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NCBC GULFPORT
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LETTER REGARDING PHASE 2 OFF BASE GROUNDWATER INVESTIGATION REPORT
NCBC GULFPORT MS
12/12/2008
TETRA TECH NUS

TETRA TECH

TtNUS/TAL-09-099/0521-5.1

Project Number 00521

Commander, Southeast
Naval Facilities Engineering Command Southeast
Attn: Robert Fisher
Remedial Project Manager
NAS Jacksonville
Jacksonville, FL 32212-0030

Reference: CLEAN Contract No. N62467-04-D-0055
Contract Task Order No. 0049

Subject: Phase II Off-Base Groundwater Investigation
Naval Construction Battalion Center Gulfport
Gulfport, Mississippi

Dear Mr. Fisher:

This Phase II Off-Base Groundwater Investigation Report provides the results of the Phase II groundwater sampling investigation at the Off-Base Areas of Concern (AOC) defined by the Mississippi Department of Environmental Quality (MDEQ). This investigation was conducted in response to the groundwater results first presented in the "Off-Base Sampling Investigation Field Report Letter", dated March 7, 2008; this sampling investigation was performed under the "Work Plan: Phase II Off-Base Groundwater Investigation", dated December 9, 2008.

**INTRODUCTION**

During the Phase I Off-Base Groundwater Investigation sampling activities, two groundwater samples, OBAOCW01 and OBAOCW02, were collected using temporary wells from the Arndt and Bennett properties (Figure 1). The dioxin toxicity equivalent quotient (TEQ) for sample OBAOCW02 was reported as 381 parts per quadrillion (ppq), which exceeds the MDEQ target remediation goal (TRG) for 2,3,7,8 tetrachloro dibenzo-p-dioxin (TCDD) of 30 ppq. It should be noted that the closest private groundwater supply wells have been tested at the tap and were non-detect for all dioxin and furan congeners [see *Off-Base Community Sampling Report* (TtNUS, 2003)].

Tetra Tech NUS, Inc.
1558 Village Square Blvd., Ste. 2, Tallahassee, FL 32309-2478
Tel 850.385.9899 Fax 850.385.9860 www.tetratech.com

Based on the results from the Phase I investigation, a subsequent Phase II Off-Base groundwater sampling event was initiated. Permanent monitoring wells were installed to determine if the Phase I groundwater sampling results were due in part to the temporary well sampling method previously used or if the detected TCDD concentrations represented actual site conditions.

The Phase II groundwater sampling fieldwork, which was designed to obtain groundwater samples while avoiding any contact between surface soil, subsurface soil, and groundwater, included the following tasks:

- Global Positioning System (GPS) mapping of the major features included in the study area.
- Permanent well installation using a double-cased technique at the Arndt and Bennett properties. Due to the potential for cross-media transfer, surface casing was used to prevent contact of the drill tools and well materials with the uppermost 5 feet of soil.
- Collection of groundwater samples for a full suite of analyses.

The following section provides the details for the Phase II groundwater sampling.

**MONITORING WELL INSTALLATION**

Four permanent monitoring wells (OBMW1 through OBMW04) were installed at locations chosen based on the results of the Phase I direct push technology (DPT) groundwater investigation (Figure 1). Wells OBMW01 and OBMW02 were installed in the vicinity of DPT groundwater sample location OBAOCW02. Monitoring well OBMW04 was installed adjacent to DPT groundwater sample location OBAOCW01. The fourth well, OBMW03 was installed in the Turkey Creek floodplain to the northeast of OBMW01 and OBMW02.

Wells were screened in the shallow zone of the shallow surficial aquifer. The screened interval for each well was based on the lithology observed while drilling and included the interval sampled during the Phase I DPT groundwater sampling (18-20 feet below grade at locations OBAOCW01 and OBAOCW02). In this area, a stiff green massive silt unit was encountered at depths of 30 to 35 feet which was considered the base of the shallow zone of the surficial aquifer. Field parameters and well installation details can be found on Table 1.

The monitoring wells were installed using rotosonic drilling methods. A 7-inch surface casing was advanced to a depth of 5 feet to prevent contact with surface soils during drilling and well installation. The rotosonic drill string was advanced inside the surface casing to the total boring depth, based on the occurrence of the green silt horizon.

