	6/23/98			5	j	4	j		j	3	j	4	j
EX1/097 AD	6/16/98 11:00	6/23/98			7	j	3	j		j	3	j	9	j
EX1/098 EB	6/16/98 11:22	6/23/98			nd	BDL	nd	BDL		j	nd	BDL	nd	BDL
EX1/099 A	6/17/98 11:00	6/22/98			4	j	3	j		j	4	j	8	j
EX1/100 M	6/17/98 11:25	6/22/98			4	j	3	j		j	4	j	9	j
EX1/101 A	6/18/98 11:00	6/22/98			4	j	3	j		j	4	j	9	j

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX1/102 A	6/19/98 10:50	6/25/98			5	j	3	j		j	4	j	11	OK
EX1/103 M	6/19/98 11:29	6/25/98			5	j	5	j		j	5	j	4	j
EX1/104 A	6/20/98 11:00	6/25/98			5	j	5	j		j	4	j	8	j
EX1/105 A	6/21/98 11:00	6/26/98			6	j	5	j		j	8	j	9	j
EX1/107 A	6/22/98 10:50	6/26/98			6	j	8	j		j	5	j	8	j

Project: PITT at ESTCP Camp Lejeune
Acceptable QA/QC limits: % Recovery between 80% and 120%

Data QA/QC by	DW
Date created	1/22/99 0:00
Date last modified	1/26/99 0:00

Sample Legend

CC = Calibration check
j = below reporting limit
d = diluted sample
BDL = below detection limit
NA = not applicable
jj = out of acceptable QA/QC and/or calibration limits
OK = within acceptable QA/QC limits
nd = not detected
DUP = Duplicate
d,DUP = diluted duplicate

Sample Point: Extraction Well EX2

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX2/004 A	5/13/98 17:30	5/19/98	nd	BDL	nd	BDL	nd	BDL	52	OK	nd	BDL	nd	BDL
EX2/003 M	5/14/98 7:34	5/19/98	nd	BDL	nd	BDL	nd	BDL	56	OK	nd	BDL	nd	BDL
EX2/005 A	5/14/98 7:40	5/19/98	nd	BDL	nd	BDL	nd	BDL	49	OK	nd	BDL	nd	BDL
EX2/006 EB	5/14/98 11:30	5/19/98	nd	BDL	nd	BDL	nd	BDL	1	j	nd	BDL	nd	BDL
EX2/006 EB	5/14/98 11:30	5/19/98	nd	BDL	nd	BDL	nd	BDL	1	j	nd	BDL	nd	BDL
EX2/011 A	5/14/98 13:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	84	OK	nd	BDL	nd	BDL
EX2/012 A	5/14/98 19:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	131	OK	nd	BDL	nd	BDL
EX2/007 M	5/14/98 19:50	5/20/98	nd	BDL	nd	BDL	nd	BDL	83	OK	nd	BDL	nd	BDL
EX2/013 A	5/15/98 1:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	91	OK	nd	BDL	nd	BDL
EX2/013 A [dup]	5/15/98 1:30	5/20/98	nd	DUP	nd	DUP	nd	DUP	90	DUP	nd	DUP	nd	DUP
EX2/014 A	5/15/98 7:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	81	OK	nd	BDL	nd	BDL
EX2/015 A	5/15/98 13:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	95	OK	nd	BDL	nd	BDL
EX2/016 A	5/15/98 19:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	91	OK	nd	BDL	nd	BDL
EX2/009 M	5/15/98 19:55	5/20/98	nd	BDL	nd	BDL	nd	BDL	111	OK	nd	BDL	nd	BDL
EX2/017 A	5/16/98 1:30	5/20/98	0	j	0	j	0	j	100	OK	0	j	nd	BDL
EX2/018 A	5/16/98 7:30	5/20/98	1	j	1	j	1	j	154	OK	1	j	0	j
EX2/010 M	5/16/98 7:44	5/20/98	1	j	1	j	1	j	98	OK	1	j	0	j
EX2/022 A	5/16/98 13:30	5/25/98	2	j	3	j	3	j	58	OK	2	j	0	j
EX2/023 A	5/16/98 19:40	5/25/98	6	j	8	j	7	j	44	OK	5	j	2	j
EX2/019 M	5/16/98 20:22	5/25/98	9	j	11	OK	10	j	99	OK	7	j	3	j
EX2/024 A	5/17/98 7:05	5/26/98	31	OK	36	OK	31	OK	119	OK	25	OK	10	j
EX2/022 M	5/17/98 7:42	5/26/98	34	OK	38	OK	34	OK	98	OK	27	OK	11	OK
EX2/029 A	5/17/98 13:40	5/26/98	54	OK	62	OK	55	OK	106	OK	46	OK	20	OK
EX2/030 A	5/17/98 19:40	5/26/98	81	OK	92	OK	82	OK	107	OK	71	OK	32	OK
EX2/031 A	5/18/98 1:40	5/27/98	104	OK	108	OK	99	OK	152	OK	87	OK	43	OK
EX2/032 A	5/18/98 7:40	5/27/98	8	j	132	OK	121	OK	*~172*	jj	111	OK	56	OK
EX2/026 M	5/18/98 8:02	6/4/98			177	OK	132	OK		j	125	OK	60	OK
EX2/033 A	5/18/98 13:40	5/27/98	151	OK	159	OK	145	OK	*~171*	jj	132	OK	71	OK
EX2/034 A	5/18/98 19:40	5/27/98	173	OK	179	OK	163	OK	*~233*	jj	150	OK	83	OK

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX2/035 A	5/19/98 1:40	6/5/98			191	OK	155	OK		j	177	OK	76	OK
EX2/028 M	5/19/98 7:39	6/5/98			209	jj	138	OK		j	122	OK	64	OK
EX2/036 A	5/19/98 7:40	6/5/98			178	OK	160	OK		j	183	OK	91	OK
EX2/038 A	5/19/98 13:40	6/5/98			217	jj	191	OK		j	218	jj	111	OK
EX2/039 A	5/19/98 19:40	6/5/98			291	jj	225	jj		j	257	jj	129	OK
EX2/040 AD	5/19/98 19:50	6/5/98			241	jj	202	jj		j	234	jj	110	OK
EX2/040 AD [dup]	5/19/98 19:50	6/5/98			237	DUP	200	DUP		DUP	224	DUP	105	DUP
EX2/037 M	5/19/98 19:54	6/5/98			183	OK	148	OK		j	133	OK	101	OK
EX2/043 A	5/20/98 7:50	6/6/98			>200	jj	>200	jj		j	>200	jj	186	OK
EX2/043 A (1:10)	5/20/98 7:50	6/30/98			271	d	238	d		d	250	d	110	d
EX2/041 EB	5/20/98 18:22	6/6/98			1	j	1	j		j	nd	BDL	1	j
EX2/045 A	5/20/98 21:00	6/6/98			>200	jj	>200	jj		j	>200	jj	152	OK
EX2/045 A (1:10)	5/20/98 21:00	6/30/98			311	d	266	d		d	267	d	163	d
EX2/044 M	5/20/98 21:41	6/7/98			>200	jj	>200	jj		j	>200	jj	158	OK
EX2/044 M (1:10)	5/20/98 21:41	6/30/98			267	d	224	d		d	212	d	127	d
EX2/046 A	5/21/98 9:00	6/7/98			>200	jj	>200	jj		j	>200	jj	156	OK
EX2/046 A (1:10)	5/21/98 9:00	7/1/98			335	d	307	d		d	292	d	152	d
EX2/048 A	5/21/98 21:00	6/7/98			>200	jj	239	jj		j	>200	jj	156	OK
EX2/047 M	5/21/98 21:02	6/7/98			>200	jj	>200	jj		j	>200	jj	177	OK
EX2/047 M (1:10)	5/21/98 21:02	7/1/98			285	d	265	d		d	251	d	143	d
EX2/049 A	5/22/98 9:00	6/7/98			4	j	14	OK		j	24	OK	36	OK
EX2/051 A	5/22/98 21:00	6/7/98			236	jj	196	OK		j	195	OK	136	OK
EX2/050 M	5/22/98 21:02	6/8/98			>200	jj	208	jj		j	215	jj	151	OK
EX2/050 M (1:10)	5/22/98 21:02	7/1/98			238	d	180	d		d	211	d	143	d
EX2/050 M (1:10) [dup]	5/22/98 21:02	7/1/98			229	d,DUP	169	d,DUP		d,DUP	206	d,DUP	129	d,DUP
EX2/052 A	5/23/98 8:50	6/8/98			209	jj	209	jj		j	223	jj	203	jj
EX2/053 AD	5/23/98 9:00	6/8/98			216	jj	213	jj		j	227	jj	207	jj
EX2/054 EB	5/23/98 10:45	6/8/98			nd	BDL	nd	BDL		j	4	j	3	j
EX2/055 M	5/23/98 19:09	6/8/98			180	OK	213	jj		j	197	OK	176	OK
EX2/055 M [dup]	5/23/98 19:09	6/9/98			178	DUP	206	DUP		DUP	192	DUP	176	DUP
EX2/057 A	5/23/98 21:00	6/8/98			152	OK	135	OK		j	135	OK	125	OK
EX2/058 A	5/24/98 9:00	6/9/98			120	OK	104	OK		j	100	OK	85	OK
EX2/059 A	5/24/98 21:00	6/9/98			130	OK	126	OK		j	127	OK	111	OK
EX2/060 AD	5/24/98 21:10	6/9/98			137	OK	123	OK		j	124	OK	113	OK
EX2/062 A	5/25/98 9:00	6/9/98			75	OK	66	OK		j	66	OK	29	OK
EX2/056 M	5/25/98 10:32	6/9/98			78	OK	73	OK		j	71	OK	53	OK
EX2/061 EB	5/25/98 12:35	6/9/98			nd	BDL	nd	BDL		j	nd	BDL	nd	BDL
EX2/063 A	5/25/98 21:00	7/14/98			89	OK	88	OK		j	101	OK	73	OK
EX2/064 A	5/26/98 8:50	6/10/98			91	OK	75	OK		j	85	OK	67	OK
EX2/065 M	5/26/98 12:12	6/10/98			84	OK	70	OK		j	79	OK	61	OK
EX2/066A	5/27/98 11:00	6/11/98			63	OK	52	OK		j	71	OK	53	OK

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX2/067 A	5/28/98 11:00	6/11/98			47	OK	40	OK		j	49	OK	35	OK
EX2/068 M	5/28/98 12:37	6/11/98			69	OK	53	OK		j	62	OK	44	OK
EX2/068 M [dup]	5/28/98 12:37	6/11/98			88	DUP	66	DUP		DUP	74	DUP	51	DUP
EX2/069 A	5/29/98 10:50	6/11/98			33	OK	33	OK		j	39	OK	27	OK
EX2/069 A [dup]	5/29/98 10:50	6/11/98			34	DUP	33	DUP		DUP	36	DUP	28	DUP
EX2/070 M	5/29/98 20:41	6/12/98			33	OK	29	OK		j	38	OK	24	OK
EX2/072 A	5/30/98 11:00	6/12/98			29	OK	27	OK		j	32	OK	25	OK
EX2/071 M	5/30/98 11:25	6/12/98			24	OK	24	OK		j	26	OK	17	OK
EX2/073 A	5/31/98 11:00	6/12/98			22	OK	20	OK		j	25	OK	23	OK
EX2/074 M	5/31/98 11:32	6/12/98			19	OK	21	OK		j	22	OK	17	OK
EX2/075 A	6/1/98 10:50	6/12/98			17	OK	18	OK		j	20	OK	10	j
EX2/076 M	6/1/98 11:34	6/15/98			22	OK	22	OK		j	24	OK	22	OK
EX2/077 A	6/2/98 11:00	6/15/98			18	OK	18	OK		j	20	OK	16	OK
EX2/078 A	6/3/98 11:00	6/21/98			12	OK	11	OK		j	15	OK	12	OK
EX2/079 M	6/3/98 11:41	6/21/98			12	OK	12	OK		j	14	OK	13	OK
EX2/080 A	6/4/98 10:50	6/21/98			12	OK	11	OK		j	12	OK	13	OK
EX2/081 AD	6/4/98 11:00	6/21/98			11	OK	10	OK		j	12	OK	13	OK
EX2/082 EB	6/4/98 11:40	6/21/98			*nd*	BDL	1	*j*		j	*nd*	BDL	*nd*	BDL
EX2/083 A	6/5/98 11:00	6/21/98			11	OK	12	OK		j	14	OK	14	OK
EX2/083 A [dup]	6/5/98 11:00	6/21/98			10	DUP	10	DUP		DUP	12	DUP	12	DUP
EX2/084 M	6/5/98 11:06	6/21/98			8	j	10	j		j	10	OK	12	OK
EX2/085 A	6/6/98 11:00	6/21/98			8	j	12	OK		j	14	OK	14	OK
EX2/086 A	6/7/98 10:50	6/24/98			10	j	9	j		j	10	OK	9	j
EX2/087 M	6/7/98 11:07	6/24/98			9	j	8	j		j	10	OK	10	OK
EX2/088 A	6/8/98 11:00	6/24/98			9	j	8	j		j	8	j	11	OK
EX2/088 A [dup]	6/8/98 11:00	6/24/98			8	DUP	8	DUP		DUP	8	DUP	10	DUP
EX2/089 A	6/9/98 11:00	6/24/98			9	j	10	j		j	10	OK	9	j
EX2/090 M	6/9/98 11:07	6/25/98			11	OK	11	OK		j	11	OK	13	OK
EX2/091 A	6/10/98 10:50	6/17/98			10	OK	9	j		j	8	j	9	j
EX2/093 A	6/11/98 11:00	6/17/98			10	j	7	j		j	8	j	6	j
EX2/092 M	6/11/98 11:18	6/17/98			12	OK	9	j		j	8	j	6	j
EX2/094 A	6/12/98 11:00	6/17/98			8	j	7	j		j	7	j	6	j
EX2/096 A	6/13/98 10:50	6/17/98			8	j	6	j		j	6	j	5	j
EX2/095 M	6/13/98 11:09	6/17/98			8	j	9	j		j	9	j	7	j
EX2/097 A	6/14/98 11:00	6/23/98			9	j	6	j		j	6	j	7	j
EX2/098 A	6/15/98 11:00	6/23/98			8	j	6	j		j	8	j	7	j
EX2/099 M	6/15/98 11:34	6/23/98			9	j	7	j		j	7	j	5	j
EX2/100 A	6/16/98 10:50	6/23/98			12	OK	7	j		j	7	j	5	j
EX2/100 A [dup]	6/16/98 10:50	6/23/98			11	DUP	7	DUP		DUP	7	DUP	4	DUP
EX2/101 A	6/17/98 11:00	6/22/98			6	j	7	j		j	7	j	4	j
EX2/102 M	6/17/98 11:29	6/22/98			5	j	4	j		j	5	j	nd	BDL

