

**SOIL AND GROUNDWATER SAMPLING  
REPORT OF FINDINGS**

**FOR**

***PP-3343***

**MARINE CORPS BASE  
CAMP LEJEUNE, NORTH CAROLINA**

**NC DENR UST INCIDENT NO. 24013  
LAND USE CLASSIFICATION: RESIDENTIAL  
RISK CLASSIFICATION: LOW**

**MAY 10, 2005**

**CONTRACT NO. N62470-01-D-3009  
DELIVERY ORDER NO. 0127  
CATLIN PROJECT NO. 204-079**



**PREPARED BY:**

**CATLIN ENGINEERS AND SCIENTISTS  
P. O. BOX 10279  
WILMINGTON, NORTH CAROLINA 28404-0279  
(910) 452-5861**

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## LIST OF ACRONYMS

2001 Guidelines	Guidelines for Assessment and Corrective Action, North Carolina Underground Storage Tank Section (Effective July 1, 2001)
2L GWQS	NCAC T15A:02L Groundwater Quality Standards
AMS	Art's Manufacturing and Supply
AST	Aboveground Storage Tank
BQL	Below Quantitation Limit
BLS	Below Land Surface
CATLIN	CATLIN Engineers and Scientists (Formerly RC&A)
CFR	Code of Federal Regulations
CSA	Comprehensive Site Assessment
DEM	Division of Environmental Management
DIPE	Diisopropyl Ether
DOD	Department of Defense
DPT	Direct Push Technology
DWQ	Division of Water Quality
DWM	Division of Waste Management
DTW	Depth to Water
EAD	Environmental Affairs Department
EMD	Environmental Management Division
EPA	Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbons
EQB	Environmental Quality Branch
FID	Flame Ionization Detector
FOD	Foreign Object Debris
FT	Feet
GCL	Gross Contaminant Level
GIS	Geographic Information System
GPS	Global Positioning System
I/C	Industrial/Commercial
ID	Identification
I&E	Installations and Environment Department
IGWQS	Interim Groundwater Quality Standards
IPE	Isopropyl Ether
LSA	Limited Site Assessment
LUST	Leaking Underground Storage Tank
MADEP	Massachusetts Department of Environmental Protection
MCALF	Marine Corps Auxiliary Landing Field
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCOLF	Marine Corps Outlying Landing Field
mg/Kg	Milligrams per Kilogram
mg/L	Milligrams per Litre

MSCC	Maximum Soil Contaminant Concentration
MTBE	Methyl tertiary butyl ether
ug/Kg	Micrograms per Kilogram
ug/L	Micrograms per Litre
NA	Not Analyzed
N/A	Not Applicable
NAVFAC Atlantic	Naval Facilities Atlantic Division
NC	North Carolina
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NE	None Established
NM	Not Measured
NMT	No Measurable Thickness
NS	Not Sampled
OVA	Organic Vapor Analyzer
PAH	Polynuclear Aromatic Hydrocarbons
PPB	Parts Per Billion
PPM	Parts Per Million
PID	Photo Ionization Detector
PQL	Practical Quantitation Limits
PVC	Polyvinyl chloride
RBCA	Risk-Based Corrective Action
RCRA	Resource Conservation and Recovery Act
Res	Residential
SOW	Scope of Work
STGW	Soil-to-Groundwater
SVOC	Semi Volatile Organic Compound
TDHF	Toxicologically Defined Hydrocarbons Fractions
TOC	Top of Casing
TPH	Total Petroleum Hydrocarbons
US	United States
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
VPH	Volatile Petroleum Hydrocarbons
WiRO	Wilmington Regional Office

**A. SITE IDENTIFICATION**

DATE OF REPORT: January 25, 2005  
Facility ID: N/A UST Incident Number (if known): 24013  
Land Use Classification: Residential Risk Classification: Low  
Site Name: PP-3343  
Site Location: 3343 Onslow Drive, MCB, Camp Lejeune (See Figure 1)  
Nearest City/Town: Jacksonville County: Onslow

UST Owner: Commanding General – MCB Camp Lejeune  
I&E/EMD/EQB  
Address: PSC 20004  
MCB Camp Lejeune, NC 28542 Phone: (910) 451-5068

UST Operator: Same as above  
Address: Same as above Phone: Same as above

Property Owner: Same as above  
Address: Same as above Phone: Same as above

Property Occupant: Military personnel and family  
Address: 3343 Onslow Dr., MCB, Camp Lejeune, Jacksonville, NC Phone: Unknown

Consultant/Contractor: CATLIN Engineers and Scientists  
Address: 220 Old Dairy Road, Wilmington, North Carolina 28405 Phone: (910) 452-5861

**Release Information**

Date Discovered: September 17, 2001  
Longitude: 77.3689 W Latitude: 34.6851 N

Estimated Quantity of Release: Unknown

Cause of Release: Unknown

Source of Release (e.g. Piping/UST):  
Possible leaking UST and/or associated piping

Sizes and contents of UST system(s) from which the release occurred:  
Non-regulated, non-commercial, 285-gallon fuel oil UST used for heating a single-family residence

I, Michael E. Mason a Professional Engineer Licensed Geologist (circle one) for  
CATLIN Engineers and Scientists, do certify that the information contained in this report is correct and  
accurate to the best of my knowledge.



(Please Affix Seal and Signature)

## **B. BACKGROUND AND PURPOSE**

*(Refer to Figure 2)*

On September 17, 2001, J.A. Jones Environmental Services Company (J.A. Jones) of Charlotte, North Carolina performed UST excavation operations and removed one 285-gallon, non-regulated, non-commercial fuel oil UST from the site (see Figure 2). The fuel oil tank was utilized strictly for heating purposes of a single-family residence. Soil samples were obtained from the UST basin during tank removal. TPH analysis revealed concentrations greater than the State Action Levels (10 mg/Kg); however, the subsequent over-excavation floor soil sample did not reveal any contaminant concentrations above the corresponding Residential MSCCs. Laboratory analyses of the over-excavation sidewall samples revealed several target compounds and petroleum hydrocarbon fractions at concentrations above the Soil-to-Groundwater MSCCs, with one petroleum hydrocarbon fraction (C<sub>9</sub>-C<sub>22</sub> Aromatics) at a concentration above the Residential MSCC in one sample.

In July 2002, CATLIN conducted field work and sampling required by NCDENR for a Phase I LSA. One groundwater sample was collected for laboratory analysis from a temporary well and one soil sample was collected from beneath the former product line location. The soil sample results did not reveal any contaminant concentrations above the Soil-to-Groundwater MSCC. A groundwater sample collected from the temporary monitoring well USTPP3343-TW01 installed in former UST basin area revealed naphthalene and the C<sub>9</sub>-C<sub>22</sub> aromatics above their corresponding 2L GWQS. The Phase I LSA Report dated November 29, 2002 concluded the site may be considered for No Further Action.