The monitoring wells were constructed of 2-inch-diameter, Schedule 40 polyvinyl chloride (PVC) flush-threaded casing with 10-foot, 0.01-inch slotted PVC, pre-packed screens. At each well, a filter pack of clean 20/40 silica sand was installed from the bottom of the borehole to 2 feet above the top of the screen. A 4-foot thick bentonite pellet seal was installed above the 20/40 sand filter pack. The remainder of the annulus of the borehole was grouted with cement/bentonite slurry. The monitoring wells were completed at ground surface with flush-mount vaults.

## GROUNDWATER SAMPLING AND ANALYSIS

Following well development, groundwater samples were collected from each of the monitoring wells using low-flow purging methods. Groundwater quality parameters including pH, conductivity, temperature, dissolved oxygen, and turbidity were measured with field instruments at each monitoring well during sampling activities. Field parameters for the well development are summarized in Table 1. A field duplicate sample was collected at OBMW01 for Quality Assurance/Quality Control (QA/QC). The groundwater samples were analyzed for the full suite of analyses listed in Table 2. Groundwater sample log sheets are included in Appendix A.

## DATA EVALUATION

Upon receipt of the sampling results, the laboratory data underwent full validation. Non-dioxin groundwater sample results were compared to MDEQ Tier 1 groundwater TRGs. The dioxin groundwater results were evaluated using the World Health Organization (WHO) 2005 congener toxicity equivalency factors (TEFs) and the resulting TEQs were screened against the MDEQ TRG for TCDD. The positive detections reported for the groundwater samples are summarized in Table 3.

### Dioxins/Furans

Three dioxin congeners were reported at concentrations above the laboratory detection limits (Table 3). 1,2,3,4,6,7,8,9-OCDD and 1,2,3,4,6,7,8-HPCDD were detected in all of the groundwater samples. 1,2,3,7,8,9-HXCDD was detected in groundwater samples OBMW0101 and OBMW0201. TCDD was not reported in the groundwater samples. The dioxin TEQs for the Phase II samples were less than the

MDEQ TRG for TCDD (Table 3). Compared to the Phase I sampling results, the dioxin TEQs were lower and TCDD was not detected.

**Other Organics**

Two volatile organic compounds (VOCs), acetone and methylene chloride, were detected above the laboratory detection limits in several samples (Table 3). Reported concentrations of these VOCs, which are common laboratory contaminants, were less than the TRGs.

Two semi-volatile organic compounds (SVOCs), di-butyl phthalate and diethyl phthalate, were detected above the laboratory detection limits, but at a concentration less than their MDEQ TRG (Table 3).

Pesticide, PCB, and herbicide concentrations were less than the laboratory detection limits.

**Metals**

Of the 20 metals detected above the laboratory detection limits, four metals (aluminum, beryllium, iron, and lead) were present at concentrations greater than the MDEQ TRGs (Table 3).

The four metals exceeding the TRGs were detected in the sample from OBGW0401.

Iron was reported in OBGW0201at a concentration of 13,500 µg/L, greater than the TRG of 11,000 µg/L.

**CONCLUSIONS**

The groundwater dioxin results from the Phase II sampling did not replicate the Phase I sampling results. The dioxin TEQs in the Phase II samples were one to two orders of magnitude lower than the Phase I sample results and TCDD was not detected in the Phase II samples.

Because dioxins have extremely low solubility in water and extremely high affinity to carbon in the soil matrix, it is unlikely that dioxins are moving in the dissolved phase in groundwater or leaching from surface soil at the site. In addition, the VOC analytical results indicate that organic compounds that could act as solvents to increase dioxin mobility are not present at the site.

The elevated dioxin TEQ reported in the Phase I OBAOCW02 sample probably resulted from mixing of surface soil with groundwater allowed by the temporary well sampling method (direct push with open mill-

slot screen). The well installation method used for Phase II (rotosonic with surface casing) prevented contact of the drilling tools and well materials with the surface soil.

Other organic analytes that were detected in the groundwater samples, VOCs (acetone and methylene chloride) and SVOCs (di-butyl phthalate, and diethyl phthalate) were at concentrations below the TRGs.