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX2/103 M/A	6/18/98 11:32	6/22/98			5	j	6	j		j	6	j	4	j
EX2/103 M/A [dup]	6/18/98 11:32	6/22/98			6	DUP	6	DUP		DUP	5	DUP	5	DUP
EX2/104 A	6/19/98 10:50	6/25/98			7	j	8	j		j	9	j	10	j
EX2/105 M	6/19/98 11:31	6/25/98			6	j	7	j		j	7	j	9	j
EX2/106 A	6/20/98 11:00	6/25/98			6	j	7	j		j	9	j	14	OK
EX2/107 A	6/21/98 11:00	6/26/98			6	j	8	j		j	8	j	6	j
EX2/108 M	6/21/98 11:28	6/26/98			5	j	6	j		j	6	j	5	j
EX2/109 A	6/22/98 10:50	6/26/98			5	j	6	j		j	6	j	6	j

Project: PITT at ESTCP Camp Lejeune
Acceptable QA/QC limits: % Recovery between 80% and 120%

Data QA/QC by DW
Date created 1/22/99
Date last modified 1/26/99

Sample Legend
CC = Calibration check
j = below reporting limit
d = diluted sample
BDL = *below detection limit*
NA = not applicable
jj = out of acceptable QA/QC and/or calibration limits
OK = within acceptable QA/QC limits
nd = not detected
DUP = Duplicate
d,DUP = diluted duplicate

Sample Point: Extraction Well EX3

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX3/004 A	5/13/98 17:30	5/19/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX3/003 M	5/14/98 7:37	5/19/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX3/005 A	5/14/98 7:40	5/19/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX3/010 A	5/14/98 13:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	3	j	nd	BDL	nd	BDL
EX3/012 A	5/14/98 19:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	3	j	nd	BDL	nd	BDL
EX3/006 M	5/14/98 19:51	5/20/98	nd	BDL	nd	BDL	nd	BDL	3	j	nd	BDL	nd	BDL
EX3/013 A	5/15/98 1:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	3	j	nd	BDL	nd	BDL
EX3/015 A	5/15/98 7:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	3	j	nd	BDL	nd	BDL
EX3/016 A	5/15/98 13:30	5/20/98	nd	BDL	nd	BDL	nd	BDL	3	j	nd	BDL	nd	BDL
EX3/017 A	5/15/98 19:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX3/018 AD	5/15/98 19:40	5/23/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX3/008 M	5/15/98 19:57	5/23/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX3/019 A	5/16/98 1:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX3/020 A	5/16/98 7:30	5/23/98	0	j	0	j	0	j	2	j	0	j	nd	BDL
EX3/009 M	5/16/98 7:45	5/23/98	0	j	0	j	0	j	2	j	0	j	nd	BDL
EX3/009 M [dup]	5/16/98 7:45	5/23/98	0	DUP	0	DUP	0	DUP	2	DUP	0	DUP	nd	DUP
EX3/014 EB	5/16/98 11:52	5/24/98	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
EX3/014 EB	5/16/98 11:52	5/24/98	0	j	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
EX3/014 EB	5/16/98 11:52	5/24/98	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
EX3/014 EB	5/16/98 11:52	5/24/98	0	j	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
EX3/023 A	5/16/98 13:30	5/25/98	nd	BDL	1	j	1	j	2	j	0	j	nd	BDL
EX3/024 A	5/16/98 19:40	5/25/98	1	j	2	j	2	j	1	j	1	j	0	j
EX3/021 M	5/16/98 20:24	5/25/98	2	j	4	j	3	j	2	j	2	j	1	j
EX3/025 A	5/17/98 7:05	5/26/98	11	OK	13	OK	12	OK	2	j	9	j	4	j
EX3/022 M	5/17/98 7:43	5/26/98	12	OK	17	OK	15	OK	2	j	12	OK	4	j
EX3/031 A	5/17/98 19:40	5/26/98	37	OK	42	OK	38	OK	2	j	31	OK	14	OK
EX3/032 A	5/18/98 1:40	5/27/98	49	OK	47	OK	45	OK	4	j	39	OK	19	OK
EX3/033 A	5/18/98 7:40	5/27/98	66	OK	66	OK	64	OK	3	j	58	OK	29	OK
EX3/027 M	5/18/98 8:03	6/4/98			79	OK	76	OK			66	OK	31	OK
EX3/034 A	5/18/98 13:40	5/27/98	68	OK	68	OK	67	OK	4	j	61	OK	34	OK
EX3/035 A	5/18/98 19:40	5/27/98	85	OK	85	OK	83	OK	5	j	78	OK	44	OK
EX3/036 A	5/19/98 1:40	6/5/98			91	OK	101	OK			96	OK	55	OK
EX3/037 A	5/19/98 7:40	6/5/98			134	OK	122	OK			111	OK	62	OK
EX3/029 M	5/19/98 7:41	6/5/98			106	OK	86	OK			77	OK	41	OK

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX3/039 A	5/19/98 13:40	6/5/98			111	OK	129	OK			117	OK	68	OK
EX3/040 A	5/19/98 19:40	6/5/98			118	OK	129	OK			117	OK	70	OK
EX3/041 AD	5/19/98 19:50	6/5/98			125	OK	137	OK			123	OK	72	OK
EX3/038 M	5/19/98 19:55	6/5/98			109	OK	95	OK			88	OK	66	OK
EX3/043 A	5/20/98 1:50	6/6/98			180	OK	159	OK			143	OK	87	OK
EX3/044 A	5/20/98 7:50	6/6/98			144	OK	142	OK			130	OK	83	OK
EX3/042 EB	5/20/98 18:40	6/6/98			1	j	nd	BDL			nd	BDL	nd	BDL
EX3/042 EB [dup]	5/20/98 18:40	6/6/98			1	DUP	nd	DUP			nd	DUP	nd	DUP
EX3/046 A	5/20/98 21:00	6/6/98			145	OK	138	OK			131	OK	85	OK
EX3/045 M	5/20/98 21:42	6/7/98			154	OK	149	OK			141	OK	92	OK
EX3/047 A	5/21/98 9:00	6/7/98			168	OK	184	OK			178	OK	114	OK
EX3/050 A	5/21/98 21:00	6/7/98			161	OK	157	OK			150	OK	98	OK
EX3/048 M	5/21/98 21:03	6/7/98			175	OK	160	OK			151	OK	102	OK
EX3/051 A	5/22/98 9:00	6/7/98			153	OK	138	OK			130	OK	89	OK
EX3/052 A	5/22/98 21:00	6/7/98			141	OK	122	OK			113	OK	84	OK
EX3/049 M	5/22/98 21:03	6/8/98			157	OK	140	OK			131	OK	100	OK
EX3/053 A	5/23/98 8:50	6/8/98			4	j	13	OK			13	OK	8	j
EX3/054 M	5/23/98 19:11	6/9/98			95	OK	107	OK			112	OK	110	OK
EX3/056 A	5/23/98 21:00	6/8/98			96	OK	107	OK			106	OK	108	OK
EX3/056 A	5/24/98 9:00	6/9/98			67	OK	66	OK			65	OK	64	OK
EX3/058 A	5/24/98 21:00	6/9/98			49	OK	50	OK			49	OK	51	OK
EX3/059 A	5/25/98 9:00	7/14/98			39	OK	47	OK			45	OK	38	OK
EX3/055 M	5/25/98 10:33	6/9/98			26	OK	22	OK			24	OK	nd	BDL
EX3/060 A	5/25/98 21:00	6/9/98			21	OK	20	OK			20	OK	0	j
EX3/061 A	5/26/98 8:50	6/10/98			32	OK	31	OK			31	OK	27	OK
EX3/062 M	5/26/98 12:14	6/10/98			36	OK	34	OK			34	OK	27	OK
EX3/063 A	5/27/98 11:00	6/11/98			22	OK	17	OK			24	OK	23	OK
EX3/064 A	5/28/98 11:00	6/11/98			16	OK	15	OK			18	OK	13	OK
EX3/065 M	5/28/98 12:39	6/11/98			25	OK	27	OK			25	OK	22	OK
EX3/066 A	5/29/98 10:50	6/11/98			14	OK	14	OK			14	OK	11	OK
EX3/067 AD	5/29/98 11:00	6/12/98			12	OK	12	OK			12	OK	10	OK
EX3/068 EB	5/29/98 11:33	6/12/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
EX3/069 M	5/29/98 20:43	6/12/98			12	OK	12	OK			12	OK	8	j
EX3/071 A	5/30/98 11:00	6/12/98			9	j	9	j			8	j	4	j
EX3/070 M	5/30/98 11:26	6/12/98			9	j	9	j			8	j	4	j
EX3/072 A	5/31/98 11:00	6/12/98			10	j	7	j			9	j	7	j
EX3/073 A	6/1/98 10:50	6/12/98			10	j	9	j			9	j	nd	BDL
EX3/074 M	6/1/98 11:35	6/15/98			9	j	9	j			9	j	5	j
EX3/075 A	6/2/98 11:00	6/15/98			11	OK	10	OK			12	OK	3	j
EX3/076 A	6/3/98 11:00	6/21/98			8	j	8	j			8	j	6	j
EX3/077 M	6/3/98 11:43	6/21/98			7	j	7	j			7	j	5	j
EX3/078 A	6/4/98 10:50	6/21/98			6	j	6	j			6	j	4	j
EX3/078 A [dup]	6/4/98 10:50	6/21/98			7	DUP	6	DUP			7	DUP	4	DUP
EX3/079 A	6/5/98 11:00	6/21/98			7	j	7	j			7	j	5	j
EX3/080 M	6/5/98 11:13	6/21/98			7	j	7	j			8	j	7	j
EX3/081 A	6/6/98 11:00	6/21/98			7	j	9	j			9	j	6	j
EX3/082 A	6/7/98 10:50	6/24/98			9	j	8	j			9	j	7	j

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX3/083 M	6/7/98 11:09	6/24/98			8	j	8	j			8	j	7	j
EX3/084 A	6/8/98 11:00	6/24/98			8	j	6	j			6	j	7	j
EX3/085 A	6/9/98 11:00	6/24/98			8	j	7	j			7	j	7	j
EX3/086 M	6/9/98 11:08	6/25/98			8	j	7	j			8	j	6	j
EX3/087 A	6/10/98 10:50	6/17/98			8	j	7	j			7	j	4	j
EX3/089 A	6/11/98 11:00	6/17/98			10	OK	6	j			5	j	4	j
EX3/088 M	6/11/98 11:19	6/17/98			10	j	6	j			5	j	4	j
EX3/090 A	6/12/98 11:00	6/17/98			12	OK	7	j			7	j	4	j
EX3/092 A	6/13/98 10:50	6/17/98			nd	BDL	5	j			6	j	3	j
EX3/091 M	6/13/98 11:12	6/17/98			9	j	6	j			7	j	3	j
EX3/091 M [dup]	6/13/98 11:12	6/17/98			10	DUP	6	DUP			6	DUP	2	DUP
EX3/093 A	6/14/98 11:00	6/23/98			9	j	6	j			6	j	3	j
EX3/094 A	6/15/98 11:00	6/23/98			9	j	5	j			4	j	3	j
EX3/095 M	6/15/98 11:35	6/23/98			8	j	5	j			6	j	3	j
EX3/096 A	6/16/98 10:50	6/23/98			9	j	6	j			7	j	3	j
EX3/097 A	6/17/98 11:00	6/22/98			5	j	4	j			4	j	nd	BDL
EX3/098 M	6/17/98 11:31	6/22/98			6	j	4	j			5	j	2	j
EX3/099 A	6/18/98 11:00	6/22/98			5	j	4	j			5	j	2	j
EX3/100 A	6/19/98 10:50	6/25/98			7	j	7	j			8	j	10	j
EX3/100 AD	6/19/98 11:00	6/25/98			6	j	7	j			7	j	6	j
EX3/100 AD [dup]	6/19/98 11:00	6/25/98			6	DUP	6	DUP			5	DUP	6	DUP
EX3/102 EB	6/19/98 11:02	6/25/98			nd	BDL	nd	BDL			nd	BDL	4	j
EX3/103 M	6/19/98 11:32	6/25/98			5	j	6	j			6	j	5	j
EX3/103 M [dup]	6/19/98 11:32	6/25/98			7	DUP	8	DUP			7	DUP	7	DUP
EX3/104 A	6/20/98 11:00	6/25/98			6	j	7	j			7	j	7	j
EX3/105 A	6/21/98 11:00	6/26/98			5	j	6	j			6	j	6	j
EX3/106 M	6/21/98 11:30	6/26/98			4	j	5	j			2	j	3	j
EX3/107 A	6/22/98 10:50	6/26/98			5	j	5	j			5	j	nd	BDL

Project: PITT at ESTCP Camp Lejeune
Acceptable QA/QC limits: % Recovery between 80% and 120%