The site meets the criteria for Low Risk and Residential Land Use. Based on historical soil and groundwater sample results, the site is eligible for “No Further Action” status with issuance of a Notice of Residual Petroleum or Land Use Restriction for soil and groundwater.

The purpose of this investigation was to resample soil identified in excess of the Residential MSCC and groundwater in excess of the 2L GWQS in order to determine if soil and groundwater contaminant concentrations had naturally attenuated below the applicable MSCCs and 2L GWQSs. If so, the site would be eligible for No Further Action Status without Land Use Restriction.

## **C. METHODS**

### **1. Field Methods**

*(Refer to Figure 2 and Appendices A, B, and C)*

All field work was conducted in general accordance with CATLIN's Standard Procedures provided in Appendix A. CATLIN personnel gathered subsurface soil data by Direct Push Technology boring advancement using an AMS PowerProbe™ 9600D (PowerProbe) on November 3, 2004. When using the PowerProbe, the borings are advanced to depth by static force and a 90-pound hydraulic percussion hammer. Two and one-quarter inch diameter by four-foot length steel is used as casing. Soil samples are continuously collected in one and one-half inch clear liners.

Liners are removed from the casing and then cut in half longitudinally to allow for visual/manual classification by the USCS and organic vapor analysis utilizing a FID. A boring log for the USTPP3343-DPT01 and USTPP3343-SB02 borings are provided in Appendix B. The boring locations are illustrated on Figure 2.

Well materials were installed at the USTPP3343-DPT01 boring in an attempt to determine accurate water table measurements and facilitate groundwater sampling. The well was constructed with 1.25-inch slotted PVC well screen.

The depth to water was measured and a grab groundwater sample was collected. The sample was collected on November 3, 2004 utilizing a peristaltic pump and new polyethylene tubing. The groundwater sample was labeled USTPP3343-DPT01 and the sample location is illustrated on Figure 2.

A soil sample was collected on November 3, 2004 from boring USTPP3343-SB02 at three to four feet BLS, which is at the location of previously revealed C<sub>9</sub>-C<sub>22</sub> aromatic concentrations above the Residential MSCCs. The sample was labeled USTPP3343-SB02 (3-4') and the sample location is illustrated on Figure 2.

New disposable nitrile gloves were worn during sampling activities. All samples were placed into the appropriately labeled glassware and packed on ice in an insulated cooler for transportation to the laboratory. Sample integrity was maintained by following proper chain of custody procedures. A copy of the chain of custody is provided following the complete laboratory report in Appendix C.

Boreholes were abandoned to the surface using three-eighth inch bentonite chips. Bentonite and water were poured into the borehole simultaneously to facilitate hydration.

## **2. Analytical Methods**

Samples were transported to Paradigm Analytical Laboratories, Inc. (NC Certification #481) in Wilmington, North Carolina. At the laboratory, the groundwater sample was analyzed for the presence of naphthalene per EPA Method 602 and per MADEP EPH and VPH. The soil sample was analyzed per MADEP EPH and VPH.

## **D. RESULTS**

*(Refer to Tables 1A, 1B, 2, 3A and 3B and Appendices B and C)*

Field observations noted during soil boring advancement indicate site geology comprised of fine to very fine silty/clayey sands to 16 feet. Moist soils were encountered during boring USTPP3343-DPT01 advancement at eight to nine feet BLS. Wet soils were noted at 10 feet BLS. Boring logs for the soil borings including organic vapor screening results are included in Appendix B. The depth to groundwater as measured on November 3, 2004 in the temporary well USTPP3343-DPT01 was approximately 9.1 feet BLS.

The complete laboratory analytical report is included in Appendix C. The soil sample USTPP3343-SB02(3-4') collected in the area of historical C<sub>9</sub>-C<sub>22</sub> aromatics concentrations greater than the Residential MSCC did not reveal any contaminant concentrations above the corresponding MSCCs. The C<sub>9</sub>-C<sub>10</sub> aromatic hydrocarbon chain was detected at 12 mg/Kg (which is less than the Residential MSCC of 34 mg/kg); however, no other MADEP EPH or VPH hydrocarbons were detected above the laboratory PQLs. Summarized soil laboratory results are on Tables 1A and 1B.

The 6.43 ug/L naphthalene concentration revealed in the USTPP3343-DPT01 groundwater sample is well below the 21 ug/L 2L GWQS. Groundwater sample analysis per MADEP EPH and VPH revealed multiple aromatic and aliphatic hydrocarbon fraction concentrations. The USTPP3343-DPT01 groundwater sample results for the combined hydrocarbon fraction C<sub>9</sub>-C<sub>18</sub> Aliphatics (<7,100 ug/L) exceeds the 4,200 ug/L 2L GWQS. Also, the groundwater sample result for the combined hydrocarbon fraction C<sub>9</sub>-C<sub>22</sub> Aromatics (<3,700 ug/L) exceeds the 210 ug/L 2L GWQS. Summarized groundwater sample analytical results are on Tables 2, 3A, and 3B.

## **E. CONCLUSIONS AND RECOMMENDATIONS**

The C<sub>9</sub>-C<sub>22</sub> aromatic concentrations previously detected in the soils around the former UST at PP-3343 have apparently naturally attenuated to below the Residential MSCC. The naphthalene concentrations previously detected in the groundwater around the former UST have also apparently naturally attenuated to below the 2L GWQS. The C<sub>9</sub>-C<sub>18</sub> Aliphatics and C<sub>9</sub>-C<sub>22</sub> Aromatics groundwater concentrations historically revealed at PP-3343 have not attenuated below the corresponding 2L GWQS. The current aliphatic and aromatic groundwater concentrations will prevent the site from being granted "No Further Action" status without a Land Use Restriction for groundwater. CATLIN recommends re-sampling groundwater in two years.

## **F. REFERENCES**

- CATLIN Engineers and Scientists. *LUST Phase I Limited Site Assessment Report UST PP-3343, MCB Camp Lejeune, NC*, November 29, 2002.
- J.A. Jones Environmental Services Company. *Underground Storage Tank Closure Report Marine Corps Base Building CC-3343, MCB Camp Lejeune, NC*, January 24, 2002.
- North Carolina Department of Environment and Natural Resources, *Guidelines for Assessment and Corrective Action, North Carolina Underground Storage Tank Section* (Effective July 1, 2001).

