OSAGE OF VIRGINIA
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April 10, 2008

Commanding Officer
I&E/EMD/EQB (Attn.: Ms. Johanna Arnold)
PSC Box 20004
Marine Corps Base
Camp Lejeune, North Carolina 28542-0004

Re: FINAL Soil Sampling Report, TT-2477
North Carolina Department of Environment and Natural Resources (NCDENR) Incident #7176
Soil Sampling Event, February 2008
Marine Corps Base (MCB) Camp Lejeune, North Carolina

Dear Ms. Arnold:

Osage of Virginia (Osage) was tasked to carry out the recommendations made in the January 2007 Soil Sampling Report for TT-2477/78. The report recommended that MCB Camp Lejeune resample soil sample location TT2477SS001 in one year to assess soil conditions and compare the results to the applicable maximum soil contaminant concentrations (MSCCs). During this investigation, one soil sample was taken from the previously identified location and analyzed for Volatile and Extractable Petroleum Hydrocarbons (VPH/EPH) using the Massachusetts Department of Environmental Protection (MADEP) Methods.

This work was authorized by the Naval Facilities Engineering Command Mid-Atlantic Marine Corps North Carolina IPT Division under Navy Contract N40085-06-D-7006, Task Order No. 0001. This site has been classified as Low Risk with Residential Land Use. Laboratory sampling results indicate the presence of soil contamination above Residential MSCCs in the soil sample. This report presents the data collected during the February 2008 sampling event and summarizes conclusions and recommendations.

Background

Buildings TT-2477 and TT-2478 are located in the Tarawa Terrace residential area of MCB, Camp Lejeune, North Carolina. Incidents from the two Buildings are managed under NCDENR Incident Numbers 7176 and 23607. Building TT-2477 is on the west side of Iwo Jima Boulevard, approximately 600 feet north of its intersection with Tarawa Boulevard. Building TT-2478 is approximately 250 feet further north on the same side of Iwo Jima Boulevard.

Building TT-2477 is currently utilized as a chapel. It was built in the early 1950s, however, as a full service gas station with vehicle maintenance capabilities. Three underground storage tanks (USTs) were located in the vicinity of this building. A 10,000 gallon gasoline tank, a 500 gallon hydraulic fluid tank, and a 500 gallon heating oil tank were removed from the site in 1992.

Building TT-2478 is currently a Marine Corps Community Services gas station with two pump islands located in front of the building. Four USTs were formerly located north of the pump islands. These included three 10,000-gallon fiberglass USTs used to hold gasoline and one 10,000-gallon UST used to hold diesel fuel. In August and September 1995, the three 10,000-gallon USTs and the associated distribution lines and dispensers were removed. During the UST removal, approximately 578 tons of petroleum-contaminated gravel and soil was excavated and disposed of offsite.

Various assessments were performed at the site in the early 1990s. Assessment work focused on the tanks at Buildings TT-2477 and TT-2478, as well as tanks located at TT-2453. Building TT-2453 was utilized as a gas station until 1987, when it was then used as a Marine Corps Community Services recreational equipment issue. The building was later demolished in 2001. There were seven USTs in the vicinity of the building, one AST, two hydraulic lifts, and the former dispenser islands and associated UST piping. Six of the tanks were removed from the site in 1987, with the remainder of the systems removed during building demolition in 2001. The Building TT-2453 area was incorporated into the TT-2477/78 remediation site in 2002.

Assessments of the site showed the presence of shallow groundwater contamination. The contaminant plume was identified in the vicinity of TT-2478 and extended southward approximately 800 feet. Contaminant levels in the TT-2477 area were to a much lesser extent, and contamination was also identified in the TT2453 area.

Free product was identified as a problem at the site. A layer of free product was detected in the vicinity of the USTs at Building TT-2478. A free product recovery system was installed in the area, and from 1993 through mid 1997, the recovery system collected approximately 229 gallons of free product. Free product recovery was also performed at Building TT-2477. From mid 1994 to early 1995, approximately 1 gallon of free product was recovered.