Data QA/QC by DW
Date created 1/22/99
Date last modified 1/26/99

Sample Legend
CC = Calibration check
j = below reporting limit
d = diluted sample
BDL = below detection limit
NA = not applicable
jj = out of acceptable QA/QC and/or calibration limits
OK = within acceptable QA/QC limits
nd = not detected
DUP = Duplicate
d,DUP = diluted duplicate

Sample Point: Extraction Well EX4R

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX4R/004 A	5/13/98 17:30	5/19/98	nd	BDL	nd	BDL	nd	BDL	61	OK	nd	BDL	nd	BDL
EX4R/003 M	5/14/98 7:38	5/19/98	nd	BDL	nd	BDL	nd	BDL	72	OK	nd	BDL	nd	BDL
EX4R/005 A	5/14/98 7:40	5/19/98	nd	BDL	nd	BDL	nd	BDL	89	OK	nd	BDL	nd	BDL
EX4R/005 A [dup]	5/14/98 7:40	5/19/98	nd	BDL	nd	DUP	nd	DUP	91	DUP	nd	DUP	nd	DUP
EX4R/010 A	5/14/98 13:30	5/21/98	nd	BDL	nd	BDL	nd	BDL	82	OK	nd	BDL	nd	BDL
EX4R/011 A	5/14/98 19:30	5/21/98	nd	BDL	nd	BDL	nd	BDL	97	OK	nd	BDL	nd	BDL
EX4R/006 M	5/14/98 19:52	5/21/98	nd	BDL	nd	BDL	nd	BDL	79	OK	nd	BDL	nd	BDL
EX4R/012 A	5/15/98 1:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	74	OK	nd	BDL	nd	BDL
EX4R/013 A	5/15/98 7:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	86	OK	nd	BDL	nd	BDL
EX4R/014 A	5/15/98 13:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	88	OK	nd	BDL	nd	BDL
EX4R/015 A	5/15/98 19:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	85	OK	nd	BDL	nd	BDL
EX4R/008 M	5/15/98 19:58	5/23/98	nd	BDL	nd	BDL	nd	BDL	95	OK	nd	BDL	nd	BDL
EX4R/016 A	5/16/98 1:30	5/23/98	0		0	j	0	j	79	OK	nd	BDL	nd	BDL
EX4R/016 A [dup]	5/16/98 1:30	5/24/98	0		0	DUP	nd	DUP	86	DUP	nd	DUP	nd	DUP
EX4R/017 A	5/16/98 7:30	5/23/98	1		1	j	1	j	85	OK	0	j	nd	BDL
EX4R/009 M	5/16/98 7:47	5/23/98	1		1	j	1	j	90	OK	0	j	nd	BDL
EX4R/020 A	5/16/98 13:30	5/25/98	2		3	j	2	j	54	OK	1	j	nd	BDL
EX4R/021 A	5/16/98 19:40	5/25/98	8		10	j	7	j	51	OK	4	j	0	j
EX4R/021 A [dup]	5/16/98 19:40	5/25/98	9		11	DUP	7	DUP	35	DUP	4	DUP	0	DUP
EX4R/018 M	5/16/98 20:25	5/25/98	10		12	OK	8	j	89	OK	5	j	1	j
EX4R/022 A	5/17/98 7:05	5/26/98	32		34	OK	25	OK	79	OK	16	OK	2	j
EX4R/019 M	5/17/98 7:44	5/26/98	34		42	OK	32	OK	77	OK	21	OK	3	j
EX4R/027 A	5/17/98 13:40	5/26/98	49		56	OK	41	OK	83	OK	28	OK	5	j
EX4R/027 A [dup]	5/17/98 13:40	5/26/98	58		66	DUP	50	DUP	76	DUP	34	DUP	6	DUP
EX4R/028 A	5/17/98 19:40	5/26/98	67		70	OK	52	OK	76	OK	38	OK	7	j
EX4R/029 A	5/18/98 1:40	5/27/98	84		86	OK	64	OK	111	OK	47	OK	10	j
EX4R/030 A	5/18/98 7:40	5/28/98	97		97	OK	72	OK	101	OK	54	OK	12	OK
EX4R/031 AD	5/18/98 7:50	6/4/98			258	jj	152	OK			118	OK	25	OK
EX4R/031 AD [dup]	5/18/98 7:50	6/4/98			97	DUP	78	DUP			63	DUP	14	DUP

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX4R/024 M	5/18/98 8:05	6/4/98			102	OK	72	OK			62	OK	13	OK
EX4R/033 A	5/18/98 13:40	6/4/98			119	OK	78	OK			62	OK	13	OK
EX4R/034 A	5/18/98 19:40	6/4/98			119	OK	84	OK			68	OK	16	OK
EX4R/035 A	5/19/98 1:40	6/5/98			199	OK	122	OK			98	OK	28	OK
EX4R/036 A	5/19/98 7:40	6/5/98			215	jj	127	OK			98	OK	25	OK
EX4R/036 A [dup]	5/19/98 7:40	6/5/98			207	DUP	123	DUP			97	DUP	25	DUP
EX4R/026 M	5/19/98 7:42	6/5/98			189	OK	107	OK			78	OK	20	OK
EX4R/032 EB	5/19/98 12:10	6/5/98			4	j	6	j			9	j	7	j
EX4R/038 A	5/19/98 13:40	6/5/98			243	jj	157	OK			124	OK	25	OK
EX4R/039 A	5/19/98 19:40	6/5/98			239	jj	169	OK			141	OK	26	OK
EX4R/037 M	5/19/98 19:56	6/5/98			158	OK	116	OK			89	OK	26	OK
EX4R/040 A	5/20/98 1:50	6/6/98			232	jj	169	OK			139	OK	38	OK
EX4R/041 A	5/20/98 7:50	6/6/98			>200	jj	182	OK			149	OK	38	OK
EX4R/041 A (1:10)	5/20/98 7:50	6/30/98			225	d	212	d			145	d	42	d
EX4R/043 A	5/20/98 21:00	6/6/98			>200	jj	206	jj			175	OK	45	OK
EX4R/043 A (1:10)	5/20/98 21:00	6/30/98			257	d	221	d			151	d	30	d
EX4R/042 M	5/20/98 21:43	6/7/98			>200	jj	191	OK			167	OK	42	OK
EX4R/042 M (1:10)	5/20/98 21:43	6/30/98			208	d	177	d			143	d	39	d
EX4R/044 A	5/21/98 9:00	6/7/98			>200	jj	193	OK			168	OK	47	OK
EX4R/044 A [dup]	5/21/98 9:00	6/7/98			>200	DUP	203	DUP			173	DUP	43	DUP
EX4R/044 A (1:10)	5/21/98 9:00	7/1/98			223	d	217	d			148	d	61	d
EX4R/047 A	5/21/98 21:00	6/7/98			>200	jj	202	jj			181	OK	54	OK
EX4R/047 A (1:10)	5/21/98 21:00	7/1/98			237	d	215	d			157	d	49	d
EX4R/045 M	5/21/98 21:04	6/7/98			>200	jj	212	jj			179	OK	51	OK
EX4R/045 M (1:10)	5/21/98 21:04	7/1/98			261	d	239	d			177	d	51	d
EX4R/048 A	5/22/98 9:00	6/7/98			226	jj	171	OK			154	OK	49	OK
EX4R/049 A	5/22/98 21:00	6/7/98			191	OK	156	OK			154	OK	48	OK
EX4R/046 M	5/22/98 21:04	6/8/98			227	jj	201	jj			191	OK	65	OK
EX4R/050 A	5/23/98 8:50	6/8/98			177	OK	187	OK			194	OK	88	OK
EX4R/051 AD	5/23/98 9:00	6/8/98			191	OK	208	jj			215	jj	101	OK
EX4R/052 EB	5/23/98 11:30	6/8/98			nd	BDL	nd	BDL			4	j	nd	BDL
EX4R/053M	5/23/98 19:13	6/9/98			154	OK	187	OK			202	jj	107	OK
EX4R/055 A	5/23/98 21:00	6/8/98			139	OK	174	OK			182	OK	92	OK
EX4R/056 A	5/24/98 9:00	6/9/98			101	OK	130	OK			137	OK	73	OK
EX4R/057 A	5/24/98 21:00	6/9/98			76	OK	106	OK			124	OK	70	OK
EX4R/058 A	5/25/98 9:00	7/14/98			72	OK	91	OK			129	OK	62	OK
EX4R/054 M	5/25/98 10:35	6/9/98			40	OK	50	OK			65	OK	nd	BDL
EX4R/059 A	5/25/98 21:00	6/9/98			44	OK	54	OK			74	OK	19	OK
EX4R/059 A [dup]	5/25/98 21:00	6/9/98			44	DUP	52	DUP			76	DUP	41	DUP
EX4R/060 A	5/26/98 8:50	6/10/98			65	OK	68	OK			111	OK	57	OK
EX4R/060 A [dup]	5/26/98 8:50	6/10/98			66	DUP	67	DUP			119	DUP	62	DUP

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX4R/061 M	5/26/98 12:16	6/10/98			53	OK	54	OK			92	OK	65	OK
EX4R/062 A	5/27/98 11:00	6/11/98			45	OK	48	OK			81	OK	61	OK
EX4R/063 A	5/28/98 11:00	6/11/98			30	OK	30	OK			44	OK	37	OK
EX4R/064 M	5/28/98 12:41	6/11/98			50	OK	48	OK			73	OK	87	OK
EX4R/065 A	5/29/98 10:50	6/12/98			20	OK	23	OK			32	OK	49	OK
EX4R/066 M	5/29/98 20:44	6/12/98			18	OK	22	OK			28	OK	50	OK
EX4R/066 M [dup]	5/29/98 20:44	6/12/98			19	DUP	22	DUP			32	DUP	53	DUP
EX4R/068 A	5/30/98 11:00	6/12/98			13	OK	15	OK			21	OK	36	OK
EX4R/067 M	5/30/98 11:27	6/12/98			14	OK	18	OK			22	OK	29	OK
EX4R/069 A	5/31/98 11:00	6/12/98			12	OK	14	OK			22	OK	50	OK
EX4R/070 A	6/1/98 10:50	6/12/98			10	j	10	j			16	OK	41	OK
EX4R/071 M	6/1/98 11:36	6/15/98			11	OK	12	OK			19	OK	45	OK
EX4R/072 A	6/2/98 11:00	6/15/98			10	OK	10	j			15	OK	46	OK
EX4R/073 A	6/3/98 11:00	6/21/98			5	j	7	j			9	j	33	OK
EX4R/074 M	6/3/98 11:44	6/21/98			5	j	6	j			8	j	26	OK
EX4R/074 M [dup]	6/3/98 11:44	6/21/98			4	DUP	5	DUP			8	DUP	33	DUP
EX4R/075 A	6/4/98 10:50	6/21/98			6	j	6	j			8	j	30	OK
EX4R/076 A	6/5/98 11:00	6/21/98			4	j	5	j			8	j	32	OK
EX4R/077 M	6/5/98 11:17	6/21/98			5	j	7	j			12	OK	38	OK
EX4R/078 A	6/6/98 11:00	6/21/98			2	j	5	j			10	j	33	OK
EX4R/079 A	6/7/98 10:50	6/24/98			5	j	4	j			6	j	22	OK
EX4R/080 M	6/7/98 11:10	6/24/98			5	j	5	j			6	j	20	OK
EX4R/081 A	6/8/98 11:00	6/24/98			4	j	4	j			3	j	14	OK
EX4R/082 A	6/9/98 11:00	6/24/98			4	j	4	j			4	j	16	OK
EX4R/083 M	6/9/98 11:11	6/25/98			4	j	5	j			7	j	22	OK
EX4R/084 A	6/10/98 10:50	6/17/98			7	j	3	j			3	j	12	OK
EX4R/085 AD	6/10/98 11:00	6/17/98			5	j	2	j			3	j	10	j
EX4R/086 EB	6/10/98 12:35	6/17/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
EX4R/088 A	6/11/98 11:00	6/17/98			4	j	3	j			2	j	11	OK
EX4R/087 M	6/11/98 11:20	6/17/98			4	j	1	j			2	j	11	OK
EX4R/089 A	6/12/98 11:00	6/17/98			4	j	3	j			2	j	9	j
EX4R/091 A	6/13/98 10:50	6/17/98			3	j	2	j			2	j	7	j
EX4R/091 A [dup]	6/13/98 10:50	6/17/98			4	DUP	2	DUP			2	DUP	6	DUP
EX4R/090 M	6/13/98 11:14	6/17/98			7	j	2	j			3	j	7	j
EX4R/092 A	6/14/98 11:00	6/23/98			5	j	1	j			4	j	7	j
EX4R/093 A	6/15/98 11:00	6/23/98			4	j	1	j			2	j	3	j
EX4R/094 M	6/15/98 11:37	6/23/98			3	j	4	j			6	j	10	j
EX4R/095 A	6/16/98 10:50	6/23/98			5	j	1	j			3	j	8	j
EX4R/096 A	6/17/98 11:00	6/22/98			3	j	1	j			3	j	4	j
EX4R/097 M	6/17/98 11:32	6/23/98			2	j	1	j			2	j	nd	BDL
EX4R/098 A	6/18/98 11:00	6/23/98			3	j	1	j			2	j	nd	BDL

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX4R/099 A	6/19/98 10:50	6/25/98			4	j	5	j			4	j	8	j
EX4R/100 M	6/19/98 11:34	6/25/98			4	j	4	j			4	j	7	j
EX4R/101 A	6/20/98 11:00	6/25/98			4	j	3	j			3	j	6	j
EX4R/102 A	6/21/98 11:00	6/26/98			4	j	3	j			3	j	5	j
EX4/103 M	6/21/98 11:31	6/26/98			3	j	2	j			2	j	nd	BDL
EX4R/104 A/M	6/22/98 10:50	6/26/98			4	j	3	j			4	j	3	j
EX4R/104 A/M [dup]	6/22/98 10:50	6/26/98			3	DUP	5	DUP			2	DUP	4	DUP

Project: PITT at ESTCP Camp Lejeune
Acceptable QA/QC limits: % Recovery between 80% and 120%