## TABLES

**TABLE 1A SUMMARY OF SOIL LABORATORY RESULTS**

Date: November 2004

Incident Number and Name:  
24013 - PP-3343

Facility ID#: N/A

**Analytical Method: MADEP EPH/VPH**

Sample ID	Contaminant of Concern →		C9-C18 Aliphatics	C19-C36 Aliphatics	C11-C22 Aromatics	C5-C8 Aliphatics	C9-C12 Aliphatics	C9-C10 Aromatics
	Date Collected	Sample Depth (ft. BGS)						
USTPP3343-SB02(3-4')	11/3/2004	(3-4')	<10	<10	<10	<10	<10	12

All results in mg/Kg

**TABLE 1B SUMMARY OF SOIL LABORATORY RESULTS**

Date: November 2004

Incident Number and Name:

24013 - PP-3343

Facility ID#: N/A

**Analytical Method: MADEP EPH/VPH COMPARED TO THE MSCCS**

Sample ID	Contaminant of Concern →		C5-C8 Aliphatics	C9-C18 Aliphatics	C19-C36 Aliphatics	C9-C22 Aromatics
	Date Collected	Sample Depth (ft. BGS)				
USTPP3343-SB02(3-4')	11/3/2004	(3-4')	<10	<20	<10	<22
Res. MSCC			939	9,386	93,860	469
I/C MSCC			24,528	245,280	Health Based (>100%)	12,264
STGW MSCC			72	3,255	Considered Immobile	34

All results in mg/Kg

**TABLE 2 SUMMARY OF GROUNDWATER LABORATORY RESULTS**

Date: November 2004

Incident Number and Name:  
24013 - PP-3343

Facility ID#: N/A

**Analytical Method: EPA METHOD 602**

Well ID	Contaminant of Concern →		Naphthalene
	Sample ID	Date Collected	
USTPP3343-DPT01	USTPP3343-DPT01	11/3/2004	6.43
2L GWQS GCL			21 15,500

All results in ug/L

**TABLE 3A SUMMARY OF GROUNDWATER LABORATORY RESULTS**

Date: November 2004

Incident Number and Name:

24013 - PP-3343

Facility ID#: N/A

**Analytical Method: MADEP EPH/VPH**

Well ID	Contaminant of Concern →		C9-C18 Aliphatics	C19-C36 Aliphatics	C11-C22 Aromatics	C5-C8 Aliphatics	C9-C12 Aliphatics	C9-C10 Aromatics
	Sample ID	Date Collected						
USTPP3343-DPT01	USTPP3343-DPT01	11/3/2004	7000	930	3600	<100	<100	<100

All results in ug/L

**TABLE 3B SUMMARY OF GROUNDWATER LABORATORY RESULTS**

Date: November 2004

Incident Number and Name:  
24013 - PP-3343

Facility ID#: N/A

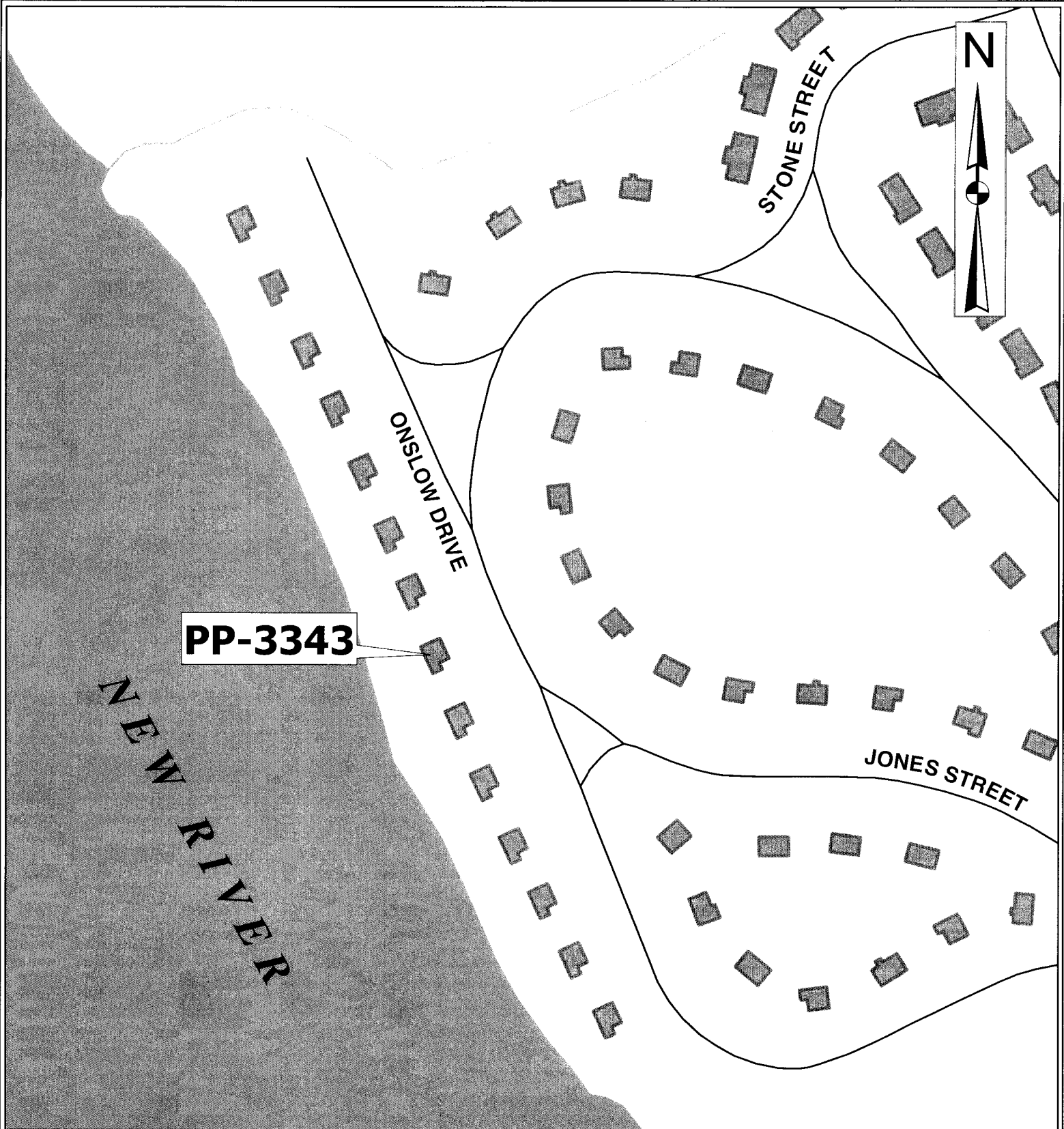
**Analytical Method: MADEP EPH/VPH AS COMPARED TO THE 2L GWQS**

Well ID	Contaminant of Concern →		C5-C8 Aliphatics	C9-C18 Aliphatics	C19-C36 Aliphatics	C9-C22 Aromatics
	Sample ID	Date Collected				
USTPP3343-DPT01	USTPP3343-DPT01	11/3/2004	<100	<7100	930	<3700
2L GWQS			420	4200	42,000	210

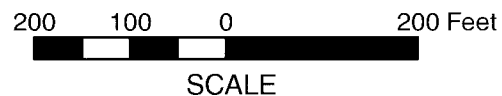
All results in ug/L

Shaded concentrations exceed the 2L GWQS

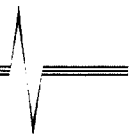
## FIGURES



NOTE: All GIS supplied by MCB Camp Lejeune Business and Logistics Support Department



**CAELIN**  
ENGINEERS and SCIENTISTS



PROJECT

PP-3343  
MARINE CORPS BASE  
CAMP LEJEUNE, NC

TITLE

SITE VICINITY MAP

FIGURE

1

JOB NO.