Metals (aluminum, beryllium, iron, and lead) were the only analytes reported at concentrations greater than TRGs. Based on the history of this area and information available, it is unlikely that Navy activities resulted in a release of these metals.

If you have any questions regarding the information presented in this document, please contact me by phone at (850) 385-9899 or via e-mail at yarissa.martinez@tetratech.com

Cordially,

Yarissa Martinez, P.E.
Task Order Manager

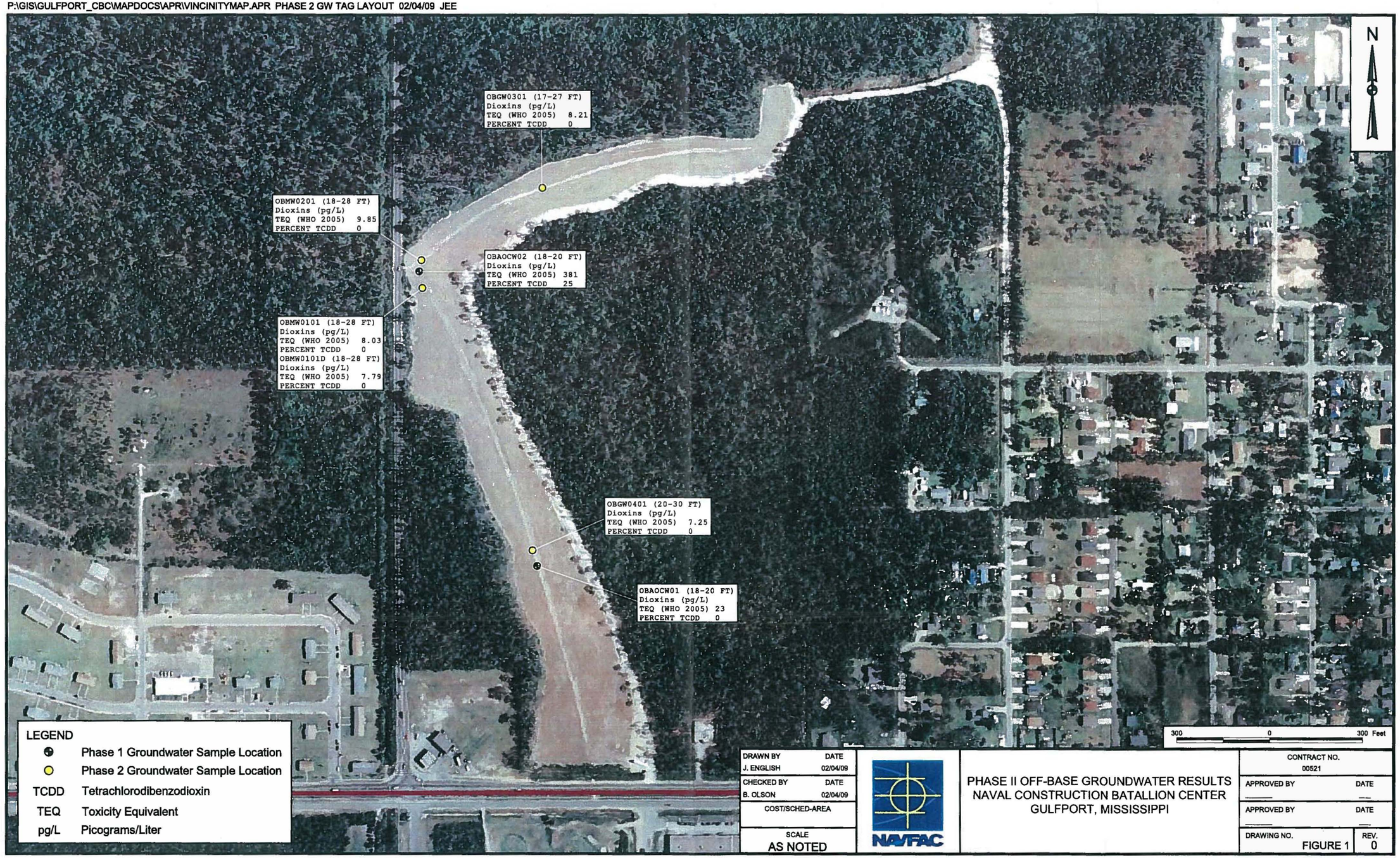
WDO/wdo

Enclosures

c: Gordon Crane (2 copies)
Bob Merrill, MDEQ (1 copy)
Debbie Humbert (1 copy)
Mark Perry (1 copy)