Data QA/QC by	DW
Date created	1/22/99
Date last modified	1/26/99

Sample Legend
CC = Calibration check
j = below reporting limit
d = diluted sample
BDL = below detection limit
NA = not applicable
jj = out of acceptable QA/QC and/or calibration limits
OK = within acceptable QA/QC limits
nd = not detected
DUP = Duplicate
d,DUP = diluted duplicate

Sample Point: Extraction Well EX5

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX5/004 A	5/13/98 17:30	5/19/98	nd	BDL	nd	BDL	nd	BDL	17	OK	nd	BDL	nd	BDL
EX5/003 M	5/14/98 7:35	5/19/98	nd	BDL	nd	BDL	nd	BDL	17	OK	nd	BDL	nd	BDL
EX5/005 A	5/14/98 7:40	5/19/98	nd	BDL	nd	BDL	nd	BDL	16	OK	nd	BDL	nd	BDL
EX5/010 A	5/14/98 13:30	5/21/98	nd	BDL	nd	BDL	nd	BDL	16	OK	nd	BDL	nd	BDL
EX5/011 A	5/14/98 19:30	5/21/98	nd	BDL	nd	BDL	nd	BDL	16	OK	nd	BDL	nd	BDL
EX5/006 M	5/14/98 19:53	5/21/98	nd	BDL	nd	BDL	nd	BDL	17	OK	nd	BDL	nd	BDL
EX5/012 A	5/15/98 1:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	18	OK	nd	BDL	nd	BDL
EX5/013 A	5/15/98 7:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	16	OK	nd	BDL	nd	BDL
EX5/014 A	5/15/98 13:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	17	OK	nd	BDL	nd	BDL
EX5/015 A	5/15/98 19:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	17	OK	nd	BDL	nd	BDL
EX5/016 AD	5/15/98 19:40	5/23/98	0	j	0	j	nd	BDL	15	OK	nd	BDL	nd	BDL
EX5/008 M	5/15/98 19:59	5/23/98	nd	BDL	nd	BDL	nd	BDL	17	OK	nd	BDL	nd	BDL
EX5/017 A	5/16/98 1:30	5/23/98	1	j	1	j	1	j	17	OK	0	j	nd	BDL
EX5/018 A	5/16/98 7:30	5/23/98	3	j	4	j	3	j	16	OK	2	j	nd	BDL
EX5/009 M	5/16/98 7:48	5/23/98	4	j	4	j	3	j	18	OK	2	j	nd	BDL
EX5/019 EB	5/16/98 12:45	5/24/98	nd	BDL	nd	BDL	nd	BDL	1	j	nd	BDL	nd	BDL
EX5/019 EB	5/16/98 12:45	5/24/98	nd	BDL	nd	BDL	nd	BDL	1	j	nd	BDL	nd	BDL
EX5/019 EB	5/16/98 12:45	5/24/98	nd	BDL	nd	BDL	nd	BDL	1	j	nd	BDL	nd	BDL
EX5/019 EB	5/16/98 12:45	5/24/98	nd	BDL	nd	BDL	nd	BDL	1	j	nd	BDL	nd	BDL
EX5/023 A	5/16/98 13:30	5/25/98	8	j	10	OK	9	j	13	OK	7	j	2	j
EX5/024 A	5/16/98 19:40	5/25/98	24	OK	nd	BDL	23	OK	13	OK	17	OK	6	j
EX5/020 M	5/16/98 20:26	5/25/98	31	OK	36	OK	31	OK	17	OK	24	OK	9	j
EX5/025 A	5/17/98 7:05	5/26/98	81	OK	85	OK	77	OK	15	OK	68	OK	29	OK
EX5/022 M	5/17/98 7:45	5/26/98	98	OK	117	OK	106	OK	24	OK	91	OK	40	OK
EX5/030 A	5/17/98 13:40	5/26/98	111	OK	119	OK	108	OK	16	OK	98	OK	49	OK
EX5/031 A	5/17/98 19:40	5/26/98	133	OK	140	OK	129	OK	16	OK	120	OK	63	OK
EX5/032 A	5/18/98 1:40	6/4/98			140	OK	144	OK			115	OK	61	OK
EX5/033 A	5/18/98 7:40	6/4/98			155	OK	166	OK			136	OK	71	OK
EX5/027 M	5/18/98 8:06	6/4/98			176	OK	175	OK			157	OK	74	OK

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX5/034 A	5/18/98 13:40	6/4/98			193	OK	206	jj			185	OK	88	OK
EX5/035 A	5/18/98 19:40	6/4/98			372	jj	304	jj			274	jj	146	OK
EX5/036 A	5/19/98 1:40	6/5/98			281	jj	241	jj			226	jj	110	OK
EX5/037 A	5/19/98 7:40	6/5/98			275	jj	232	jj			221	jj	111	OK
EX5/029 M	5/19/98 7:43	6/5/98			191	OK	158	OK			132	OK	71	OK
EX5/029 M [dup]	5/19/98 7:43	6/5/98			264	DUP	221	DUP			189	DUP	104	DUP
EX5/039 A	5/19/98 13:40	6/5/98			261	jj	239	jj			227	jj	118	OK
EX5/040 A	5/19/98 19:40	6/5/98			263	jj	229	jj			221	jj	116	OK
EX5/041 AD	5/19/98 19:50	6/5/98			299	jj	237	jj			224	jj	120	OK
EX5/038 M	5/19/98 19:57	6/5/98			186	OK	176	OK			151	OK	107	OK
EX5/043 A	5/20/98 1:50	6/6/98			>200	jj	239	jj			222	jj	129	OK
EX5/043 A (1:10)	5/20/98 1:50	6/30/98			263	d	245	d			188	d	118	d
EX5/044 A	5/20/98 7:50	6/6/98			>200	jj	>200	jj			>200	jj	154	OK
EX5/044 A (1:10)	5/20/98 7:50	6/30/98			263	d	239	d			228	d	123	d
EX5/042 EB	5/20/98 17:06	6/6/98			nd	BDL	0	j			1	j	nd	BDL
EX5/046 A	5/20/98 21:00	6/6/98			>200	jj	>200	jj			>200	jj	153	OK
EX5/046 A [dup]	5/20/98 21:00	6/6/98			>200	DUP	>200	DUP			>200	DUP	146	DUP
EX5/046 A (1:10)	5/20/98 21:00	6/30/98			266	d	239	d			228	d	73	d
EX5/046 A (1:10) [du	5/20/98 21:00	6/30/98			270	d, DUP	249	d, DUP			228	d, DUP	145	d, DUP
EX5/045 M	5/20/98 21:44	6/7/98			>200	jj	>200	jj			>200	jj	163	OK
EX5/045 M (1:10)	5/20/98 21:44	6/30/98			302	d	292	d			265	d	149	d
EX5/047 A	5/21/98 9:00	6/7/98			>200	jj	>200	jj			230	jj	140	OK
EX5/047 A (1:10)	5/21/98 9:00	7/1/98			243	d	230	d			209	d	121	d
EX5/050 A	5/21/98 21:00	6/7/98			>200	jj	>200	jj			>200	jj	172	OK
EX5/050 A [dup]	5/21/98 21:00	6/7/98			>200	DUP	>200	DUP			>200	DUP	181	DUP
EX5/050 A (1:10)	5/21/98 21:00	7/1/98			264	d	228	d			229	d	117	d
EX5/048 M	5/21/98 21:05	6/7/98			>200	jj	>200	jj			>200	jj	156	OK
EX5/048 M (1:10)	5/21/98 21:05	7/1/98			273	d	259	d			211	d	111	d
EX5/051 A	5/22/98 9:00	6/7/98			>200	jj	233	jj			219	jj	159	OK
EX5/051 A (1:10)	5/22/98 9:00	7/1/98			220	d	220	d			250	d	176	d
EX5/052 A	5/22/98 21:00	6/7/98			199	OK	192	OK			179	OK	137	OK
EX5/052 A [dup]	5/22/98 21:00	6/7/98			218	DUP	199	DUP			183	DUP	138	DUP
EX5/049 M	5/22/98 21:05	6/8/98			196	OK	187	OK			174	OK	130	OK
EX5/053 A	5/23/98 8:50	6/8/98			141	OK	141	OK			126	OK	116	OK
EX5/054 M	5/23/98 19:16	6/9/98			143	OK	170	OK			158	OK	144	OK
EX5/056 A	5/23/98 21:00	6/8/98			137	OK	143	OK			151	OK	128	OK
EX5/057 A	5/24/98 9:00	6/9/98			111	OK	112	OK			103	OK	93	OK
EX5/057 A [dup]	5/24/98 9:00	6/9/98			118	DUP	120	DUP			113	DUP	99	DUP
EX5/058 A	5/24/98 21:00	6/9/98			93	OK	97	OK			90	OK	82	OK
EX5/059 A	5/25/98 9:00	7/14/98			88	OK	91	OK			85	OK	63	OK
EX5/055 M	5/25/98 10:37	6/9/98			70	OK	63	OK			57	OK	12	OK

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX5/061 A	5/26/98 8:50	6/10/98			73	OK	64	OK			67	OK	50	OK
EX5/062 M	5/26/98 12:18	6/10/98			73	OK	62	OK			70	OK	56	OK
EX5/063 A	5/27/98 11:00	6/11/98			56	OK	59	OK			67	OK	53	OK
EX5/064 A	5/28/98 11:00	6/11/98			37	OK	34	OK			45	OK	23	OK
EX5/065 M	5/28/98 12:42	6/11/98			69	OK	57	OK			64	OK	50	OK
EX5/066 A	5/29/98 10:50	6/12/98			25	OK	26	OK			30	OK	23	OK
EX5/067 M	5/29/98 20:45	6/12/98			24	OK	24	OK			28	OK	23	OK
EX5/069 A	5/30/98 11:00	6/12/98			19	OK	20	OK			21	OK	13	OK
EX5/069 A [dup]	5/30/98 11:00	6/12/98			19	DUP	21	DUP			21	DUP	14	DUP
EX5/068 M	5/30/98 11:28	6/12/98			20	OK	20	OK			22	OK	14	OK
EX5/070 A	5/31/98 11:00	6/12/98			17	OK	21	OK			22	OK	18	OK
EX5/071 A	6/1/98 10:50	6/12/98			16	OK	16	OK			18	OK	16	OK
EX5/072 AD	6/1/98 11:00	6/12/98			16	OK	15	OK			18	OK	19	OK
EX5/073 EB	6/1/98 11:30	6/12/98			1	j	3	j			nd	BDL	2	j
EX5/074 M	6/1/98 11:38	6/15/98			17	OK	17	OK			20	OK	13	OK
EX5/075 A	6/2/98 11:00	6/15/98			21	OK	17	OK			21	OK	17	OK
EX5/076 A	6/3/98 11:00	6/21/98			10	j	10	OK			12	OK	13	OK
EX5/077 M	6/3/98 11:45	6/21/98			10	OK	10	j			18	OK	13	OK
EX5/078 A	6/4/98 10:50	6/21/98			7	j	7	j			7	j	8	j
EX5/079 A	6/5/98 11:00	6/21/98			8	j	11	OK			12	OK	10	OK
EX5/080 M	6/5/98 11:21	6/21/98			6	j	7	j			9	j	9	j
EX5/081 A	6/6/98 11:00	6/21/98			5	j	7	j			8	j	9	j
EX5/082 A	6/7/98 10:50	6/24/98			8	j	8	j			8	j	9	j
EX5/083 M	6/7/98 11:12	6/24/98			9	j	11	OK			10	OK	13	OK
EX5/084 A	6/8/98 11:00	6/24/98			8	j	8	j			10	j	8	j
EX5/085 A	6/9/98 11:00	6/24/98			7	j	8	j			5	j	8	j
EX5/086 M	6/9/98 11:13	6/25/98			7	j	9	j			8	j	8	j
EX5/087 A	6/10/98 10:50	6/17/98			10	j	7	j			6	j	5	j
EX5/089 A	6/11/98 11:00	6/17/98			9	j	6	j			5	j	4	j
EX5/088 M	6/11/98 11:22	6/17/98			8	j	6	j			5	j	3	j
EX5/090 A	6/12/98 11:00	6/17/98			10	OK	6	j			5	j	5	j
EX5/092 A	6/13/98 10:50	6/17/98			7	j	5	j			6	j	3	j
EX5/093 AD	6/13/98 11:00	6/17/98			9	j	6	j			5	j	4	j
EX5/091 M	6/13/98 11:16	6/17/98			8	j	6	j			6	j	4	j
EX5/094 EB	6/13/98 11:38	6/17/98			0	j	0	j			1	j	nd	BDL
EX5/095 A	6/14/98 11:00	6/23/98			8	j	5	j			6	j	8	j
EX5/096 A	6/15/98 11:00	6/23/98			5	j	5	j			5	j	3	j
EX5/096 A [dup]	6/15/98 11:00	6/23/98			6	DUP	5	DUP			5	DUP	4	DUP
EX5/097 M	6/15/98 11:38	6/23/98			5	j	4	j			4	j	3	j
EX5/098 A	6/16/98 10:50	6/23/98			5	j	4	j			4	j	2	j
EX5/099 A	6/17/98 11:00	6/23/98			4	j	4	j			4	j	2	j

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX5/100 M	6/17/98 11:34	6/23/98			4	j	3	j			2	j	nd	BDL
EX5/101 A	6/18/98 11:00	6/23/98			4	j	2	j			4	j	nd	BDL
EX5/102 A	6/19/98 10:50	6/25/98			4	j	6	j			6	j	5	j
EX5/103 M	6/19/98 11:36	6/25/98			4	j	4	j			4	j	6	j
EX5/104 A	6/20/98 11:00	6/25/98			4	j	5	j			6	j	6	j
EX5/104 A [dup]	6/20/98 11:00	6/25/98			4	DUP	6	DUP			6	DUP	5	DUP
EX5/105 A	6/21/98 11:00	6/26/98			4	j	5	j			7	j	3	j
EX5/106 M	6/21/98 11:32	6/26/98			4	j	5	j			5	j	nd	BDL
EX5/107 A	6/22/98 10:50	6/26/98			4	j	4	j			4	j	3	j
EX5/108 AD	6/22/98 11:00	6/26/98			3	j	5	j			4	j	3	j
EX5/109 EB	6/22/98 11:29	6/26/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL

Project: PITT at ESTCP Camp Lejeune

Acceptable QA/QC limits: % Recovery between 80% and 120%

Data QA/QC by DW
Date created 1/22/99
Date last modifie 1/26/99

Sample Legend

CC = Calibration check
j = below reporting limit
d = diluted sample
BDL = below detection limit
NA = not applicable
jj = out of acceptable QA/QC and/or calibration limits
OK = within acceptable QA/QC limits
nd = not detected
DUP = Duplicate
d,DUP = diluted duplicate

Sample Point: Extraction Well EX6

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX6/004 A	5/13/98 17:30	5/19/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX6/003 M	5/14/98 7:34	5/19/98	nd	BDL	nd	BDL	nd	BDL	3	j	nd	BDL	nd	BDL
EX6/005 A	5/14/98 7:40	5/19/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX6/010 A	5/14/98 13:30	5/24/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX6/011 A	5/14/98 19:30	5/24/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX6/006 M	5/14/98 19:54	5/24/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX6/012 A	5/15/98 1:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX6/013 A	5/15/98 7:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX6/014 A	5/15/98 13:30	5/23/98	nd	BDL	nd	BDL	nd	BDL	2	j	nd	BDL	nd	BDL
EX6/014 A [dup]	5/15/98 13:30	5/24/98	nd	DUP	nd	DUP	nd	DUP	2	DUP	nd	DUP	nd	DUP
EX6/015 A	5/15/98 19:30	5/24/98	0	j	0	j	0	j	2	j	nd	BDL	nd	BDL
EX6/008 M	5/15/98 20:00	5/24/98	0	j	0	j	0	j	2	j	0	j	nd	BDL
EX6/016 A	5/16/98 1:30	5/24/98	1	j	1	j	1	j	2	j	1	j	0	j
EX6/017 A	5/16/98 7:30	5/24/98	3	j	4	j	3	j	2	j	2	j	1	j
EX6/009 M	5/16/98 7:49	5/24/98	4	j	4	j	3	j	2	j	2	j	1	j
EX6/020 A	5/16/98 13:30	5/25/98	5	j	6	j	6	j	2	j	5	j	2	j
EX6/021 A	5/16/98 19:40	5/25/98	13	OK	14	OK	13	OK	2	j	10	OK	5	j
EX6/018 M	5/16/98 20:28	5/25/98	16	OK	19	OK	17	OK	2	j	13	OK	6	j
EX6/018 M [dup]	5/16/98 20:28	5/26/98	17	DUP	19	DUP	17	DUP	2	DUP	13	DUP	6	DUP
EX6/022 A	5/17/98 7:05	5/26/98	55	OK	58	OK	53	OK	2	j	45	OK	19	OK

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX6/019 M	5/17/98 7:47	5/26/98	62	OK	77	OK	70	OK	2	j	58	OK	25	OK
EX6/027 A	5/17/98 13:40	5/26/98	76	OK	80	OK	73	OK	2	j	65	OK	32	OK
EX6/028 A	5/17/98 19:40	5/26/98	97	OK	101	OK	95	OK	2	j	87	OK	47	OK
EX6/029 A	5/18/98 1:40	6/4/98			124	OK	119	OK			101	OK	57	OK
EX6/030 A	5/18/98 7:40	6/4/98			133	OK	136	OK			116	OK	66	OK
EX6/031 AD	5/18/98 7:50	6/4/98			160	OK	146	OK			126	OK	70	OK
EX6/024 M	5/18/98 8:08	6/4/98			145	OK	140	OK			129	OK	68	OK
EX6/033 A	5/18/98 13:40	6/4/98			155	OK	145	OK			128	OK	74	OK
EX6/033 A [dup]	5/18/98 13:40	6/4/98			155	DUP	172	DUP			157	DUP	90	DUP
EX6/034 A	5/18/98 19:40	6/4/98			167	OK	162	OK			149	OK	84	OK
EX6/035 A	5/19/98 1:40	6/5/98			180	OK	125	OK			108	OK	57	OK
EX6/036 A	5/19/98 7:40	6/5/98			184	OK	139	OK			123	OK	73	OK
EX6/026 M	5/19/98 7:45	6/5/98			165	OK	135	OK			115	OK	72	OK
EX6/032 EB	5/19/98 13:10	6/5/98			4	j	5	j			10	j	6	j
EX6/038 A	5/19/98 13:40	6/5/98			217	jj	159	OK			139	OK	81	OK
EX6/039 A	5/19/98 19:40	6/5/98			212	jj	169	OK			151	OK	93	OK
EX6/039 A [dup]	5/19/98 19:40	6/5/98			205	DUP	154	DUP			141	DUP	84	DUP
EX6/037 M	5/19/98 19:58	6/5/98			144	OK	119	OK			115	OK	83	OK
EX6/040 A	5/20/98 1:50	6/6/98			224	jj	210	jj			200	jj	132	OK
EX6/041 A	5/20/98 7:50	6/6/98			197	OK	190	OK			184	OK	122	OK
EX6/043 A	5/20/98 21:00	6/6/98			237	jj	218	jj			207	jj	135	OK
EX6/042 M	5/20/98 21:45	6/7/98			220	jj	217	jj			202	jj	138	OK
EX6/042 M [dup]	5/20/98 21:45	6/7/98			227	DUP	215	DUP			205	DUP	133	DUP
EX6/044 A	5/21/98 9:00	6/7/98			215	jj	210	jj			197	OK	128	OK
EX6/047 A	5/21/98 21:00	6/7/98			>200	jj	>200	jj			237	jj	166	OK
EX6/047 A (1:10	5/21/98 21:00	7/1/98			204	DUP	203	DUP			195	DUP	143	DUP
EX6/045 M	5/21/98 21:06	6/7/98			199	OK	191	OK			185	OK	124	OK
EX6/048 A	5/22/98 9:00	6/7/98			232	jj	204	jj			197	OK	142	OK
EX6/049 A	5/22/98 21:00	6/7/98			181	OK	162	OK			156	OK	121	OK
EX6/046 M	5/22/98 21:06	6/8/98			177	OK	159	OK			156	OK	118	OK
EX6/050 A	5/23/98 8:50	6/8/98			94	OK	92	OK			87	OK	89	OK
EX6/050 A [dup]	5/23/98 8:50	6/8/98			133	DUP	142	DUP			139	DUP	144	DUP

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX6/051 AD	5/23/98 9:00	6/8/98			126	OK	139	OK			137	OK	138	OK
EX6/052 EB	5/23/98 12:05	6/8/98			nd	BDL	nd	BDL			2	j	nd	BDL
EX6/053 M	5/23/98 19:17	6/9/98			108	OK	121	OK			118	OK	118	OK
EX6/055 A	5/23/98 21:00	6/8/98			103	OK	112	OK			115	OK	110	OK
EX6/056 A	5/24/98 9:00	6/9/98			93	OK	74	OK			73	OK	72	OK
EX6/057 A	5/24/98 21:00	6/9/98			86	OK	63	OK			62	OK	65	OK
EX6/058 A	5/25/98 9:00	7/14/98			54	OK	52	OK			58	OK	44	OK
EX6/054 M	5/25/98 10:39	6/9/98			42	OK	38	OK			38	OK	31	OK
EX6/059 A	5/25/98 21:00	6/9/98			26	OK	24	OK			22	OK	nd	BDL
EX6/060 A	5/26/98 8:50	6/10/98			40	OK	32	OK			40	OK	34	OK
EX6/061 M	5/26/98 12:20	6/10/98			39	OK	42	OK			46	OK	42	OK
EX6/062 A	5/27/98 11:00	6/11/98			25	OK	30	OK			28	OK	30	OK
EX6/063 A	5/28/98 11:00	6/11/98			18	OK	22	OK			21	OK	18	OK
EX6/064 M	5/28/98 12:45	6/11/98			18	OK	18	OK			18	OK	17	OK
EX6/065 A	5/29/98 10:50	6/12/98			13	OK	12	OK			13	OK	11	OK
EX6/066 M	5/29/98 20:46	6/12/98			10	OK	13	OK			13	OK	10	OK
EX6/068 A	5/30/98 11:00	6/12/98			10	OK	11	OK			10	OK	6	j
EX6/067 M	5/30/98 11:30	6/12/98			10	OK	10	OK			10	j	6	j
EX6/069 A	5/31/98 11:00	6/12/98			8	j	7	j			7	j	6	j
EX6/070 A	6/1/98 10:50	6/12/98			8	j	8	j			8	j	6	j
EX6/070 A [dup]	6/1/98 10:50	6/13/98			8	DUP	7	DUP			8	DUP	7	DUP
EX6/071 M	6/1/98 11:39	6/15/98			9	j	8	j			9	j	3	j
EX6/072 A	6/2/98 11:00	6/15/98			8	j	6	j			7	j	4	j
EX6/073 A	6/3/98 11:00	6/21/98			5	j	5	j			6	j	6	j
EX6/074 M	6/3/98 11:47	6/21/98			4	j	4	j			6	j	7	j
EX6/075 A	6/4/98 10:50	6/21/98			5	j	5	j			5	j	5	j
EX6/076 A	6/5/98 11:00	6/21/98			3	j	4	j			5	j	nd	BDL
EX6/077 M	6/5/98 11:25	6/21/98			2	j	3	j			5	j	3	j
EX6/077 M [dup]	6/5/98 11:25	6/21/98			2	DUP	5	DUP			5	DUP	4	DUP
EX6/078 A	6/6/98 11:00	6/21/98			1	j	3	j			4	j	nd	BDL
EX6/079 A	6/7/98 10:50	6/24/98			5	j	4	j			4	j	5	j
EX6/080 AD	6/7/98 11:00	6/24/98			4	j	4	j			4	j	4	j

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
EX6/082 M	6/7/98 11:13	6/25/98			5	j	5	j			6	j	7	j
EX6/081 EB	6/7/98 11:46	6/24/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
EX6/083 A	6/8/98 11:00	6/24/98			4	j	3	j			4	j	nd	BDL
EX6/085 A	6/9/98 11:00	6/24/98			3	j	4	j			4	j	4	j
EX6/085 A [dup]	6/9/98 11:00	6/24/98			3	DUP	3	DUP			3	DUP	6	DUP
EX6/084 M	6/9/98 11:15	6/25/98			4	j	4	j			4	j	nd	BDL
EX6/086 A	6/10/98 10:50	6/17/98			4	j	2	j			2	j	1	j
EX6/088 A	6/11/98 11:00	6/17/98			4	j	2	j			2	j	2	j
EX6/088 A [dup]	6/11/98 11:00	6/17/98			5	DUP	2	DUP			2	DUP	2	DUP
EX6/087 M	6/11/98 11:23	6/17/98			6	j	2	j			1	j	2	j
EX6/089 A	6/12/98 11:00	6/17/98			4	j	2	j			2	j	1	j
EX6/091 A	6/13/98 10:50	6/17/98			5	j	2	j			2	j	1	j
EX6/090 M	6/13/98 11:18	6/17/98			1	j	3	j			2	j	1	j
EX6/092 A	6/14/98 11:00	6/23/98			3	j	2	j			4	j	nd	BDL
EX6/093 A	6/15/98 11:00	6/23/98			3	j	2	j			4	j	nd	BDL
EX6/094 M	6/15/98 11:39	6/23/98			3	j	1	j			1	j	nd	BDL
EX6/095 A	6/16/98 10:50	6/23/98			2	j	2	j			1	j	1	j
EX6/096 A	6/17/98 11:00	6/23/98			3	j	2	j			2	j	nd	BDL
EX6/096 A [dup]	6/17/98 11:00	6/23/98			3	DUP	2	DUP			2	DUP	nd	DUP
EX6/097 M	6/17/98 11:35	6/23/98			3	j	2	j			2	j	nd	BDL
EX6/098 A	6/18/98 11:00	6/23/98			3	j	2	j			2	j	nd	BDL
EX6/099 A	6/19/98 10:50	6/25/98			3	j	4	j			4	j	nd	BDL
EX6/100 M	6/19/98 11:37	6/25/98			3	j	3	j			4	j	nd	BDL
EX6/101 A	6/20/98 11:00	6/25/98			3	j	3	j			3	j	nd	BDL
EX6/102 A	6/21/98 11:00	6/26/98			3	j	3	j			3	j	nd	BDL
EX6/103 M	6/21/98 11:35	6/26/98			2	j	4	j			2	j	2	j
EX6/103 M [dup]	6/21/98 11:35	6/26/98			2	DUP	2	DUP			2	DUP	nd	DUP
EX6/104 A	6/22/98 10:50	6/26/98			3	j	2	j			2	j	nd	BDL

Project: PITT at ESTCP Camp Lejeune

Acceptable QA/QC limits: % Recovery between 80% and 120%

Data QA/QC by	DW
Date created	1/22/99
Date last modified	1/26/99

Sample Legend

CC = Calibration check
j = below reporting limit
d = diluted sample
BDL = below detection limit
NA = not applicable
jj = out of acceptable QA/QC and/or calibration limits
OK = within acceptable QA/QC limits
nd = not detected
DUP = Duplicate
d,DUP = diluted duplicate