204-079

DATE

JAN 2005

SCALE

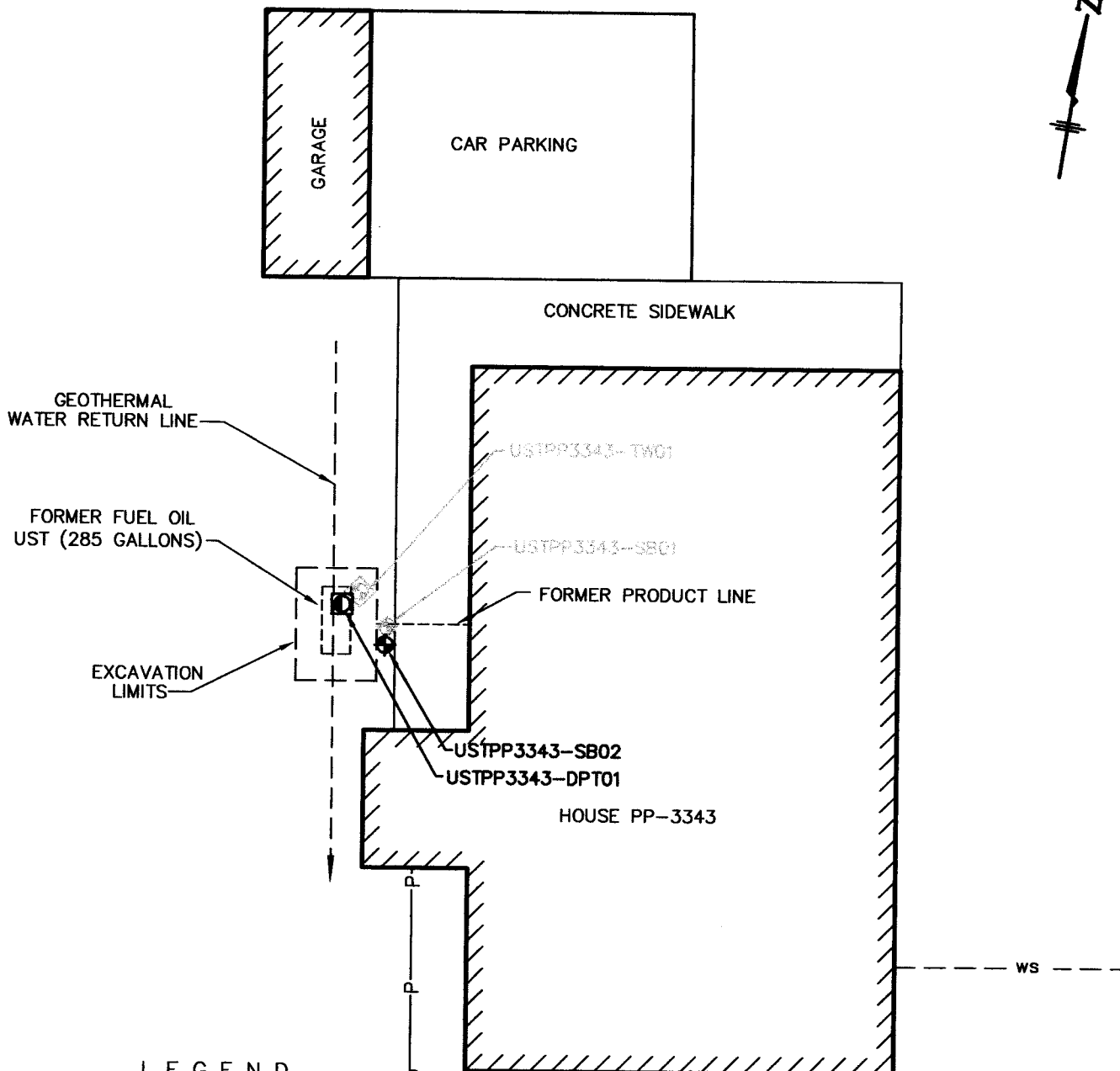
AS SHOWN

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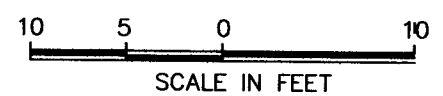
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BA



LEGEND

PREVIOUS	EXISTING	NEW	DESCRIPTION
			BUILDING
			TEMPORARY WELL
			SOIL BORING AND SOIL SAMPLE
			DPT PROBE AND GROUNDWATER SAMPLE
		--WS--	WATER AND SEWER LINES
		--P--	POWER LINE



NOTE:  
1. MAP ADAPTED FROM J.A. JONES

 WILMINGTON, NORTH CAROLINA	PROJECT PP-3343 MARINE CORPS BASE CAMP LEJEUNE, N.C.	TITLE PP-3343 SITE PLAN	FIGURE 2
	JOB NO: 204-079	DATE: DEC 2004	SCALE: 1"=10'

**APPENDIX A**  
**STANDARD PROCEDURES**

# CATLIN STANDARD METHODS OF INVESTIGATION

(REVISED APRIL 2002)

## 1.0 DATA COLLECTION

### 1.1 BACKGROUND DATA

Background data and history information relevant to the site investigation is generated through numerous sources. These sources may include, but are not limited to, the following:

- Conversations with the client and regulatory officials involved with the incident.
- Review of pertinent regulatory correspondence.
- Review of previous and existing reports and other technical data.
- Review of available historical records.

### 1.2 SURVEYS AND POTENTIAL RECEPTOR DATA

Physical survey and potential receptor data are collected in accordance with the intended level of investigation. In general, the purpose is to collect sufficient information for site assessment and corrective action planning.

Individual receptors are identified and evaluated in the context of their potential for contaminant impact. Potential receptors of contamination can include surface water bodies, groundwater supply wells, wellhead protection areas, and subsurface building structures.

#### 1.2.1 Horizontal Survey

Horizontal survey data are generated using either accepted general field surveying techniques, or existing survey maps; or by using a combination of existing data and field generated information. The survey area generally extends to a point at least 50 feet beyond suspected plume boundaries. A receptor scale survey of a larger area surrounding a site will be made if appropriate and necessary.

#### 1.2.2 Vertical Survey

A vertical survey is conducted at the site typically within an accuracy of 0.01 foot. The datum plane is generally assumed unless otherwise noted. Assumed temporary benchmarks (TBM) are selected near ground level. The vertical survey includes such points as top of all well casings, selected ground shots, important utility inverts, utility fluid levels, important surface water levels, and other items determined to be significant.

### **1.3 DRILLING AND MONITORING WELL/PIEZOMETER INSTALLATION**

Necessary permits are applied for and obtained in accordance with federal, state, and local requirements prior to drilling or well construction activities. Additionally, the well locations are scanned for underground utilities prior to conducting intrusive subsurface activities. Wells are installed under applicable licensing requirements, and are designed and constructed in accordance with accepted standards and practices. Any wells purposely installed at off-site locations are permitted through appropriate right-of-entry agreements with all necessary property owners and/or their agents.