**FIGURE**

P:\GIS\GULFPORT_CBC\MAPDOCS\APR\VINCINITYMAP.APR PHASE 2 GW TAG LAYOUT 02/04/09 JEE




LEGEND

- Phase 1 Groundwater Sample Location
- Phase 2 Groundwater Sample Location
- TCDD Tetrachlorodibenzodioxin
- TEQ Toxicity Equivalent
- pg/L Picograms/Liter

| | | | |
|---|---|---|---|
| DRAWN BY J. ENGLISH | DATE 02/04/09 | PHASE II OFF-BASE GROUNDWATER RESULTS<br>NAVAL CONSTRUCTION BATALLION CENTER<br>GULFPORT, MISSISSIPPI | CONTRACT NO. 00521 |
| CHECKED BY B. OLSON | DATE 02/04/09 | | APPROVED BY / DATE |
| COST/SCHED-AREA | | | APPROVED BY / DATE |
| SCALE AS NOTED | | | DRAWING NO. FIGURE 1 / REV. 0 |

# TABLES

**TABLE 1**

**GROUNDWATER QUALITY PARAMETERS**
**NAVAL CONSTRUCTION BATTALION CENTER GULFPORT**
**GULFPORT, MISSISSIPPI**

| **Sample**<br>**Location**<br>**Dated Sampled** | **OBMW0101**<br>OBMW01<br>12/11/2008 | **OBMW0201**<br>OBMW02<br>12/12/2008 | **OBGW0301**<br>OBMW03<br>12/18/2008 | **OBGW0401**<br>OBMW04<br>12/18/2008 |
|---|---|---|---|---|
| **Well Depth (feet)** | 28 | 28 | 27 | 30 |
| **Screen Length (feet)** | 10 | 10 | 10 | 10 |
| pH | 6.50 | 6.27 | 5.47 | 6.56 |
| Conductivity (mS/cm) | 0.266 | 0.247 | 0.560 | 0.256 |
| Temperature (°C) | 20.09 | 20.31 | 20.42 | 21.33 |
| Turbidity (NTU) | 221 | 396 | 46.7 | 714 |
| DO (mg/L) | 0.08 | 0.07 | 0.23 | 0.06 |
| ORP (mV) | -261.4 | -181.2 | -80.2 | -139.4 |
| Draw Down (feet) | 0.23 | 1.25 | 7.91 | 1.53 |
| Volume Purged (liters) | 80 | 82 | 45 | 57 |
| Time Purged (minutes) | 260 | 320 | 260 | 270 |

Notes:

mS/cm = millisiemens per centimeter
°C = degrees celsius
NTU = Nephelometric Turbidity Units
DO = dissolved oxygen
mg/L = milligrams per liter
ORP = Oxidation/Reduction Potential
mV = millivolts

**TABLE 2**

**SAMPLING AND ANALYSIS SUMMARY TABLE**
**NAVAL CONSTRUCTION BATTALION CENTER GULFPORT**
**GULFPORT, MISSISSIPPI**

| SAMPLE ANALYSIS | TOTAL SAMPLES | ANALYTICAL METHOD (SW-846) |
|---|---|---|
| Dioxins and Furans | 5 | 8290 |
| TCL VOCs | 5 | 8260B |
| TCL SVOCs | 5 | 8270C |
| TCL Pesticides/PCBs | 5 | 8081A/8082 |
| Appendix IX Herbicides | 5 | 8151A |
| TAL Metals | 5 | 6010B |

Notes:
TCL = Target Compound List
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Compound
PCB = Polychlorinated Biphenyl
TAL = Target Analyte List