Law Engineering and Environmental Services, Inc. (LAW) prepared a CAP in 1996 that recommended the installation of an AS/SVE system. The system was placed in operation in October 1997 and operated continuously until shut down in May 2004. The system was expanded in March 1998 and again in April 2001 to treat contamination in the vicinity of TT-2453. OHM Remediation Services (now operating as Shaw Environmental and Infrastructure Inc. (Shaw)) constructed the system and maintained the site until 2005.

CATLIN Engineers and Scientists (CATLIN) conducted an optimization study at the site, dated February 2004, to review the effectiveness of the remedial action at the site. The 2004 optimization report concluded that the remediation system was effective in reducing petroleum constituent concentrations at the site. CATLIN recommended in the report to conduct additional soil sampling for Risk Based analyses, shut down the groundwater remediation system, and conduct groundwater sampling to monitor rebound effects. The system was subsequently deactivated in May 2004, and Shaw conducted post operational monitoring at the site in April and October 2004. No measureable free product had been detected at the site since approximately 1998, and groundwater contaminant concentrations were below Gross Contaminant Levels (GCLs). Shaw also conducted a soil sampling event along the TT-2478 transfer piping and dispenser islands in 2005.

Sovereign Consulting Inc. (Sovereign) conducted monitoring well gauging and sampling of site monitoring wells from October 2005 to May 2006. The remediation system is inoperable, so system O&M was not performed. The following 44 wells were gauged quarterly: 2477-MW01 – 2477-MW14, 2477-MWOB01, 2477-MWOB10, 2478-PW01, 2478-MW01 – 2478-MW07, 2478-MW09, 2478-MW10, 2478-MW12, 2478-MW13, 2478-MW14, 2478-MW14D, 2478-MW15, 2478-MW16, 2478-MW17, 2478-MW17D, 2478-MW18, 2478-MW19, 2478-MW20, 2478-MW21D, 2478-MW22 - 2478-MW25, 2478-MWSS100, and 2478-MWPVC101. A total of 17 wells were sampled as part of the April 2006 groundwater sampling event – 2477-MW01, 2477-MW02, 2477-MW06, 2477-MW11, 2477-MW14, 2477-MWOB01, 2477-MWOB10, 2477-MWPVC101, 2478-MW17, 2478-MW17D, 2478-MW18, 2478-MW19, 2478-MW20, 2478-MW21D, 2478-MW23, 2478-MW24, and 2478-MWSS100. Samples were analyzed for volatiles and semi-volatile compounds via EPA Methods 602 and 625 in accordance with the program scope of work, as well as VPH/EPH using the MADEP methods.

No measurable free product was detected at any site well designated for gauging during the 2005-2006 monitoring program, and based on the groundwater elevations, the overall groundwater flow direction remained generally to the south**.**

The April 2006 annual groundwater sampling event, including 17 groundwater monitoring wells, analyzed samples for the following parameters:

- VOCs - EPA Method 602
- SVOC - EPA Method 625 and 10 largest non-detect peaks (TICs)
- VPH and EPH – MADEP Methods

Benzene, ethylbenzene, and total xylenes were detected at concentrations above the NCGWQSs. Most of the detections were in the vicinity of Building TT-2453. Bis(2-ethylhexyl)phthalate and naphthalene were also detected above 2L Groundwater Quality Standards (2L GWQSs) in wells located at both Buildings TT-2477 and TT-2453. MADEP constituents were also detected in the TT-2453 area.

Sovereign recommended in the 2005-2006 annual monitoring report that MCB Camp Lejeune collect soil samples for Risk Based Analysis in the vicinity of MW01 and MW02 near Building TT-2477, as well as the former tank basin sides, transfer piping, and dispenser islands at Building TT-2478. These recommendations duplicated what was recommended in the CATLIN RAO & RCAP report, as well as historical NCDENR letters dated 2004 and 2001. Sovereign also recommended continuing gauging and sampling of existing monitoring program wells on an annual and biennial basis, respectively.