Injectate, Trip Blank, and Monitoring Well Samples

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
PER/001	5/12/98 17:05	5/19/98	nd	BDL	nd	BDL	nd	BDL	6	j	nd	BDL	nd	BDL
INJ/010	5/13/98 11:25	5/19/98	nd	BDL	nd	BDL	nd	BDL	5	j	nd	BDL	nd	BDL
INJ/011 (1:10)	5/13/98 11:45	5/19/98	752	d	780	d	717	d	nd	d	706	d	494	d
INJ/011 (1:10) [dup]	5/13/98 11:45	5/19/98	766	d, DUP	778	d, DUP	730	d, DUP	nd	d, DUP	730	d, DUP	506	d, DUP
INJ/011 (1:10)	5/13/98 11:45	7/9/98		d	772	d	690	d		d	672	d	452	d
INJ/012 (1:10)	5/14/98 10:40	5/19/98	957	d	1050	d	974	d	nd	d	973	d	682	d
INJ/012 (1:10)	5/14/98 10:40	7/9/98		d	989	d	898	d		d	856	d	587	d
INJ/013 TB	5/14/98 11:50	5/19/98	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
INJ/014 (1:10)	5/15/98 12:05	5/24/98	890	d	942	d	901	d	nd	d	926	d	672	d
INJ/014 (1:10)	5/15/98 12:05	5/24/98	1060	d	1060	d	1010	d			1030	d	726	d
INJ/014 (1:10)	5/15/98 12:05	7/9/98		d	936	d	824	d			846	d	565	d
TB02	5/16/98 0:00	5/24/98	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
TB02	5/16/98 0:00	5/24/98	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
TB03	5/16/98 0:00	5/25/98	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
TB03	5/16/98 0:00	5/25/98	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
TB04	5/16/98 0:00	5/25/98	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
INJ/015 (1:10)	5/16/98 16:25	5/25/98	855	d	876	d	815	d	nd	d	832	d	587	d
INJ/015 (1:10)	5/16/98 16:25	7/9/98			956	d	885	d			863	d	584	d
INJ/016 (1:10)	5/18/98 8:28	5/27/98	925		943	d	895	d	nd	d	898	d	647	d
INJ/016 (1:10) [dup]	5/18/98 8:28	5/27/98	806		812	d, DUP	755	d, DUP	nd	d, DUP	770	d, DUP	551	d, DUP
INJ/016 (1:10)	5/18/98 8:28	7/9/98			950	d	850	d			827	d	516	d
INJ/017 (1:10)	5/18/98 16:25	5/27/98	824		853	d	782	d	nd	d	803	d	569	d
INJ/017 (1:10)	5/18/98 16:25	7/9/98			963	d	895	d			890	d	595	d
INJ/018	5/18/98 16:35	5/27/98	nd		nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
INJ/019	5/18/98 16:50	5/27/98	nd		nd	BDL	nd	BDL	nd	BDL	nd	BDL	nd	BDL
TB/07	5/20/98 0:00	6/6/98				j	0.18	j			nd	BDL	0.87	j
TB/06	5/20/98 0:00	6/7/98			0.56	j	0.11	j			nd	BDL	nd	BDL
MW02/02	5/20/98 16:50	6/6/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
MW02IW/02	5/20/98 19:25	6/7/98			nd	BDL	nd	BDL			nd	BDL	0.34	j

Sample ID	Date and Time	Date Analyzed	Methanol (mg/L)	Flag for Methanol	1-Propanol (mg/L)	Flag for 1-Propanol	4-Methanol-2-pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	PCE (mg/L)	Flag for PCE	1-Hexanol (mg/L)	Flag for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol
INJ/021 TB	5/26/98 12:05	6/10/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
INJ/022 TB	5/26/98 12:36	6/10/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
INJ/022 TB [dup]	5/26/98 12:36	6/10/98			nd	DUP	nd	DUP			nd	DUP	nd	DUP
MW02IW-03	5/27/98 11:50	6/11/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
MW02-3	5/27/98 14:05	6/11/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
INJ/024 TB	5/28/98 13:14	6/11/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
INJ/025 TB	5/28/98 13:28	6/11/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
INJ/026 TB	5/30/98 12:01	6/12/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
INJ/027 TB	6/2/98 12:13	6/15/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
INJ/027 TB [dup]	6/2/98 12:13	6/15/98			nd	DUP	nd	DUP			nd	DUP	nd	DUP
INJ/028 TB	6/2/98 12:16	6/15/98			nd	BDL		j			nd	BDL	nd	BDL
TB/029	6/4/98 14:28	6/21/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
TB/030	6/4/98 14:30	6/21/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
TB/031	6/6/98 12:05	6/21/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
TB/031 [dup]	6/6/98 12:05	6/22/98			nd	DUP	nd	DUP			nd	DUP	nd	DUP
TB/032	6/6/98 12:06	6/22/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
MW02/05	6/8/98 13:27	6/24/98			nd	BDL	1.76	j			nd	BDL	nd	BDL
MW02IW/04	6/8/98 15:28	6/24/98			nd	BDL	1.66	j			nd	BDL	nd	BDL
TB/033	6/9/98 12:14	6/24/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
TB/034	6/9/98 12:15	6/25/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
TB/035	6/11/98 12:06	6/16/98			nd	BDL	1.27	j			4.45	j	6.02	j
TB/036	6/11/98 12:06	6/16/98			nd	BDL	nd	BDL			0.75	j	1.75	j
TB/036	6/11/98 12:06	6/16/98			nd	BDL	nd	BDL			0.75	j	nd	BDL
TB/038	6/13/98 11:30	6/16/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
TB/039	6/13/98 11:53	6/23/98			nd	BDL	nd	BDL			2.24	j	nd	BDL
TB/040	6/15/98 12:50	6/23/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
TB/040 [dup]	6/15/98 12:50	6/23/98			nd	DUP	nd	DUP			nd	DUP	nd	DUP
MW02IW/05	6/16/98 14:07	6/22/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
MW02/06	6/16/98 14:13	6/22/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
TB/041	6/18/98 11:15	6/22/98			nd	BDL	nd	BDL			3.41	j	4.85	j
TB/042	6/18/98 11:17	6/22/98			nd	BDL	nd	BDL			0.88	j	nd	BDL
TB/043	6/20/98 9:08	6/25/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
TB/044	6/20/98 10:18	6/25/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
TB/045	6/22/98 12:26	6/26/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
TB/046	6/22/98 12:26	6/26/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
MW02/626	6/26/98 9:10	7/1/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL
MW02IW/626	6/26/98 11:10	7/1/98			nd	BDL	nd	BDL			nd	BDL	nd	BDL

Project: PITT at ESTCP Camp Lejeune

Acceptable QA/QC limits: % Recovery between 80% and 120%

Data QA/QC by	DW
Date created	1/22/99 0:00
Date last modified	1/27/99 0:00

Sample Legend

CC = Calibration check
j = below reporting limit
d = diluted sample
BDL = below detection limit
NA = not applicable
jj = out of acceptable QA/QC and/or calibration limits
OK = within acceptable QA/QC limits
nd = not detected
DUP = Duplicate
d,DUP = diluted duplicate

Duplicate Samples

Sample ID	Date and Time	Date Analyzed	1-Propanol (mg/L)	Flag for 1-Propanol	Duplicate Analyses for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	Duplicate Analyses for 4-Methyl-2-pentanol	1-Hexanol (mg/L)	Flag for 1-Hexanol	Duplicate Analyses for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol	Duplicate Analyses for 1-Heptanol
3-17.5/014	5/17/98 19:03	5/27/98	nd	BDL		nd	BDL		nd	BDL		nd	BDL	
3-17.5/014 [dup]	5/17/98 19:03	5/27/98	nd	DUP		nd	DUP		nd	DUP		nd	DUP	
3-17.5/015	5/18/98 9:15	6/4/98	nd	BDL		nd	BDL		4	j		nd	BDL	
3-17.5/015 [dup]	5/18/98 9:15	6/4/98	nd	DUP		nd	DUP		4	DUP	92	nd	DUP	
3-17.5/018	5/19/98 19:17	6/6/98	1	j		1	j		0	j		nd	BDL	
3-17.5/018 [dup]	5/19/98 19:17	6/6/98	2	DUP	191	2	DUP	148	1	DUP	124	nd	DUP	
3-17.5/024D	5/22/98 19:42	6/8/98	89	OK		61	OK		52	OK		16	OK	
3-17.5/022 [dup]	5/22/98 19:47	6/7/98	31	DUP	35	20	DUP	32	13	DUP	25	5	DUP	32
3-17.5/026	5/23/98 18:38	6/9/98	81	OK		58	OK		47	OK		25	OK	
3-17.5/026 [dup]	5/23/98 18:38	6/9/98	82	DUP	101	57	DUP	99	48	DUP	102	19	DUP	79
3-17.5/038	6/2/98 7:50	6/15/98	193	OK		202	jj		179	OK		110	OK	
3-17.5/038 [dup]	6/2/98 7:50	6/15/98	192	DUP	99	184	DUP	91	180	DUP	100	107	DUP	97
3-17.5/043	6/7/98 9:02	6/18/98	79	OK		76	OK		73	OK		51	OK	
3-17.5/043 [dup]	6/7/98 9:02	6/18/98	71	DUP	90	68	DUP	90	67	DUP	92	46	DUP	92
2-18.5/029	5/25/98 8:11	6/9/98	4	j		45	OK		nd	BDL		nd	BDL	
2-18.5/029 [dup]	5/25/98 8:11	6/9/98	3	DUP	84	40	DUP	88	nd	DUP		nd	DUP	
2-18.5/032	5/27/98 8:05	6/11/98	39	OK		11	OK		nd	BDL		nd	BDL	
2-18.5/032 [dup]	5/27/98 8:05	6/11/98	37	DUP	95	7	DUP	61	nd	DUP		nd	DUP	
2-18.5/035	5/30/98 7:50	6/12/98	114	OK		31	OK		9	j		nd	BDL	
2-18.5/035 [dup]	5/30/98 7:50	6/12/98	118	DUP	104	32	DUP	102	9	DUP	96	nd	DUP	
2-17.0/021 (1:10)	5/21/98 10:43	7/1/98	973	d		838	d		846	d		432	d	
2-17.0/021 (1:10) [du	5/21/98 10:43	7/1/98	1050	d,DUP	108	1020	d,DUP	122	963	d,DUP	114	606	d,DUP	141
2-17.0/036	5/31/98 7:30	6/12/98	nd	BDL		nd	BDL		nd	BDL		nd	BDL	
2-17.0/036 [dup]	5/31/98 7:30	6/12/98	nd	DUP		nd	DUP		nd	DUP		nd	DUP	
2-17.0/047	6/11/98 9:20	6/17/98	1	j		nd	BDL		nd	BDL		nd	BDL	
2-17.0/047 [dup]	6/11/98 9:20	6/17/98	1	DUP	90	nd	DUP		nd	DUP		0	DUP	

Sample ID	Date and Time	Date Analyzed	1-Propanol (mg/L)	Flag for 1-Propanol	Duplicate Analyses for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	Duplicate Analyses for 4-Methyl-2-pentanol	1-Hexanol (mg/L)	Flag for 1-Hexanol	Duplicate Analyses for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol	Duplicate Analyses for 1-Heptanol
EX1/058 A	5/25/98 9:00	6/9/98	74	OK		104	OK		106	OK		42	OK	
EX1/058 A [dup]	5/25/98 9:00	6/9/98	60	OK	82	84	OK	80	87	OK	82	40	OK	94
EX1/086 M	6/9/98 11:05	6/25/98	6	j		7	j		12	OK		29	OK	
EX1/086 M [dup]	6/9/98 11:05	6/25/98	6	DUP	93	9	DUP	127	10	DUP	83	39	DUP	137
EX1/092 M	6/13/98 11:08	6/17/98	3	j		3	j		3	j		15	OK	
EX1/092 M [dup]	6/13/98 11:08	6/17/98	5	DUP	179	3	DUP	106	3	DUP	101	16	DUP	109
EX2/013 A	5/15/98 1:30	5/20/98	nd	BDL		nd	BDL		nd	BDL		nd	BDL	
EX2/013 A [dup]	5/15/98 1:30	5/20/98	nd	DUP		nd	DUP		nd	DUP		nd	DUP	
EX2/040 AD	5/19/98 19:50	6/5/98	241	jj		202	jj		234	jj		110	OK	
EX2/040 AD [dup]	5/19/98 19:50	6/5/98	237	DUP	98	200	DUP	99	224	DUP	96	105	DUP	95
EX2/050 M (1:10)	5/22/98 21:02	7/1/98	238	d		180	d		211	d		143	d	
EX2/050 M (1:10) [du	5/22/98 21:02	7/1/98	229	d,DUP	96	169	d,DUP	94	206	d,DUP	98	129	d,DUP	90
EX2/055 M	5/23/98 19:09	6/8/98	180	OK		213	jj		197	OK		176	OK	
EX2/055 M [dup]	5/23/98 19:09	6/9/98	178	DUP	99	206	DUP	97	192	DUP	97	176	DUP	100
EX2/068 M	5/28/98 12:37	6/11/98	69	OK		53	OK		62	OK		44	OK	
EX2/068 M [dup]	5/28/98 12:37	6/11/98	88	DUP	127	66	DUP	123	74	DUP	119	51	DUP	114
EX2/069 A	5/29/98 10:50	6/11/98	33	OK		33	OK		39	OK		27	OK	
EX2/069 A [dup]	5/29/98 10:50	6/11/98	34	DUP	103	33	DUP	98	36	DUP	92	28	DUP	102
EX2/083 A	6/5/98 11:00	6/21/98	11	OK		12	OK		14	OK		14	OK	
EX2/083 A [dup]	6/5/98 11:00	6/21/98	10	DUP	85	10	DUP	81	12	DUP	87	12	DUP	88
EX2/088 A	6/8/98 11:00	6/24/98	9	j		8	j		8	j		11	OK	
EX2/088 A [dup]	6/8/98 11:00	6/24/98	8	DUP	97	8	DUP	97	8	DUP	98	10	DUP	89
EX2/100 A	6/16/98 10:50	6/23/98	12	OK		7	j		7	j		5	j	
EX2/100 A [dup]	6/16/98 10:50	6/23/98	11	DUP	94	7	DUP	98	7	DUP	95	4	DUP	96
EX2/103 M/A	6/18/98 11:32	6/22/98	5	j		6	j		6	j		4	j	
EX2/103 M/A [dup]	6/18/98 11:32	6/22/98	6	DUP	123	6	DUP	96	5	DUP	86	5	DUP	102
EX3/009 M	5/16/98 7:45	5/23/98	0	j		0	j		0	j		nd	BDL	
EX3/009 M [dup]	5/16/98 7:45	5/23/98	0	DUP	107	0	DUP	99	0	DUP	106	nd	DUP	
EX3/042 EB	5/20/98 18:40	6/6/98	1	j		nd	BDL		nd	BDL		nd	BDL	
EX3/042 EB [dup]	5/20/98 18:40	6/6/98	1	DUP	93	nd	DUP		nd	DUP		nd	DUP	
EX3/078 A	6/4/98 10:50	6/21/98	6	j		6	j		6	j		4	j	
EX3/078 A [dup]	6/4/98 10:50	6/21/98	7	DUP	107	6	DUP	100	7	DUP	109	4	DUP	105
EX3/091 M	6/13/98 11:12	6/17/98	9	j		6	j		7	j		3	j	
EX3/091 M [dup]	6/13/98 11:12	6/17/98	10	DUP	122	6	DUP	92	6	DUP	85	2	DUP	65
EX3/100 AD	6/19/98 11:00	6/25/98	6	j		7	j		7	j		6	j	
EX3/100 AD [dup]	6/19/98 11:00	6/25/98	6	DUP	98	6	DUP	91	5	DUP	72	6	DUP	108
EX3/103 M	6/19/98 11:32	6/25/98	5	j		6	j		6	j		5	j	
EX3/103 M [dup]	6/19/98 11:32	6/25/98	7	DUP	124	8	DUP	134	7	DUP	126	7	DUP	132
EX4R/005 A	5/14/98 7:40	5/19/98	nd	BDL		nd	BDL		nd	BDL		nd	BDL	