#### **1.3.1 Drilling Methods and Subsurface Data Collection**

Drilling is accomplished utilizing one or more of the following methods:

##### ***Auger Drilling***

Auger drilling is the preferred, most often used method of subsurface investigation and is accomplished using a vehicle or trailer mounted drill rig. Continuous flight auger types used vary upon the site and situation; ranging from the 4-inch outside diameter solid stem to the 12-inch outside diameter hollow stem. Auger type is selected based upon appropriateness and/or site-specific requirements.

##### ***Hand Augering***

Hand augering is utilized when economically and scientifically feasible, or when no other method is suitable. Hand augers typically produce three-inch diameter holes and are generally limited to depths of less than 15 feet.

##### ***Direct Push***

Direct push methods of subsurface investigation are used generally for soil screening purposes or collection of groundwater samples where permanent wells are not viable.

##### ***Other Methods***

Other drilling methods, such as mud and air rotary, rock coring, cable tool, and large bucket augering are used when site conditions or project requirements dictate.

Regardless of the drilling method used, the drill rig(s) and all drilling tools are thoroughly cleaned between boreholes to prevent cross introduction of contaminants. Split spoon samples are collected and field-described at intervals of five feet or less, and cuttings are continuously monitored for organic vapors. Drill cuttings are containerized for off-site disposal or are spread on the ground surface in proximity to the well or boring in accordance with North Carolina Department of Environment and Natural Resources (NCDENR) requirements. A geologist or engineer, trained in using visual/manual techniques, is always present during drilling and is responsible for subsurface contaminant and geologic data collection. Soils are classified in general agreement with the Unified Soils Classification System (USCS).

### **1.3.2 Hydropunch Installation**

Hydropunch penetrometers (Hydropunches) are used to delineate the spatial extent of dissolved and free phase plumes. Soil borings are advanced to the appropriate depth and then the Hydropunch is advanced through the soil boring into undisturbed material. Groundwater samples are collected by pulling back on the body of the Hydropunch and allowing the groundwater to enter the screened portion of the sample chamber. Samples are retrieved using a decontaminated Teflon bailer or peristaltic pump.

### **1.3.3 Well Installation**

Wells are typically constructed of threaded PVC casing and screen. No glues or cements are used in joining PVC components. Well diameter, slot sizes, and protective covers vary depending upon site-specific conditions or situation-specific requirements.

### **1.3.4 Well Development**

Wells are developed by over-pumping or surging using appropriate pumps, blocks, or bailers. Through development, unwanted fine materials are removed from the natural formation surrounding the well. Well development will be performed no sooner than 24-hours after grouting is completed for the Type III wells. Water generated during development is containerized and properly disposed or is discharged onto the ground in proximity of the well in accordance with NCDENR requirements.

## **1.4 HYDROGEOLOGIC DATA COLLECTION**

Data used to help characterize hydrogeologic conditions at a site are obtained through various procedures including, but not necessarily limited to, those described below:

#### **1.4.1 Regional Geology**

Information pertaining to the regional geologic framework is compiled from existing publications, maps, and scientific papers.

#### **1.4.2 Site Geology**

Shallow site geology is generally determined from field descriptions and borehole samples. Interpretations with regard to hydrogeologically important contacts, zones, fractures, faults, cleavage, and facies changes are made when possible.

#### **1.4.3 Groundwater Occurrence and Characteristics**

Groundwater data is obtained utilizing a number of methods and procedures, not limited to the general list below:

##### ***Well Water Levels***

After well development, wells are allowed to stabilize for a minimum of 24 hours prior to measuring. Water level and free product thickness (where applicable) measurements are performed using an electronic interface probe or steel tape with water/product finding pastes.

The specific gravity of any accumulated product is determined and used to calculate true hydraulic grade from measured water levels. This information is combined with vertical survey data to determine relative potentiometric surface elevations for all wells.

##### ***Aquifer Testing***

Various aquifer tests may be used to make determinations of hydraulic conductivity. Slug or pumping tests are often used to characterize site hydrogeologic conditions and to develop remedial action alternatives utilizing appropriate pumping technologies.

##### ***Other Methods***

Other methods may be deemed appropriate for determining various groundwater characteristics. These other methods may include nested well configurations and/or clustered piezometer installations; sieve or pipette analysis; fracture trace analysis; computer modeling; and geophysical logging.

## **1.5 PETROLEUM HYDROCARBON DATA COLLECTION**

### **1.5.1 Collection Methods**

Petroleum hydrocarbon data is obtained through various methods including, but not limited to, the following:

#### ***Field Analysis***

- Direct thickness measurement of phase separated components using tapes and/or probes.
- Manual vapor analysis using a photoionization detector (PID) or flame ionization detector (FIS).
- Detectable odor and visual observation.

#### ***Laboratory Analysis***

- Laboratory analysis of phase-separated products.
- Laboratory vapor, soil, and groundwater analysis using appropriate EPA Methods.

### **1.5.2 Field Sampling**

Field sampling procedures are performed in accordance with recommended protocol, accepted industry standards, and under appropriate chain-of-custody procedures. Generally, sampling procedures are as follows:

#### ***Product Samples***

Product samples are obtained using clean equipment and containers. Each is shipped to the analytical laboratory in protective containers.

#### ***Vapor Samples***

PID/FID readings are measured from soil sample headspace using containerized samples that have been brought to ambient temperature.

Carbon tubes are utilized in conjunction with a laboratory-calibrated vacuum pump to obtain vapor samples. The carbon tubes are sealed and refrigerated for shipment to the analytical laboratory (This method is known as the Carbon Adsorption Method).

### *Soil Samples*

Soil samples are immediately packed into clean containers, and refrigerated for shipment to the analytical laboratory.

### *Groundwater Samples*

Groundwater samples are collected in accordance with the following procedures:

- Creeks/Lakes/Etc.

Grab samples are obtained.

- Domestic Wells

Wells are pumped for a time sufficient to completely purge the well and any pressure or holding tanks prior to sampling.

- Monitoring Wells

Water level measurements are made and well volumes calculated for each well.

Three well volumes are removed from each well using a thoroughly cleaned Teflon bailer or appropriate purging pump. If it is not possible to remove three volumes, due to very low yields, a minimum of one volume is removed prior to obtaining a sample.

Where analysis for metals is required, wells are typically sampled utilizing low flow techniques, which reduce turbidity and the potential for matrix interference.

Samples are collected and containerized in a manner that minimizes agitation and contact with the air.

Sampling records are field prepared.

Samples are labeled and proper chain of custody documents are maintained.

Samples are promptly protectively packed, refrigerated, and shipped to the analytical laboratory for analysis.