Sovereign recently conducted the biennial groundwater sampling event in November 2007. Results of the investigation have not been published as of this letter report.

Osage and Sovereign partnered to carry out the recommended soil sampling. In September 2006, field personnel collected soil samples from the MW01 and MW02 area at TT-2477, around the tank basin at TT-2478, and at one location (Shaw soil sample location 004) along the TT-2478 transfer line. Shaw previously conducted sampling in the transfer line and dispenser area at TT-2478; therefore, resampling was not conducted in these areas. Only one sample location, 004, was resampled since the Shaw 2005 results indicated an exceedence.

Results of the September 2006 soil sampling event were reported in the *FINAL Soil Sampling Report, TT-2477/78, NCDENR Incident #7176, Soil Sampling Event, September 2006, MCB Camp Lejeune, North Carolina*, dated January 24, 2007. The report recommended that MCB Camp Lejeune resample location TT2477SS001 in one year to determine if MADEP soil constituents attenuated to below applicable Maximum Soil Contaminant Concentrations (MSCCs).

As part of this investigation, Osage was tasked to collect the recommended soil samples and provide the results in a summary report.

Field Activities and Discussion

Field personnel conducted the soil sampling event on February 4, 2008. As shown on Figure 2, one soil sample was obtained from the MW01 area at TT-2477.

A geoprobe was used to advance the soil boring from which the selected soil sample was obtained. Depth to water (DTW) levels in the vicinity of TT-2477 measured approximately 13.5 feet Below Land Surface (BLS). The soil sample was obtained from the 10-11.5 feet BLS interval, which is where contamination was observed during the September 2006 sampling event.

The geoprobe was decontaminated before each boring using an Alconox solution, and new, disposable latex gloves were worn for each sample acquisition. Field screening using a Photoionization Detector (PID) was used to monitor organic vapor readings from the soil boring intervals.

The soil sample was packed into appropriately labeled laboratory glassware, placed on ice in an insulated cooler, and shipped under chain of custody to SGS Environmental Services, Inc. (NC Certification #481). The sample was then analyzed for the presence of VPH and EPH using the MADEP Methods. A copy of the laboratory analytical report and proper COC is attached.

Results and Discussion

One soil sample was collected in the vicinity of monitoring well USTTT2477-MW01 in accordance with the recommendations made in the Osage January 2007 Soil Sampling Report. Results of the soil sample submitted for laboratory analysis can be summarized as follows:

MADEP Methods

MADEP constituents were detected in soil sample TT2477-SS01A. The soil sample contained C_5-C_8 Aliphatics at a concentration of 108 mg/kg, which is above the Soil to Groundwater (STGW) MSCC (72 mg/kg) and below the Residential and Industrial/Commercial (I/C) MSCCs of 939 mg/kg and 24,528 mg/kg, respectively. The detected C_9-C_{18} Aliphatics concentration of 4,713 mg/kg is also above the STGW (3,300 mg/kg) MSCC, but below the Residential (9,386 mg/kg) and I/C (245,280 mg/kg) MSCCs. Soil sample TT2477-SS01A contained C_{19}-C_{36} Aliphatics at a concentration of 708 mg/kg as compared to the Residential MSCC of 93,860 mg/kg. Finally, laboratory analysis detected C_9-C_{22} Aromatics at a concentration of 3,261 mg/kg, which is above both the STGW (34 mg/kg) and Residential (469 mg/kg) MSCCs, but below the I/C (12,264 mg/kg) MSCC.

As compared to historical data obtained in September 2006, MADEP concentrations have increased. Most notably, C_9-C_{22} Aromatics were detected above the Residential MSCC (469 mg/kg) at a concentration of 3,261 mg/kg during this investigation as compared to 561 mg/kg in 2006. All other MADEP fractions also showed an increase in concentration. The C_5-C_8 Aliphatics fraction increased from <28 mg/kg in 2006 to 108 mg/kg. The C_9-C_{18} Aliphatics concentration also increased from 1,455 mg/kg to 4,713 mg/kg. Finally, the C_{19}-C_{36} Aliphatics concentration increased from <340 mg/kg to 708 mg/kg.