**TABLE 3**

**GROUNDWATER DETECTIONS**
**NAVAL CONSTRUCTION BATTALION CENTER GULFPORT**
**GULFPORT, MISSISSIPPI**

| **Sample**<br>**Location**<br>**Dated Sampled**<br>**Media** | **MDEQ TRGs** | **OBMW0101**<br>OBMW01<br>12/11/2008<br>GW | **OBMW0101-D**<br>OBMW01<br>12/11/2008<br>GW<br>OBMW0101<br>(Duplicate) | **OBMW0201**<br>OBMW02<br>12/12/2008<br>GW | **OBGW0301**<br>OBMW03<br>12/18/2008<br>GW | **OBGW0401**<br>OBMW04<br>12/18/2008<br>GW |
|---|---|---|---|---|---|---|
| **Volatile Organics (µg/L)** | | | | | | |
| ACETONE | **608** | 4 J | 4 J | 5 U | 4 J | 2 J |
| METHYLENE CHLORIDE | **5** | 0.6 J | 0.6 J | 5 U | 5 U | 5 U |
| **Semivolatile Organics (µg/L)** | | | | | | |
| DI-N-BUTYL PHTHALATE | **3650** | 10 U | 10 U | 10 U | 1 J | 10 U |
| DIETHYL PHTHALATE | **29200** | 10 U | 10 U | 10 U | 2 J | 3 J |
| **Dioxins/Furans (ng/L)** | | | | | | |
| 1,2,3,4,6,7,8,9-OCDD | **0.446** | **1.07** | **0.857** | **1.51** | **0.885** | 0.161 |
| 1,2,3,4,6,7,8-HPCDD | **0.0446** | **0.057** | **0.047** J | **0.113** | 0.012 J | 0.008 J |
| 1,2,3,7,8,9-HXCDD | **0.0108** | 0.004 J | 0.006 U | **0.011** J | 0.005 U | 0.005 U |
| **Dioxin TEQ as TCDD (pg/L)** | | | | | | |
| EPA 1989 | **30** | 8.02 | 7.64 | 10.15 | 8.04 | 6.62 |
| WHO 2005 | **30** | 8.03 | 7.79 | 9.86 | 8.21 | 7.25 |
| percent TCDD | | 0 | 0 | 0 | 0 | 0 |
| **Inorganics (µg/L)** | | | | | | |
| ALUMINUM | **36500** | 11300 | 8460 | 29000 | 2240 | 61700 |
| ANTIMONY | **6** | 0.78 U | 0.78 U | 0.78 U | 0.78 U | 1.1 |
| BARIUM | **2000** | 247 | 231 | 250 | 285 | 1160 |
| BERYLLIUM | **4** | 0.76 | 0.61 U | 1.5 | 0.68 | 5.1 |
| CADMIUM | **5** | 0.04 U | 0.04 U | 0.04 U | 0.37 | 0.8 |
| CALCIUM | **NA** | 4320 | 4140 | 3880 | 6240 | 11900 |
| CHROMIUM | **110** | 13.2 | 9.4 | 25.2 | 6.2 | 58.6 |
| COBALT | **2190** | 0.75 | 0.46 | 1.6 | 1.1 | 0.96 |
| COPPER | **1300** | 13.5 | 8.8 | 16.2 | 8.3 | 33.9 |
| IRON | **11000** | 10400 | 8970 | 13500 | 10700 | 19900 |
| LEAD | **15** | 5.4 | 3.5 | 9.3 | 0.97 U | 22.2 |
| MAGNESIUM | **NA** | 5340 | 4980 | 5040 | 5590 | 10200 |
| MANGANESE | **730** | 159 | 149 | 124 | 317 | 398 |
| MERCURY | **2** | 0.03 U | 0.03 U | 0.03 U | 0.03 U | 0.11 |
| NICKEL | **730** | 2.9 | 2.2 | 6 | 4.8 | 12.6 |
| POTASSIUM | **NA** | 3590 | 3360 | 3900 | 1870 | 5840 |
| SELENIUM | **50** | 1.3 | 0.96 U | 0.96 U | 0.99 U | 6.6 |
| SODIUM | **NA** | 43100 | 41900 | 44100 | 1E+05 | 44100 |
| VANADIUM | **256** | 13.4 | 10.1 | 34.9 | 6.2 | 90.6 |
| ZINC | **11000** | 13.2 | 9.7 | 24.1 | 13.5 | 26.9 |

Notes:

Shaded = Exceeds MDEQ Target Remediation Goals
MDEQ = Mississippi Department of Environmental Quality

| | | |
|---|---|---|
| GW = groundwater | pg/L = picograms per liter | NA = not applicable |
| µg/L = microgram per liter | U = non detect | TRG = target remediation goal |
| ng/L = nanogram per liter | J = estimation | TEQ = toxicity equivalent |

# APPENDIX A

# FIELD FORMS

Tetra Tech NUS, Inc.