## 2.0 DATA EVALUATION

Data obtained as a result of the site investigation is compiled and evaluated and a report is prepared for client review and distribution to the appropriate agencies. Generally, specific data are evaluated as follows:

- Background data are evaluated in context with the suspected or confirmed problem.
- Survey data are utilized to develop site maps and to evaluate contaminant receptors.
- Well construction records are compiled and presented as part of the report. As-built information is used in combination with other data to evaluate subsurface conditions and monitoring well screen settings as they relate to the investigation.
- Subsurface drilling logs are used to develop geologic cross-sections, fence diagrams, isopachs, structure contours, or other constructions. Regional geologic data are used to obtain an overall framework.
- Hydrogeologic data are used to develop contour maps, flow nets and other constructions. The data is also used to calculate various hydrogeologic parameters that describe aquifer characteristics.
- Hydrocarbon data are utilized to develop various plume geometry and isoconcentration maps.
- All data are compiled and utilized for making specific recommendations with regard to remedial action alternatives.

**APPENDIX B**  
**BORING LOG**

# BORING LOG

**CATLIN**

ENGINEERS and SCIENTISTS

Wilmington, North Carolina

SHEET 1 OF 1

PROJECT NO.: 204-079	STATE: NC	COUNTY: Onslow	LOCATION: Havelock
PROJECT NAME: Eight Site Closures		LOGGED BY: Tom Stetler	BORING ID: USTPP3343
		DRILLER: Bobbie Fowler	-DPT01
NORTHING:	EASTING:	CREW:	
SYSTEM:	BORING LOCATION: PP-3343		LAND ELEV.:
DRILL MACHINE: Power Probe	METHOD: Direct Push	0 HOUR DTW: 9.12	BORING DEPTH: 16.0
START DATE: 11/03/04	FINISH DATE: 11/03/04	24 HOUR DTW: NM	ROCK DEPTH: ---

DEPTH	BLOW COUNT				BLOWS PER FOOT					LAB.	U S C S	L O G	DEPTH	SOIL AND ROCK DESCRIPTION
	6in	6in	6in	6in	0	20	40	60	80					
0.0													0.0	LAND SURFACE
													0.3	TOPSOIL
2.0	DP	DP	DP	DP								SM	4.0	Light tan, silty, f. to vf. SAND. Only trace silt. Moist. No hydrocarbon odor. 2.9' return on 0-4' tube.
4.0	DP	DP	DP	DP								SC	6.6	Light brown, silty to clayey, f. to vf. SAND. Moist. Minor mottling. Low plasticity. Slight hydrocarbon odor.
6.0	DP	DP	DP	DP								SM	8.0	Grayish-brown, silty, f. to vf. SAND. Slight hydrocarbon odor. 3.6' return on 4-8' tube.
8.0	DP	DP	DP	DP								SP	9.1	Light brown, clean, f. to vf. SAND. Moist. Strong hydrocarbon odor.
10.0	DP	DP	DP	DP								SC/ SM	12.0	Interlayered silty, f. SAND, and clayey f. to vf. SAND. Pronounced orange to dark gray banding. Wet at approximately 10' BLS. Strong hydrocarbon odor. 3.0' return on 8-12' tube.
12.0	DP	DP	DP	DP								SP	14.4	Reddish-orange, f. to vf. SAND. Moist to wet. Strong hydrocarbon odor.
14.0	DP	DP	DP	DP								SC/ SM	16.0	Interlayered silty, vf. SAND and clayey f. to vf. SAND. Saturated at 14' BLS. Similar to sediment between 9.1 and 12' BLS. 4' return on 12-16' tube.
														Boring Terminated at Depth 16.0 ft Assumes uniform compaction. Set temporary 1" well and abandoned with bentonite following water sample collection.

CATLIN BORING LOG\_204-079.8\_SITES.CAMP.LEJUNE.GPJ.CATLIN.GDT\_01/12/05

# BORING LOG

**CATLIN**  
ENGINEERS and SCIENTISTS  
ENGLISH  
Wilmington, North Carolina

SHEET 1 OF 1

PROJECT NO.: 204-079	STATE: NC	COUNTY: Onslow	LOCATION: Havelock
PROJECT NAME: Eight Site Closures		LOGGED BY: Tom Stetler	BORING ID: USTPP3343 -SB02
		DRILLER: Bobbie Fowler	
LATITUDE:	LONGITUDE:	CREW:	
SYSTEM:	BORING LOCATION: PP-3343		LAND ELEV.: NM
DRILL MACHINE: Power Probe	METHOD: Direct Push	0 HOUR DTW: NE	BORING DEPTH: 4.0
START DATE: 11/03/04	FINISH DATE: 11/03/04	24 HOUR DTW: NM	ROCK DEPTH: --

DEPTH	BLOW COUNT 0.5 0.5 0.5 0.5	SAMP. TYPE	OVA RESULTS (ppm)				LAB.	U S C S	L O G	SOIL AND ROCK DESCRIPTION	
			0	1000	2000	3000				4000	DEPTH
0.0									0.0	LAND SURFACE	
0.0									0.0	TOPSOIL	
0.2									0.2		
1.0	DP DP DP DP		▲0							Dark brown, silty, f. to vf. SAND. Moist. No hydrocarbon odor.	
1.5	DP DP DP DP		▲0						1.5		
2.0											
3.0	DP DP DP DP		▲0							Light brown to tan, silty, f. to vf. SAND. Moist. No hydrocarbon odor. 2.2' return on 0-4' tube.	
4.0	DP DP DP DP	DP	▲0			USTPP 3343 -SB02 (3-4')			4.0	Boring Terminated at Depth 4.0 ft Assumes uniform compaction.	

CATLIN ENVIRO. LOG\_204-079.8 SITES.CAMP.LEIFUNE.GPJ CATLIN.GDT\_01/05/05

**APPENDIX C**

**LABORATORY ANALYTICAL REPORT AND  
CHAIN OF CUSTODY DOCUMENTATION**

Mr. Ben Ashba  
Richard Catlin & Associates  
P.O. Box 10279  
Wilmington NC 28404-0279

Report Number: G128-1405

Client Project: PP-3343

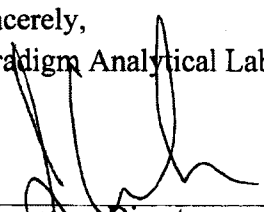
Dear Mr. Ashba:

Enclosed are the results of the analytical services performed under the referenced project. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of five years in the event they are required for future reference. Any samples submitted to our laboratory will be retained for a maximum of thirty (30) days from the date of this report unless other arrangements are requested.

If there are any questions about the report or the services performed during this project, please call Paradigm at (910) 350-1903. We will be happy to answer any questions or concerns which you may have.

Thank you for using Paradigm Analytical Labs for your analytical services. We look forward to working with you again on any additional analytical needs which you may have.

Sincerely,  
Paradigm Analytical Laboratories, Inc.