Tables 1 and 2 summarize lab data and compare the results to the applicable MSCCs. Note that the 2006 historical sample results are also included in the tables.

Summary and Conclusions

Osage personnel resampled soil in the area of monitoring well USTTT2477-MW01, adjacent to Building TT-2477, in order to assess contaminant levels. MADEP hydrocarbon fraction concentrations have shown an overall increase as compared to

the data obtained in 2006. Osage recommends that MCB Camp Lejeune perform a soil assessment in the area of concern to determine the horizontal and vertical extent of soil contamination above Residential MSCCs.

Sincerely,

Michael J. Cree
Contract Manager

Nicole L. Hall, P.E.
Senior Engineer

Attachments: Figures 1-2, Tables 1-2, Laboratory Analytical Report

Cc: Ms. Lori Reuther (NAVFAC)

TABLE 1 SUMMARY OF SOIL LABORATORY RESULTS

Date: April 2008 Incident No. and Project Name: 7176 - TT-2477

Analytical Method: MADEP VPH/EPH

Sample ID	Contaminant of Concern →		C_5-C_8 Aliphatics	C_9-C_{12} Aliphatics	C_9-C_{10} Aromatics	C_9-C_{18} Aliphatics	C_{19}-C_{36} Aliphatics	C_{11}-C_{22} Aromatics
	Date Collected	Sample Depth (ft. BLS)						
TT2477SS001	9/6/2006	10-11.5	<28	165	111	1,290	<340	450
TT2477-SS01A	2/4/2008	10-11.5	108	473	611	4,240	708	2,650

All results in milligrams per kilogram (mg/kg)

< = Less than method detection limit

TABLE 2 SUMMARY OF SOIL LABORATORY RESULTS

Date: April 2008 Incident No. and Project Name: 7176 - TT-2477

Analytical Method: MADEP VPH/EPH as compared to NCDENR MSCCs

Sample ID	Contaminant of Concern →		C_5-C_8 Aliphatics	C_9-C_{18} Aliphatics	C_{19}-C_{36} Aliphatics	C_9-C_{22} Aromatics
	Date Collected	**Sample Depth (ft. BLS)**				
Residential MSCC (mg/kg) **Industrial/Commercial MSCC (mg/kg)** **Soil to Groundwater MSCC (mg/kg)**			939 24,528 72	9,386 245,280 3,300	93,860 # ##	469 12,264 34
TT2477SS001	9/6/2006	10-11.5	<28	1,455	<340	**561**
TT2477-SS01A	2/4/2008	10-11.5	108	4,713	708	**3,261**

All results in milligrams per kilogram (mg/kg)