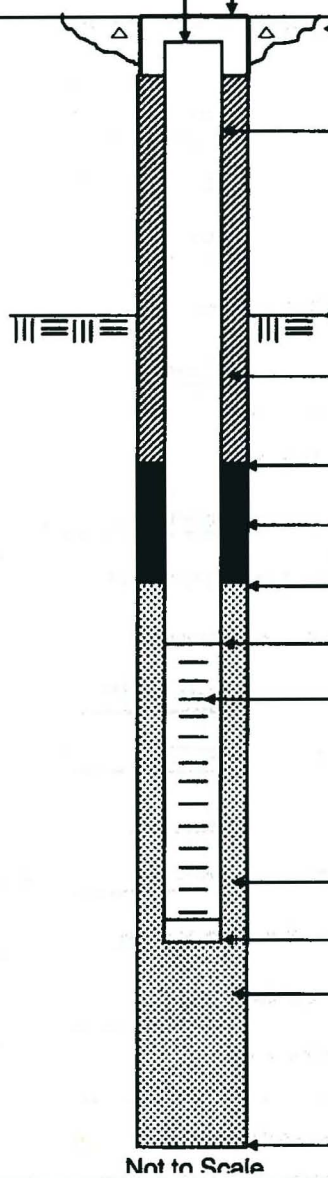
WELL No.: OBMW01

## MONITORING WELL SHEET

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: | 112G-00521 | DRILLING Co.: | BLY | BORING No.: | OBMW01 |
| PROJECT No.: | OBAOC P2 | DRILLER: | J. Blackwood | DATE COMPLETED: | 12-9/08 |
| SITE: | OBAOC | DRILLING METHOD: | Sonic | NORTHING: | |
| GEOLOGIST: | W. D. Olson | DEV. METHOD: | Surge/Pump | EASTING: | |

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser: /

Elevation / Height of Top of Surface Casing: /

I.D. of Surface Casing: 8"

Type of Surface Casing: bolt down

Type of Surface Seal: 2x2 PAD

I.D. of Riser: 2"

Type of Riser: Sched 40 PVC

Borehole Diameter: 6"

Elevation / Depth Top of Rock: / N/A

Type of Backfill: grout

Elevation / Depth of Seal: / 12

Type of Seal: bentonite pellets

Elevation / Depth of Top of Filter Pack: / 16

Elevation / Depth of Top of Screen: / 18

Type of Screen: Sched 40 PVC

Slot Size x Length: 0.010 X 10'

I.D. of Screen: ~~8~~ 2 inch

Type of Filter Pack: Prepack

Elevation / Depth of Bottom of Screen: / 28

Elevation / Depth of Bottom of Filter Pack: / 28

Type of Backfill Below Well: fine sand

Elevation / Total Depth of Borehole: / 35

Tetra Tech NUS, Inc.