Sample ID	Date and Time	Date Analyzed	1-Propanol (mg/L)	Flag for 1-Propanol	Duplicate Analyses for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	Duplicate Analyses for 4-Methyl-2-pentanol	1-Hexanol (mg/L)	Flag for 1-Hexanol	Duplicate Analyses for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol	Duplicate Analyses for 1-Heptanol
EX4R/005 A [dup]	5/14/98 7:40	5/19/98	nd	DUP		nd	DUP		nd	DUP		nd	DUP	
EX4R/016 A	5/16/98 1:30	5/23/98	0	j		0	j		nd	BDL		nd	BDL	
EX4R/016 A [dup]	5/16/98 1:30	5/24/98	0	DUP	105	nd	DUP		nd	DUP		nd	DUP	
EX4R/021 A	5/16/98 19:40	5/25/98	10	j		7	j		4	j		0	j	
EX4R/021 A [dup]	5/16/98 19:40	5/25/98	11	DUP	110	7	DUP	114	4	DUP	117	0	DUP	87
EX4R/027 A	5/17/98 13:40	5/26/98	56	OK		41	OK		28	OK		5	j	
EX4R/027 A [dup]	5/17/98 13:40	5/26/98	66	DUP	118	50	DUP	120	34	DUP	121	6	DUP	117
EX4R/031 AD	5/18/98 7:50	6/4/98	258	jj		152	OK		118	OK		25	OK	
EX4R/031 AD [dup]	5/18/98 7:50	6/4/98	97	DUP	37	78	DUP	51	63	DUP	53	14	DUP	57
EX4R/036 A	5/19/98 7:40	6/5/98	215	jj		127	OK		98	OK		25	OK	
EX4R/036 A [dup]	5/19/98 7:40	6/5/98	207	DUP	96	123	DUP	97	97	DUP	99	25	DUP	101
EX4R/044 A	5/21/98 9:00	6/7/98	>200	jj		193	OK		168	OK		47	OK	
EX4R/044 A [dup]	5/21/98 9:00	6/7/98	>200	DUP		203	DUP		173	DUP		43	DUP	
EX4R/066 M	5/29/98 20:44	6/12/98	18	OK		22	OK		28	OK		50	OK	
EX4R/066 M [dup]	5/29/98 20:44	6/12/98	19	DUP	107	22	DUP	104	32	DUP	113	53	DUP	105
EX4R/074 M	6/3/98 11:44	6/21/98	5	j		6	j		8	j		26	OK	
EX4R/074 M [dup]	6/3/98 11:44	6/21/98	4	DUP	91	5	DUP	95	8	DUP	90	33	DUP	124
EX4R/091 A	6/13/98 10:50	6/17/98	3	j		2	j		2	j		7	j	
EX4R/091 A [dup]	6/13/98 10:50	6/17/98	4	DUP	118	2	DUP	100	2	DUP	105	6	DUP	80
EX4R/104 A/M	6/22/98 10:50	6/26/98	4	j		3	j		4	j		3	j	
EX4R/104 A/M [dup]	6/22/98 10:50	6/26/98	3	DUP	85	5	DUP	141	2	DUP	52	4	DUP	138
EX5/029 M	5/19/98 7:43	6/5/98	191	OK		158	OK		132	OK		71	OK	
EX5/029 M [dup]	5/19/98 7:43	6/5/98	264	DUP	138	221	DUP	140	189	DUP	143	104	DUP	147
EX5/046 A	5/20/98 21:00	6/6/98	>200	jj		>200	jj		>200	jj		153	OK	
EX5/046 A [dup]	5/20/98 21:00	6/6/98	>200	DUP		>200	DUP		>200	DUP		146	DUP	
EX5/046 A (1:10)	5/20/98 21:00	6/30/98	266	d		239	d		228	d		73	d	
EX5/046 A (1:10) [du	5/20/98 21:00	6/30/98	270	d, DUP	101	249	d, DUP	104	228	d, DUP	100	145	d, DUP	198
EX5/050 A	5/21/98 21:00	6/7/98	>200	jj		>200	jj		>200	jj		172	OK	
EX5/050 A [dup]	5/21/98 21:00	6/7/98	>200	DUP		>200	DUP		>200	DUP		181	DUP	
EX5/052 A	5/22/98 21:00	6/7/98	199	OK		192	OK		179	OK		137	OK	
EX5/052 A [dup]	5/22/98 21:00	6/7/98	218	DUP	110	199	DUP	103	183	DUP	102	138	DUP	101
EX5/057 A	5/24/98 9:00	6/9/98	111	OK		112	OK		103	OK		93	OK	
EX5/057 A [dup]	5/24/98 9:00	6/9/98	118	DUP	106	120	DUP	107	113	DUP	109	99	DUP	106
EX5/069 A	5/30/98 11:00	6/12/98	19	OK		20	OK		21	OK		13	OK	
EX5/069 A [dup]	5/30/98 11:00	6/12/98	19	DUP	97	21	DUP	104	21	DUP	102	14	DUP	111
EX5/096 A	6/15/98 11:00	6/23/98	5	j		5	j		5	j		3	j	
EX5/096 A [dup]	6/15/98 11:00	6/23/98	6	DUP	115	5	DUP	98	5	DUP	97	4	DUP	126
EX5/104 A	6/20/98 11:00	6/25/98	4	j		5	j		6	j		6	j	
EX5/104 A [dup]	6/20/98 11:00	6/25/98	4	DUP	97	6	DUP	131	6	DUP	98	5	DUP	78

Sample ID	Date and Time	Date Analyzed	1-Propanol (mg/L)	Flag for 1-Propanol	Duplicate Analyses for 1-Propanol	4-Methanol-2 pentanol (mg/L)	Flag for 4-Methanol-2-pentanol	Duplicate Analyses for 4-Methyl-2-pentanol	1-Hexanol (mg/L)	Flag for 1-Hexanol	Duplicate Analyses for 1-Hexanol	1-Heptanol (mg/L)	Flag for 1-Heptanol	Duplicate Analyses for 1-Heptanol
EX6/014 A	5/15/98 13:30	5/23/98	nd	BDL		nd	BDL		nd	BDL		nd	BDL	
EX6/014 A [dup]	5/15/98 13:30	5/24/98	nd	DUP		nd	DUP		nd	DUP		nd	DUP	
EX6/018 M	5/16/98 20:28	5/25/98	19	OK		17	OK		13	OK		6	j	
EX6/018 M [dup]	5/16/98 20:28	5/26/98	19	DUP	97	17	DUP	100	13	DUP	100	6	DUP	100
EX6/033 A	5/18/98 13:40	6/4/98	155	OK		145	OK		128	OK		74	OK	
EX6/033 A [dup]	5/18/98 13:40	6/4/98	155	DUP	100	172	DUP	119	157	DUP	122	90	DUP	122
EX6/039 A	5/19/98 19:40	6/5/98	212	jj		169	OK		151	OK		93	OK	
EX6/039 A [dup]	5/19/98 19:40	6/5/98	205	DUP	97	154	DUP	91	141	DUP	94	84	DUP	90
EX6/042 M	5/20/98 21:45	6/7/98	220	jj		217	jj		202	jj		138	OK	
EX6/042 M [dup]	5/20/98 21:45	6/7/98	227	DUP	103	215	DUP	99	205	DUP	101	133	DUP	97
EX6/050 A	5/23/98 8:50	6/8/98	94	OK		92	OK		87	OK		89	OK	
EX6/050 A [dup]	5/23/98 8:50	6/8/98	133	DUP	142	142	DUP	154	139	DUP	159	144	DUP	162
EX6/070 A	6/1/98 10:50	6/12/98	8	j		8	j		8	j		6	j	
EX6/070 A [dup]	6/1/98 10:50	6/13/98	8	DUP	101	7	DUP	88	8	DUP	96	7	DUP	110
EX6/077 M	6/5/98 11:25	6/21/98	2	j		3	j		5	j		3	j	
EX6/077 M [dup]	6/5/98 11:25	6/21/98	2	DUP	115	5	DUP	135	5	DUP	89	4	DUP	115
EX6/085 A	6/9/98 11:00	6/24/98	3	j		4	j		4	j		4	j	
EX6/085 A [dup]	6/9/98 11:00	6/24/98	3	DUP	94	3	DUP	94	3	DUP	75	6	DUP	153
EX6/088 A	6/11/98 11:00	6/17/98	4	j		2	j		2	j		2	j	
EX6/088 A [dup]	6/11/98 11:00	6/17/98	5	DUP	115	2	DUP	107	2	DUP	134	2	DUP	81
EX6/096 A	6/17/98 11:00	6/23/98	3	j		2	j		2	j		nd	BDL	
EX6/096 A [dup]	6/17/98 11:00	6/23/98	3	DUP	114	2	DUP	118	2	DUP	115	nd	DUP	
EX6/103 M	6/21/98 11:35	6/26/98	2	j		4	j		2	j		2	j	
EX6/103 M [dup]	6/21/98 11:35	6/26/98	2	DUP	88	2	DUP	64	2	DUP	107	nd	DUP	

Camp Lejeune Background Arsenic Analyses

STAR ANALYTICAL
14500 Trinity Boulevard, Suite 106 • Fort Worth, Texas 76155
Tarrant County • (817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

Duke Engineering & Services	Client Project ID:	Camp Lejeune		Sampled:	Apr 10, 1998
9111 Research Blvd.	Sample Matrix:	Water		Received:	Apr 14, 1998
Austin, TX 78758				Reported:	Apr 20, 1998
Attention: Fred Holzmer	First Sample #:	804-0351			

Analytical and Quality Control Report

Enclosed is the Analytical and Quality Control Report for the following samples submitted to Star Analytical for analysis. The results in this report are limited to the samples tested. Reproduction of this report is permitted only in its entirety with written permission from the laboratory.

Sample No. 804-0351 to 804-0354

Comments:

All **holding times** were within method criteria.

All **calibration criteria** were met for these analyses.

method blanks were within required quality control criteria.

Total Number of Pages in Report: 03

STAR ANALYTICAL

Joy Dilday
Laboratory Director

STAR ANALYTICAL

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Duke Engineering & Services
9111 Research Blvd.
Austin, TX 78758
Attention: Fred Holzmer

Client Project ID: Camp Lejeune
Sample Descript: Water
Analysis for: Arsenic
First Sample #: 804-0351
Method: EPA 206.2

Sampled: Apr 10, 1998
Received: Apr 14, 1998
Extracted: Apr 20, 1998
Analyzed: Apr 20, 1998
Reported: Apr 20, 1998

LABORATORY ANALYSIS FOR: Arsenic

Sample Number	Sample Description	Reporting Limit mg/L	Sample Result mg/L
804-0351	88-MW02(S)	0.0050	N.D.
804-0352	88-MW03(S)	0.0050	N.D.
804-0353	88-MW05(S)	0.0050	N.D.
804-0354	TW04	0.0050	N.D.

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

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Anthony Dilday
Laboratory Director

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Duke Engineering & Services
9111 Research Blvd.
Austin, TX 78758
Attention: Fred Holzmer

Client Project ID: Camp Lejeune
Matrix: Water
QC Sample Group: 8040351-354

Reported: Apr 20, 1998

QUALITY CONTROL DATA REPORT

ANALYTE
Arsenic

Method: EPA 206.2
Analyst: SW
Reporting Units: µg/L
Date Prepared: Apr 20, 1998
Date Analyzed: Apr 20, 1998
LCS ID #: LCS042098

Spike Conc. Added: 10

LCS Spike % Recovery: 98

Control Limits: 80-120

MS/MSD SAMPLE #: 8040351MS

Matrix Spike % Recovery: 114

Matrix Spike Duplicate % Recovery: 109

Relative % Difference: 4.5

Please Note: The LCS is a Laboratory control sample of interferent free matrix that is analyzed using the same reagents, preparation and methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, MS/MSD's QC limits are advisory only and are not used to accept or reject batch results. The % Rec. and RPD are calculated as follows:

% Recovery: $$\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$$

Relative % Difference: $$\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$$

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thony Dilday
Laboratory Director

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Duke Engineering & Services
9111 Research Blvd.
Austin, TX 78758

Project: TDN 307 PITT
Project Number: none
Project Manager: John Londergan

Sampled: 5/29/98
Received: 6/1/98
Reported: 6/8/98 15:32

Total Metals by EPA 6000/7000 Series Methods
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	Reporting Limit	Result	Units	Notes*
MW02-4			**8060026-00**				**Water**	
Arsenic	06V8125	6/2/98	6/8/98	EPA 206.2	0.0050	ND	mg/l	
MW03-4			**8060026-01**				**Water**	
Arsenic	06V8125	6/2/98	6/8/98	EPA 206.2	0.0050	ND	mg/l	
MW05-4			**8060026-02**				**Water**	
Arsenic	06V8125	6/2/98	6/8/98	EPA 206.2	0.0050	ND	mg/l	

Star Analytical, Inc.