Health based level > 100%

Considered immobile

MSCC = Maximum Soil Contaminant Concentration

Bold results indicate concentrations above the Residential MSCC

< = Less than method detection limit

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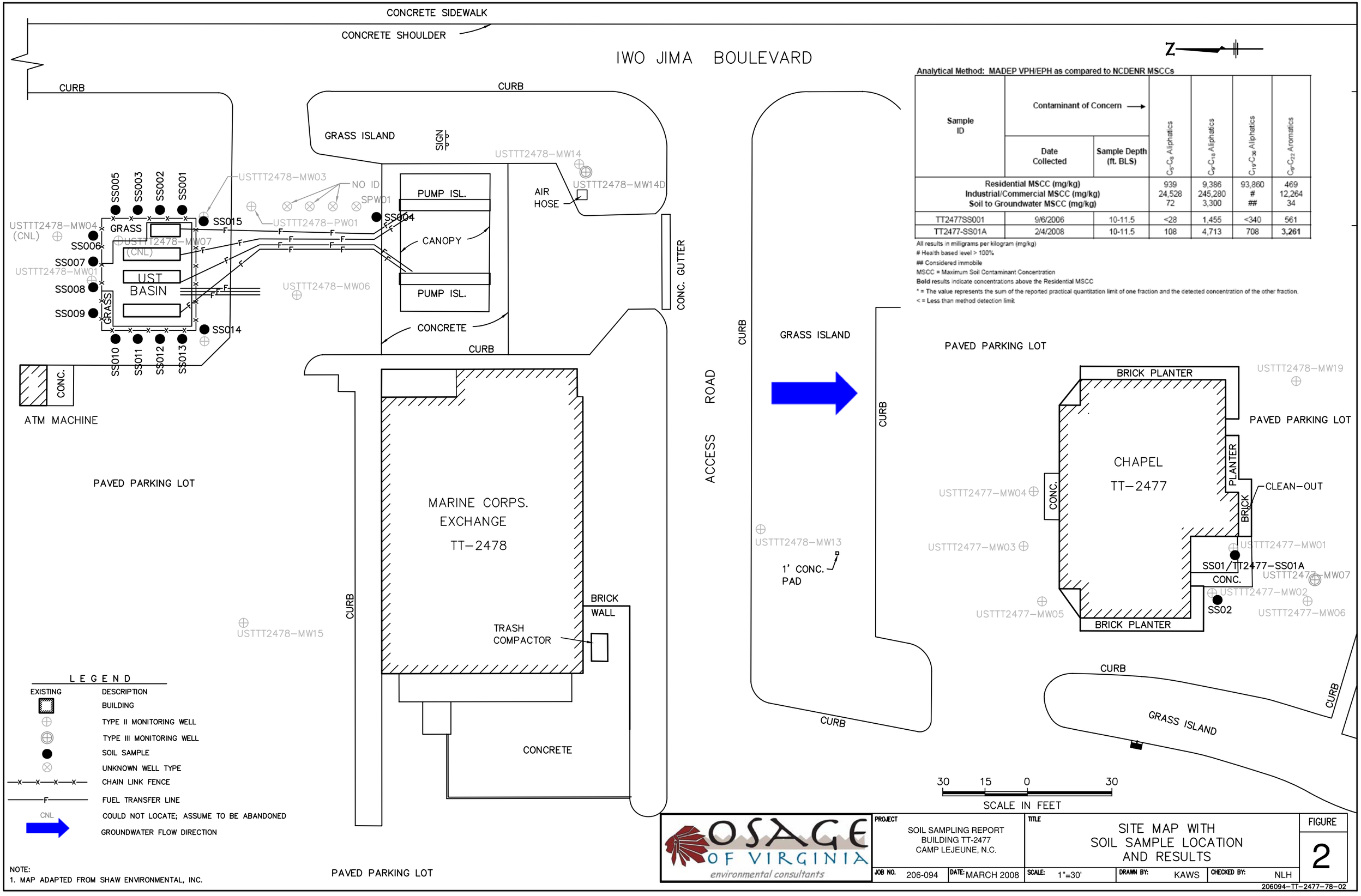
PROJECT	TITLE	FIGURE
SOIL SAMPLING REPORT BUILDING TT-2477 MARINE CORPS BASE CAMP LEJEUNE, N.C.	**SITE VICINITY MAP**	**1**

JOB NO.	DATE	SCALE	DRAWN BY	CHECKED BY
206-094	MAR 2008	AS SHOWN	SAC	STAFF



Analytical Method: MADEP VPH/EPH as compared to NCDENR MSCCs

Sample ID	Date Collected	Sample Depth (ft. BLS)	C_5-C_8 Aliphatics	C_9-C_{18} Aliphatics	C_{19}-C_{36} Aliphatics	C_9-C_{22} Aromatics
Contaminant of Concern →						
Residential MSCC (mg/kg)			939	9,386	93,860	469
Industrial/Commercial MSCC (mg/kg)			24,528	245,280	#	12,264
Soil to Groundwater MSCC (mg/kg)			72	3,300	##	34
TT2477SS001	9/6/2006	10-11.5	<28	1,455	<340	561
TT2477-SS01A	2/4/2008	10-11.5	108	4,713	708	**3,261**