  
\_\_\_\_\_  
Laboratory Director  
J. Patrick Weaver

11/29/04  
\_\_\_\_\_  
(Date)

**EPH (Aliphatics/Aromatics) Results**

by MDEP-EPH

Client Name: Richard Catlin & Associates

Project Name: PP-3343

Sample Information and Analytical Results	
Sample Identification	USTPP3343-SB02(3-4')
Sample Matrix	Soil
Date Collected	11/03/04
Date Received	11/04/04
Date Extracted	11/09/04
Date Analyzed	11/10/04
Dry Weight	86.3
Dilution Factor	1
C <sub>9</sub> -C <sub>18</sub> Aliphatics*	< 10 (mg/Kg)
C <sub>19</sub> -C <sub>36</sub> Aliphatics*	< 10 (mg/Kg)
C <sub>11</sub> -C <sub>22</sub> Aromatics*	< 10 (mg/Kg)
Aliphatic Surrogate % Recovery	96
Aromatic Surrogate % Recovery	87

**Comments:**

\* = Excludes any surrogates or internal standards.  
 Sample did not require fractionation.

Lab info: G128-1405-1D

Reviewed By: 

**EPH (Aliphatics/Aromatics) Results**

by MDEP-EPH

Client Name: Richard Catlin & Associates

Project Name: PP-3343

Sample Information and Analytical Results	
Sample Identification	USTPP3343-DPT01
Sample Matrix	Water
Date Collected	11/03/04
Date Received	11/04/04
Date Extracted	11/16/04
Date Analyzed	11/19/04
Dry Weight	
Dilution Factor	2:1
C <sub>9</sub> -C <sub>18</sub> Aliphatics*	7000 (µg/L)
C <sub>19</sub> -C <sub>36</sub> Aliphatics*	930 (µg/L)
C <sub>11</sub> -C <sub>22</sub> Aromatics*	3600 (µg/L)
Aliphatic Surrogate % Recovery	48
Aromatic Surrogate % Recovery	87
Fractionation Surrogate 1 % Recovery	110

**Comments:**

\* = Excludes any surrogates or internal standards.

Lab info: G128-1405-2G

Reviewed By: 

Attachment 3

EPH Laboratory Reporting Form

**Calibration and QA/QC Information**

Initial Calibration Date: 11/03/04

**Calibration Ranges and Limits**

Range	MDL (2/2004) (µg/L)	ML (µg/L)	RL (µg/L)	RL (mg/Kg)
C <sub>9</sub> -C <sub>18</sub> Aliphatics	3.84	12.2	100	10
C <sub>19</sub> -C <sub>36</sub> Aliphatics	0.57	1.8	100	10
C <sub>11</sub> -C <sub>22</sub> Aromatics	4.54	14.4	100	10

**Calibration Concentration Levels**

Range	Levels (µg/mL)	%RSD or CCC	Method of Quantitation
C <sub>9</sub> -C <sub>18</sub> Aliphatics	6	6.70	Calibration Factor
	30		
	60		
	120		
	240		
C <sub>19</sub> -C <sub>36</sub> Aliphatics	8	20.2	Calibration Factor
	40		
	80		
	160		
	320		
C <sub>11</sub> -C <sub>22</sub> Aromatics	17	6.7	Calibration Factor
	85		
	170		
	340		
	680		

Calibration Check Date: 11/10/04

**Calibration Check**

Range	Levels (µg/mL)	RPD
C <sub>9</sub> -C <sub>18</sub> Aliphatics	120	-2.7
C <sub>19</sub> -C <sub>36</sub> Aliphatics	160	-16.1
C <sub>11</sub> -C <sub>22</sub> Aromatics	340	-13.7

MDL = Method Detection Limit  
 ML = Minimum Limit  
 RL = Reportable Limit

RPD = Relative Percent Difference  
 %RSD = Percent Relative Standard Deviation  
 CCC = Correlation Coefficient of Curve

Attachment 3

EPH Laboratory Reporting Form

**Calibration and QA/QC Information**

Initial Calibration Date: 11/18/04

**Calibration Ranges and Limits**

Range	MDL (2/2004) (µg/L)	ML (µg/L)	RL	
			(µg/L)	(mg/Kg)
C <sub>9</sub> -C <sub>18</sub> Aliphatics	3.84	12.2	100	10
C <sub>19</sub> -C <sub>36</sub> Aliphatics	0.57	1.8	100	10
C <sub>11</sub> -C <sub>22</sub> Aromatics	4.54	14.4	100	10

**Calibration Concentration Levels**

Range	Levels (µg/mL)	%RSD or CCC	Method of Quantitation
C <sub>9</sub> -C <sub>18</sub> Aliphatics	6	2.40	Calibration Factor
	30		
	60		
	120		
	240		
C <sub>19</sub> -C <sub>36</sub> Aliphatics	8	1.6	Calibration Factor
	40		
	80		
	160		
	320		
C <sub>11</sub> -C <sub>22</sub> Aromatics	17	2	Calibration Factor
	85		
	170		
	340		
	680		

Calibration Check Date: 11/19/04

**Calibration Check**

Range	Levels (µg/mL)	RPD
C <sub>9</sub> -C <sub>18</sub> Aliphatics	120	-1.2
C <sub>19</sub> -C <sub>36</sub> Aliphatics	160	-1.6
C <sub>11</sub> -C <sub>22</sub> Aromatics	340	-4.7

MDL = Method Detection Limit  
 ML = Minimum Limit  
 RL = Reportable Limit

RPD = Relative Percent Difference  
 %RSD = Percent Relative Standard Deviation  
 CCC = Correlation Coefficient of Curve

**VPH (Aliphatics/Aromatics) Laboratory Reporting Form**

Client Name: Richard Catlin & Associates

Project Name: PP-3343

Sample Information and Analytical Results	
Sample Identification	USTPP3343-SB02(3-4')
Sample Matrix	Soil
Collection Option (for Soil)*	2
Date Collected	11/03/04
Date Received	11/04/04
Date Extracted	11/03/04
Date Analyzed	11/24/04
Dry Weight	86
Dilution Factor	1
C <sub>5</sub> -C <sub>8</sub> Aliphatics**	< 10 (mg/Kg)
C <sub>9</sub> -C <sub>12</sub> Aliphatics**	< 10 (mg/Kg)
C <sub>9</sub> -C <sub>10</sub> Aromatics**	12 (mg/Kg)
Surrogate % Recovery - PID	110
Surrogate % Recovery - FID	110

\* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

\*\* = Excludes any surrogates or internal standards.

Lab Info: g128-1405-1b

Reviewed By: 

**VPH (Aliphatics/Aromatics) Laboratory Reporting Form**

Client Name: Richard Catlin & Associates


Project Name: PP-3343

Sample Information and Analytical Results	
Sample Identification	USTPP3343-DPT01
Sample Matrix	Water
Collection Option (for Soil)*	
Date Collected	11/03/04
Date Received	11/04/04
Date Extracted	11/16/04
Date Analyzed	11/16/04
Dry Weight	
Dilution Factor	1
C <sub>5</sub> -C <sub>8</sub> Aliphatics**	< 100 (µg/L)
C <sub>9</sub> -C <sub>12</sub> Aliphatics**	< 100 (µg/L)
C <sub>9</sub> -C <sub>10</sub> Aromatics**	< 100 (µg/L)
Surrogate % Recovery - PID	70
Surrogate % Recovery - FID	75

\* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

\*\* = Excludes any surrogates or internal standards.