**Refer to end of report for text of notes and definitions.*

LHall

Lari Hall, Project Manager

STAR ANALYTICAL

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Duke Engineering & Services
9111 Research Blvd.
Austin, TX 78758

Project: TDN 307 PITT
Project Number: none
Project Manager: John Londergan

Sampled: 5/29/98
Received: 6/1/98
Reported: 6/8/98 15:32

Total Metals by EPA 6000/7000 Series Methods/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 06V8125	**Date Prepared: 6/2/98**				**Extraction Method: EPA 3010**					
Blank	**06V8125-BLK1**									
Arsenic	6/8/98			ND	mg/l	0.0050				
LCS	**06V8125-BS1**									
Arsenic	6/8/98	0.010		0.010	mg/l	80-120	100			
LCS Dup	**06V8125-BSD1**									
Arsenic	6/8/98	0.010		0.010	mg/l	80-120	100		0	
Matrix Spike	**06V8125-MS1**		**8060012-00**							
Arsenic	6/8/98	0.010	ND	0.013	mg/l	80-120	130			
Matrix Spike Dup	**06V8125-MSD1**		**8060012-00**							
Arsenic	6/8/98	0.010	ND	0.012	mg/l	80-120	120	30	8.0	

14

S[illegible]alytical, Inc.

LHall

Lari Hall, Project Manager

**Refer to end of report for text of notes and definitions.*

Duke Engineering & Services	Project:	TDN 307 PITT	Sampled:	5/29/98
9111 Research Blvd.	Project Number:	none	Received:	6/1/98
Austin, TX 78758	Project Manager:	John Londergan	Reported:	6/8/98 15:32

Notes and Definitions

#	Note
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
Recov.	Recovery
RPD	Relative Percent Difference

St [illegible]alytical, Inc.

LHall

Lari Hall, Project Manager

STAR ANALYTICAL
CHAIN-OF-CUSTODY FORM

14500 Trinity Boulevard, Suite 106
Fort Worth, Texas 76155
(817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

Company Name: Duke Engineering & Services	Project Name: TDN 307 PITT
Address: 9111 Research Blvd	Billing Address (if different):
City: Austin State: TX Zip Code: 78758	
Telephone: 512-425-2000 FAX#:	P.O.#:
Report To: John Londergan Sampler: Harry / Jerry	

Turnaround Time:
☐ 10 Working Days ☐ 4 Working Days ☐ 24 Hours
☒ 7 Working Days ☐ 3 Working Days ☐ 2 - 8 Hours
☐ 5 Working Days ☐ 2 Working Days

Analyses Requested

Client Sample I.D.	Date/Time Sampled	Matrix Desc.	# of Cont.	Cont. Type	Star's Sample #	Arsenic HNO3									Comments
1. MW02 - 4	5/29/98 1145	Aq	1		8060026-00										
2. MW03 - 4	5/29/98 0920	Aq	1		8060026-01										
3. MW05 - 4	5/29/98 1040	Aq	1		8060026-02										
4.															
5.															
6.															
7.															
8.															
9.															
10.															

Relinquished By:	Date: 5/29/98	Time: 1300	Received By:	Date: 6/1/98	Time: 0930
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

Samples Received in Good Condition? ☑ Yes ☐ No   Samples Cold? ☐ Yes ☑ No   Method of Shipment FED EX   Page 1 of 1

Pink - Client

Yellow - Star

White - Star

STAR ANALYTICAL
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Tarrant County (817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431
ACCREDITED

FAX

Date: 6-8-98

Number of pages including cover sheet: 6

To: John Londergan
Company: Duke
Fax Number:
CC:

From: Lori Hall
Company: STAR ANALYTICAL
14500 Trinity Blvd., # 106
Fort Worth, Tx 76155
Phone: (817) 540-6982 metro
Fax Number: (817) 267-5431

REMARKS: ☐ Urgent ☐ For your review ☐ Reply ASAP ☐ Please comment

Should any problems occur during receiving this transmission, Please call (817)540-6982

STAR ANALYTICAL

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Duke Engineering & Services
9111 Research Blvd.
Austin, TX 78758

Project: TDN 307 PITT
Project Number: none
Project Manager: John Londergan

Sampled: 5/29/98
Received: 6/1/98
Reported: 6/8/98 15:32

ANALYTICAL REPORT FOR SAMPLES:

Sample Description	Laboratory Sample Number	Sample Matrix	Date Sampled
MW02-4	8060026-00	Water	5/29/98
MW03-4	8060026-01	Water	5/29/98
MW05-4	8060026-02	Water	5/29/98

S Analytical, Inc.

LHall

Lari Hall, Project Manager

The results in this report apply to the samples analyzed in accordance with the chain of custody document.
This analytical report must be reproduced in its entirety.

APPENDIX P

Sample Holding Time Study

Ref: 98-PW4
EPA CONTRACT NO. 68-C-98-138

August 27, 1998

Dr. Lynn Wood
National Risk Management Research Laboratory
Subsurface Protection & Remediation Division
U.S. Environmental Protection Agency
P.O. Box 1198
Ada, OK 74820

THRU: D. Fine D.Fine

Dear Dr. Wood:

Attached is a data report for the analysis of aqueous samples made from tap water. The analyses were conducted on August 6 (0 day), 12 (6 days), 20 (14 days) and 27 (21 days), 1998 respectively, as per Service Request #RE-0-16. Five duplicates were run for each set. The samples were analyzed for methanol, 1-propanol, 4-methyl-2-pentanol, 1-hexanol and 1-heptanol.

Analyses were performed using RSKSOP-201, Revision No. 0 (under preparation) by Perry Wang.

Detection limits and quantitation limits for each component are as follows:

Analytes	LOD*	LOQ**
Methanol	0.05	0.18
1-Propanol	0.05	0.18
4-Methyl-2-pentanol	0.06	0.18
1-Hexanol	0.07	0.23
1-Heptanol	0.05	0.15

*Limits of Detection, ppm. **Limit of Quantitation ppm.

If you have any question, please feel free to contact me.

Sincerely,

Perry G. Wang
Perry G. Wang

xc: J.L. Seeley
R.L. Cosby
G.B. Smith

ManTech Environmental Research Services Corporation
R.S. Kerr Environmental Research Laboratory, P.O. Box 1198, 919 Research Drive
Ada, Oklahoma 74821-1189 405-436-8660 FAX 405-436-8501

Dada Sheet of RE-0-16

Units: ppm

0 DAY	MeOH	1-PRO	4M2P	1Hex	1Hep
	102.1	98.7	92.9	96.6	99.4
	94.0	94.9	100.1	94.6	96.3
	96.6	101.9	98.2	88.9	103.5
	97.2	97.2	101.3	96.5	99.5
	101.8	102.3	99.2	89.9	100.2
MEAN	98.3	99.0	98.3	93.3	99.7
SD	3.1	2.8	2.9	3.3	2.3
RSD	3.2%	2.8%	3.0%	3.5%	2.3%

6 DAYS	MeOH	1-PRO	4M2P	1Hex	1Hep
	93.3	90.3	99.4	93.8	93.9
	99.7	100.5	93.6	97.6	101.7
	100.6	101.2	95.6	86.8	102.9
	94.1	94.2	100.4	94.6	96.7
	94.5	96.2	99.2	95.7	98.5
MEAN	96.4	96.5	97.6	93.7	98.7
SD	3.1	4.0	2.6	3.7	3.3
RSD	3.2%	4.2%	2.6%	3.9%	3.3%

14 DAYS	MeOH	1-PRO	4M2P	1Hex	1Hep
	93.2	93.1	101.2	92.7	95.6
	100.2	101.3	97.8	83.6	102.6
	94.7	96.0	102.3	93.2	96.6
	99.0	103.1	99.4	85.5	103.6
	96.1	97.3	103.5	94.7	98.2
MEAN	96.6	98.2	100.8	89.9	99.3
SD	2.6	3.6	2.0	4.5	3.2
RSD	2.7%	3.7%	2.0%	5.0%	3.2%

21 DAYS	MeOH	1-PRO	4M2P	1Hex	1Hep
	90.1	95.6	100.8	91.5	93.6
	99.0	101.9	97.6	98.3	102.9
	97.9	99.7	104.1	95.4	100.3
	90.0	103.0	101.5	90.5	105.0
	101.3	102.0	97.5	98.0	104.1
MEAN	95.6	100.5	100.3	94.8	101.2
SD	4.7	2.7	2.5	3.2	4.1
RSD	5.0%	2.6%	2.5%	3.4%	4.0%

MEAN: Mean solution concentration (ppm) for each set.
SD: Standard Deviation

RSD:Relative Standard Deviation (=100 x (SD/MEAN))
Nomenclature: MeOH= methanol, 1-PRO = 1-propanol, 4M2P = 4-methyl-2-pentanol
1Hex = 1-hexanol, 1-Hep = 1-Heptanol

APPENDIX Q

EACN Discussion

Appendix Q
Effect of DNAPL Composition on Volume Estimation Using Partitioning Interwell Tracer Tests (PITTs)

The critical component in the use of PITTs for estimating the residual nonaqueous phase liquid (NAPL) volume is the accurate measurement of the tracer partition coefficients. The volume of NAPL in a PITT is determined by the following equation:

$$V_N = \frac{\overline{V}_p - \overline{V}_n}{K_i} \qquad (1)$$

where,

V_N = Volume of NAPL estimated by the PITT
$\overline{V}_p$ = First moment of the partitioning tracer
$\overline{V}_n$ = First moment of the nonpartitioning tracer
K_i = partition coefficient of tracer 'i'

From the above it is obvious that the error in the estimation of the NAPL volume is directly proportional to any error in the measurement or estimation of the tracer partition coefficient. The DNAPL at Camp Lejeune is primarily composed of tetrachloroethylene (PCE) and Varsol, a petroleum derivative. The objective of this write-up is to determine the effect of Varsol on the estimation of the DNAPL volume using PITTs.

Theory

The partition coefficient of a given tracer depends upon the relative hydrophobic or hydrophilic nature of the NAPL. The hydrophobic or hydrophilic nature of a petroleum hydrocarbon is defined by the equivalent alkane carbon number or EACN (Salager et al., 1979). A high NAPL EACN is indicative of a strongly hydrophobic NAPL and vice versa.

Dwarakanath and Pope (1998) used the EACN concept to estimate the tracer partition coefficients. They discovered that an alcohol tracer will partition weakly into a strongly hydrophobic NAPL with a high EACN, whereas it will partition strongly into a more polar NAPL with a lower EACN. Hence for a given partitioning tracer, a lower partition coefficient will be observed when the NAPL EACN is high, whereas a low NAPL EACN will translate into a higher partition coefficient. Since field NAPLs are frequently multi-component mixtures, some uncertainty in the PITT estimates of the DNAPL volume can be caused by differences in the NAPL composition.

The equation for estimating tracer partition coefficients using the EACN approach is given below:

$$\log K_i = -2.9562 + 0.6548 A_i - 0.0505 N_j \tag{2}$$

where,

A_i = EACN of alcohol tracer 'i'
N_j = EACN of NAPL 'j'

The EACN of a NAPL mixture ($N_{mixture}$) with 'j' components is given below:

$$N_{mixture} = \sum_{j=1}^{n} x_j N_j \tag{3}$$

x_j = mole fraction of NAPL component 'j'

Using equations (2) and (3), the partition coefficient of a tracer 'i' with a complex NAPL mixture can be estimated. The concentration of PCE and the primary components of Varsol in two DNAPL samples from Camp Lejeune is shown in Table 1.

Table 1. Analysis of DNAPL Samples from Camp Lejeune

Sample	**Component**	**EACN**	**Concentration (mg/L)**	**Mole Fraction**
	Tetrachloroethylene	2.21	1,590,600	0.997
	Decane	10	3,083	0.002
	Undecane	11	1,710	0.001
	Tetrachloroethylene	2.21	1,433,533	0.994
	Decane	10	4,842	0.004
	Undecane	11	3,098	0.002

Using the above equations, the percent change in the partition coefficient of 1-Heptanol as a function of increasing amounts of Varsol is shown in Figure 1. From this Figure it can be seen that if the mole fraction of PCE is zero, then the partition coefficient of the Varsol is 20% less than the partition coefficient of PCE. Hence, if the NAPL were entirely composed of Varsol and the PCE-partition coefficients were used in the analysis of PITT data, then the DNAPL volume will be under-predicted by 20%. This is obviously the worst case scenario. However from Table 1, it is evident that the fraction of Varsol is less than 1% at which the error in the estimation of DNAPL volume due to the uncertainty in the DNAPL composition will be negligible.

References

Salager J.L., J.C. Morgan, R.S. Schechter and W.H. Wade: "Optimum Formulation of Surfactant/Water/Oil Systems for Minimum Interfacial Tension or Phase Behavior," SPE Journal, pp.107-115, April 1979.

Dwarakanath, V. and G.A. Pope, 1998. A New Approach for Estimating Alcohol Partition Coefficients between Nonaqueous Phase Liquids and Water. Environmental Science and Technology, 32(11) pp.1662-1666.

Figure 1. % Change in the Partition Coefficient of 1-Heptanol