All results in milligrams per kilogram (mg/kg)
Health based level > 100%
Considered immobile
MSCC = Maximum Soil Contaminant Concentration
Bold results indicate concentrations above the Residential MSCC
* = The value represents the sum of the reported practical quantitation limit of one fraction and the detected concentration of the other fraction.
< = Less than method detection limit

LEGEND

EXISTING	DESCRIPTION
	BUILDING
⊕	TYPE II MONITORING WELL
⊕	TYPE III MONITORING WELL
●	SOIL SAMPLE
⊗	UNKNOWN WELL TYPE
—x—x—x—x—	CHAIN LINK FENCE
———F———	FUEL TRANSFER LINE
CNL	COULD NOT LOCATE; ASSUME TO BE ABANDONED
	GROUNDWATER FLOW DIRECTION

NOTE:
1. MAP ADAPTED FROM SHAW ENVIRONMENTAL, INC.

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PROJECT: SOIL SAMPLING REPORT BUILDING TT-2477 CAMP LEJEUNE, N.C.			TITLE: SITE MAP WITH SOIL SAMPLE LOCATION AND RESULTS		FIGURE 2
JOB NO. 206-094	DATE: MARCH 2008	SCALE: 1"=30'	DRAWN BY: KAWS	CHECKED BY: NLH	

206094-TT-2477-78-02

SGS

Mike Cree
Osage of Virginia
2618 A Colley Ave.
Norfolk, VA 23517

Report Number: G649-30

Client Project: CTO 004

Dear Mike Cree,

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 services performed during this project, please call Erin Stagaard at (910) 350-1903. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS Environmental Services for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS Environmental Services, Inc.

Erin Stagaard
2008.02.15 13:23:49 -05'00'

Project Manager
Erin Stagaard

Date

List of Reporting Abbreviations and Data Qualifiers

B = Compound also detected in batch blank

BQL = Below Quantitation Limit (RL or MDL)

DF = Dilution Factor

Dup = Duplicate

D = Detected, but RPD is > 40% between results in dual column method.

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

% soilds = 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.

Print Date: 2/14/2008

Client Sample ID: **TT2477-SS01A**
Client Project ID: CTO 004
Lab Sample ID: G649-30-1D
Lab Project ID: G649-30

Collection Date: 04-Feb-08 0:00
Received Date: 05-Feb-08
Matrix: SOIL
Solids: 85.1
Basis: Dry

Results by MADEP EPH

PARAMETER	Result	RL/CL	Units	DF	Date Analyzed
C9-C18 Aliphatics	**4240**	10.0	MG/KG	20	13-Feb-08 22:24
C19-C36 Aliphatics	**708**	10.0	MG/KG	20	13-Feb-08 22:24
C11-C22 Aromatics	**2650**	10.0	MG/KG	20	13-Feb-08 22:24

Surrogates

COD_SR	N/A	40-140	%	20	13-Feb-08 22:24
OTP_SR	N/A	40-140	%	20	13-Feb-08 22:24
Frac1_SR	N/A	40-140	%	20	13-Feb-08 22:24
Frac2_SR	N/A	40-140	%	20	13-Feb-08 22:24

Batch Information

Analytical Batch: EP021308
Analytical Method: MADEP EPH
Instrument: GC6
Analyst: DCS

Prep Batch: 3541
Prep Method: 3541
Prep Date/Time: 08-Feb-08 10:00
Initial Prep Wt./Vol.: 13.11
Prep Extract Vol: 10.0

Print Date: 2/14/2008

Client Sample ID: **TT2477-SS01A**
Client Project ID: CTO 004
Lab Sample ID: G649-30-1A
Lab Project ID: G649-30