Lab Info: g128-1405-2d

Reviewed By: 

**VPH (Aliphatics/Aromatics) Laboratory Reporting Form**

Client Name: Richard Catlin & Associates

Project Name: PP-3343

Sample Information and Analytical Results	
Sample Identification	Trip Blank
Sample Matrix	Soil
Collection Option (for Soil)*	2
Date Collected	11/03/04
Date Received	11/04/04
Date Extracted	11/01/04
Date Analyzed	11/24/04
Dry Weight	100
Dilution Factor	1
C <sub>5</sub> -C <sub>8</sub> Aliphatics**	< 10 (mg/Kg)
C <sub>9</sub> -C <sub>12</sub> Aliphatics**	< 10 (mg/Kg)
C <sub>9</sub> -C <sub>10</sub> Aromatics**	< 10 (mg/Kg)
Surrogate % Recovery - PID	98
Surrogate % Recovery - FID	100

\* = Option 1 = Established fill line on vial, Option 2 = Sampling Device/Brand, or Option 3 = Field weight of soil.

\*\* = Excludes any surrogates or internal standards.

Lab Info: g128-1405-3a

Reviewed By: 

Attachment 2

VPH Laboratory Reporting Form

Calibration and QA/QC Information

FID Initial Calibration Date: 11/16/04      PID Initial Calibration Date: 11/16/04

**Calibration Ranges and Limits**

Range	MDL (07/15/2004) (µg/L)	ML (µg/L)	RL	
			(µg/L)	(mg/Kg)
C <sub>5</sub> -C <sub>8</sub> Aliphatics	4.4	14	100	10
C <sub>9</sub> -C <sub>12</sub> Aliphatics	3.4	11	100	10
C <sub>9</sub> -C <sub>10</sub> Aromatics	0.13	0.41	100	10

**Calibration Concentration Levels**

Range	Levels (µg/L)	%RSD or CCC	Method of Quantitation
C <sub>5</sub> -C <sub>8</sub> Aliphatics	40	3.3	Calibration Factor
	1000		
	2000		
	3000		
	4000		
C <sub>9</sub> -C <sub>12</sub> Aliphatics	10	21.7	Calibration Factor
	250		
	500		
	750		
	1000		
C <sub>9</sub> -C <sub>10</sub> Aromatics	10	10.6	Calibration Factor
	250		
	500		
	750		
	1000		

Calibration Check Date: 11/16/04

**Calibration Check**

Range	Levels		RPD
	(µg/L)	(mg/Kg)	
C <sub>5</sub> -C <sub>8</sub> Aliphatics	2000	200	-2.2
C <sub>9</sub> -C <sub>12</sub> Aliphatics	500	50	-2.5
C <sub>9</sub> -C <sub>10</sub> Aromatics	500	50	-4.9

MDL = Method Detection Limit  
ML = Minimum Limit  
RL = Reportable Limit

RPD = Relative Percent Difference  
%RSD = Percent Relative Standard Deviation  
CCC = Correlation Coefficient of Curve

Attachment 2

VPH Laboratory Reporting Form

Calibration and QA/QC Information

FID Initial Calibration Date: 11/16/04      PID Initial Calibration Date: 11/16/04

**Calibration Ranges and Limits**

Range	MDL (07/15/2004) (µg/L)	ML (µg/L)	RL	
			(µg/L)	(mg/Kg)
C <sub>5</sub> -C <sub>8</sub> Aliphatics	4.4	14	100	10
C <sub>9</sub> -C <sub>12</sub> Aliphatics	3.4	11	100	10
C <sub>9</sub> -C <sub>10</sub> Aromatics	0.13	0.41	100	10

**Calibration Concentration Levels**

Range	Levels (µg/L)	%RSD or CCC	Method of Quantitation
C <sub>5</sub> -C <sub>8</sub> Aliphatics	40	3.3	Calibration Factor
	1000		
	2000		
	3000		
	4000		
C <sub>9</sub> -C <sub>12</sub> Aliphatics	10	21.7	Calibration Factor
	250		
	500		
	750		
	1000		
C <sub>9</sub> -C <sub>10</sub> Aromatics	10	10.6	Calibration Factor
	250		
	500		
	750		
	1000		

Calibration Check Date: 11/24/04

**Calibration Check**

Range	Levels		RPD
	(µg/L)	(mg/Kg)	
C <sub>5</sub> -C <sub>8</sub> Aliphatics	2000	200	-9.6
C <sub>9</sub> -C <sub>12</sub> Aliphatics	500	50	-5.9
C <sub>9</sub> -C <sub>10</sub> Aromatics	500	50	-21.9

MDL = Method Detection Limit  
ML = Minimum Limit  
RL = Reportable Limit

RPD = Relative Percent Difference  
%RSD = Percent Relative Standard Deviation  
CCC = Correlation Coefficient of Curve

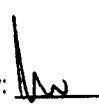
**Results for Volatiles**  
by GC 602

Client Sample ID: USTPP3343-DPT01  
 Client Project ID: PP-3343  
 Lab Sample ID: G128-1405-2A  
 Lab Project ID: G128-1405

Analyzed By: DCS  
 Date Collected: 11/03/2004 13:30  
 Date Received: 11/4/2004  
 Matrix: Water

Analyte	Result ug/L	RL ug/L	Dilution Factor	Date Analyzed
Naphthalene	6.43	1.00	1	11/17/2004
<b>Surrogate Spike Recoveries</b>		<b>Spike Added</b>	<b>Spike Result</b>	<b>Percent Recovery</b>
Trifluorotoluene		40	39.5	98.7

**Comments:**  
 All values corrected for dilution.  
 BQL = Below quantitation limit.

Reviewed By: 

**List of Reporting Abbreviations  
and Data Qualifiers**

B = Compound also detected in batch blank

BQL = Below Quantitation Limit

DF = Dilution Factor

Dup = Duplicate

E = Estimated concentration, exceeds calibration range.

J = Estimated concentration, below calibration range and above MDL

LCS(D) = Laboratory Control Spike (Duplicate)

MDL = Method Detection Limit

MS(D) = Matrix Spike (Duplicate)

PQL = Practical Quantitation Limit

RL = Reporting Limit

RPD = Relative Percent Difference

mg/kg = milligram per kilogram, ppm, parts per million

ug/kg = micrograms per kilogram, ppb, parts per billion

mg/L = milligram per liter, ppm, parts per million

ug/L = micrograms per liter, ppb, parts per billion

% Rec = Percent Recovery

% solids = Percent Solids

**Special Notes:**

- 1) Metals and mercury samples are digested with a hot block, see the standard operating procedure document for details.
- 2) Uncertainty for all reported data is less than or equal to 30 percent.