Collection Date: 04-Feb-08 0:00
Received Date: 05-Feb-08
Matrix: SOIL
Solids: 85.1
Basis: Dry

Results by MADEP VPH

PARAMETER	Result	RL/CL	Units	DF	Date Analyzed
C5-C8 Aliphatics	**108**	10.0	MG/KG	2	06-Feb-08 10:59
C9-C12 Aliphatics	**473**	10.0	MG/KG	2	06-Feb-08 10:59
C9-C10 Aromatics	**611**	23.5	MG/KG	2	06-Feb-08 10:59

Surrogates

BFB-F	133 *	70-130	%	2	06-Feb-08 10:59
BFB-P	102	70-130	%	2	06-Feb-08 10:59

Batch Information

Analytical Batch: VP020608
Analytical Method: MADEP VPH
Instrument: GC4
Analyst: DVG

Prep Batch: NA
Prep Method: 5035
Prep Date/Time:
Initial Prep Wt./Vol.: 5
Prep Extract Vol: 5

Print Date: 2/14/2008

Client Sample ID: **Trip Blank**
Client Project ID: CTO 004
Lab Sample ID: G649-30-2A
Lab Project ID: G649-30

Collection Date: 04-Feb-08 0:00
Received Date: 05-Feb-08
Matrix: SOIL
Solids: 100
Basis: Dry

Results by MADEP VPH

PARAMETER	Result	RL/CL	Units	DF	Date Analyzed
C5-C8 Aliphatics	BQL	10.0	MG/KG	1	06-Feb-08 21:12
C9-C12 Aliphatics	BQL	10.0	MG/KG	1	06-Feb-08 21:12
C9-C10 Aromatics	BQL	10.0	MG/KG	1	06-Feb-08 21:12

Surrogates

BFB-F	88.6	70-130	%	1	06-Feb-08 21:12
BFB-P	77.2	70-130	%	1	06-Feb-08 21:12

Batch Information

Analytical Batch: VP020608
Analytical Method: MADEP VPH
Instrument: GC4
Analyst: DVG

Prep Batch: NA
Prep Method: 5035
Prep Date/Time:
Initial Prep Wt./Vol.: 5
Prep Extract Vol: 5

SGS

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- Ohio
- New Jersey
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- Hawaii
- Maryland
- North Carolina

www.us.sgs.com

092144

(1)

CLIENT: OSAGE of VIRGINIA

CONTACT: THERESA ELFORMA PHONE NO:(757 274-4949

PROJECT: CTO 004 SITE/PWSID#: TT2477

REPORTS TO: MIKE CREE E-MAIL: mcree@osageva.com

FAX NO.:(757 420-0411

INVOICE TO: MIKE CREE 2618 COLLEY AVE STE A Norfolk VA 23517 QUOTE #

P.O. NUMBER

SGS Reference: 6649-30

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(2)

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX	No CONTAINERS	SAMPLE TYPE (C=COMP G=GRAB)	Preservatives Used: METHANOL / NONE	Analysis Required (3): MADEP VPH / MADEP EPH	REMARKS
	TT2477-SS01 A	2/4/08	1150	S	3		2	1	
	Trip Blank	2/4/08	1150		1		1		

(5)

Collected/Relinquished By:(1)	Date	Time	Received By:	Date	Time
	2/4/08	1410		2/5/08	1232
Relinquished By: (2)	Date	Time	Received By:	Date	Time
Relinquished By: (3)	Date	Time	Received By:	Date	Time
Relinquished By: (4)	Date	Time	Received By:	Date	Time

(4)

Shipping Carrier: FED EX 8600 9939

Shipping Ticket No: 27756

Samples Received Cold? (Circle) YES NO

Temperature °C: 3.9°C °F:

Special Deliverable Requirements: EDD

Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT

Special Instructions: Email RESULTS in EDD format to: nhall@catlinusa.com + mcree@OSAGEVA.com

Requested Turnaround Time: ☐ RUSH _____ Date Needed ☒ STD

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