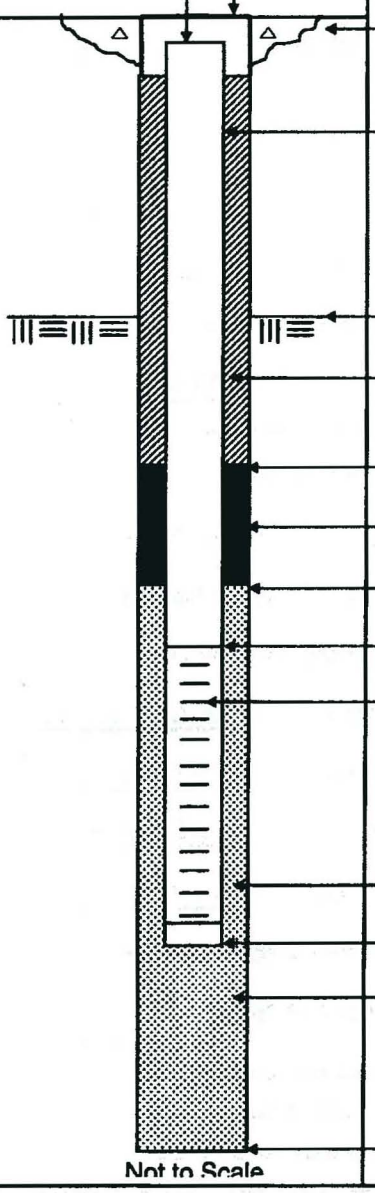
WELL No.: OBMW02

## MONITORING WELL SHEET

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: | 8B/CEECA | DRILLING Co.: | BLY | BORING No.: | OBMW02 |
| PROJECT No.: | 112G 00521 | DRILLER: | J. Blackwood | DATE COMPLETED: | 12-9/08 |
| SITE: | OBAOC P2 | DRILLING METHOD: | Sonic | NORTHING: | |
| GEOLOGIST: | W.D. Olson | DEV. METHOD: | Surge/Pump | EASTING: | |

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser: /

Elevation / Height of Top of Surface Casing: /

I.D. of Surface Casing: 8"

Type of Surface Casing: Bolt down

Type of Surface Seal: 2x2 Pad

I.D. of Riser: 2"

Type of Riser: Sched 40 PVC

Borehole Diameter: 6"

Elevation / Depth Top of Rock: / NA

Type of Backfill: grout

Elevation / Depth of Seal: / 12'

Type of Seal: bentonite Pellets

Elevation / Depth of Top of Filter Pack: / 16

Elevation / Depth of Top of Screen: / 18

Type of Screen: Sched 40 PVC

Slot Size x Length: 0.010 x10'

I.D. of Screen: 2"

Type of Filter Pack: Pre pack 20/30

Elevation / Depth of Bottom of Screen: / 28'

Elevation / Depth of Bottom of Filter Pack: / 28'

Type of Backfill Below Well: NA

Elevation / Total Depth of Borehole: / 28'

Tetra Tech NUS, Inc.

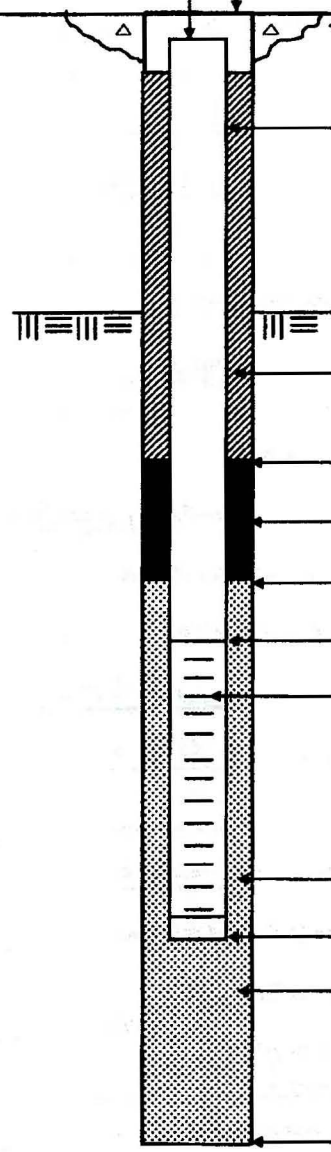
WELL No.: OBMW03

# MONITORING WELL SHEET

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: | OB/C EECA | DRILLING Co.: | RLY | BORING No.: | OBMW03 |
| PROJECT No.: | 112G0052 | DRILLER: | J. Blackwood | DATE COMPLETED: | |
| SITE: | OBAOC P2 | DRILLING METHOD: | Sonic | NORTHING: | |
| GEOLOGIST: | W.D. Olsen | DEV. METHOD: | Surge/Purge | EASTING: | |

Ground Elevation =

Datum:



Not to Scale

| | |
|---|---|
| Elevation / Depth of Top of Riser: | / |
| Elevation / Height of Top of Surface Casing: | / |
| I.D. of Surface Casing: | 8" |
| Type of Surface Casing: | bolt down |
| Type of Surface Seal: | 2x2 PAD |
| I.D. of Riser: | 2" |
| Type of Riser: | Sched 40 PVC |
| Borehole Diameter: | 6" |
| Elevation / Depth Top of Rock: | / NA |
| Type of Backfill: | grout |
| Elevation / Depth of Seal: | / 11' |
| Type of Seal: | bentonite pellets |
| Elevation / Depth of Top of Filter Pack: | / 15' |
| Elevation / Depth of Top of Screen: | / 17' |
| Type of Screen: | Sched 40 PVC |
| Slot Size x Length: | 0.010 x 10' |
| I.D. of Screen: | 2" |
| Type of Filter Pack: | Pre Pack |
| Elevation / Depth of Bottom of Screen: | / 27' |
| Elevation / Depth of Bottom of Filter Pack: | / 27' |
| Type of Backfill Below Well: | Fine Sand |
| Elevation / Total Depth of Borehole: | / 30 |

Tetra Tech NUS, Inc.

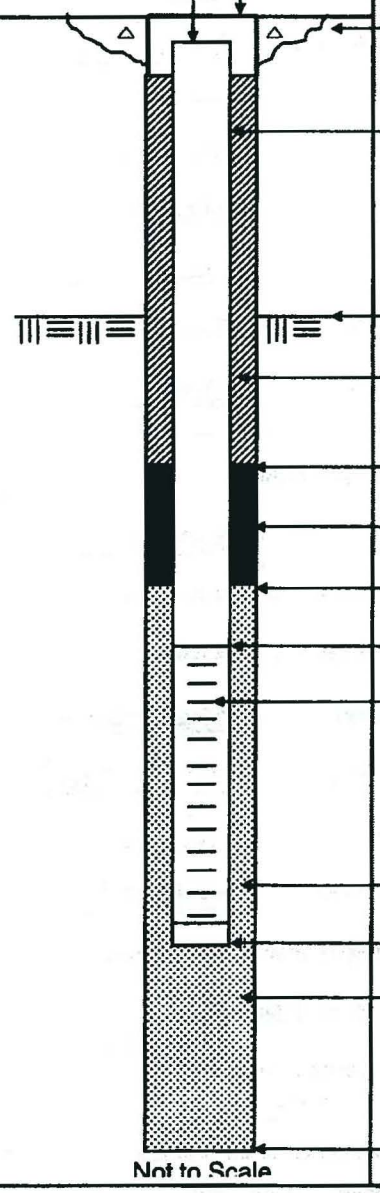
WELL No.: OBmw04

# MONITORING WELL SHEET

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: | BRK EECA | DRILLING Co.: | BLY | BORING No.: | OBmw04 |
| PROJECT No.: | 112G0052/ | DRILLER: | J. Blackwood | DATE COMPLETED: | |
| SITE: | OBAOC P2 | DRILLING METHOD: | Sonic | NORTHING: | |
| GEOLOGIST: | W.D. Olson | DEV. METHOD: | Surge/Pump | EASTING: | |

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser: /

Elevation / Height of Top of Surface Casing: /

I.D. of Surface Casing: 8"

Type of Surface Casing: Bolt down

Type of Surface Seal: 2x2 PAD

I.D. of Riser: 2"

Type of Riser: Sched 40 PVC

Borehole Diameter: 6"

Elevation / Depth Top of Rock: / NA

Type of Backfill: grout

Elevation / Depth of Seal: / 14'

Type of Seal: bentonite pellets

Elevation / Depth of Top of Filter Pack: / 18'

Elevation / Depth of Top of Screen: / 20

Type of Screen: Sched 4 PVC

Slot Size x Length: 0.010 x 10'

I.D. of Screen: 2"

Type of Filter Pack: Prepack

Elevation / Depth of Bottom of Screen: / 30'

Elevation / Depth of Bottom of Filter Pack: / 30'

Type of Backfill Below Well: Fine Sand

Elevation / Total Depth of Borehole: / 35'

Tetra Tech NUS, Inc.

# BORING LOG



PROJECT NAME:
PROJECT NUMBER: 112G0521
DRILLING COMPANY: B/L
DRILLING RIG: SONIC SAX

BORING NUMBER: MW01
DATE: 12.9.08
GEOLOGIST: W.A. Olsen
DRILLER: J. Blackwood

| Sample No. and Type or RQD | Depth (Ft.) or Run No. | ~~Blows / 6" or RQD (%)~~ | Sample Recovery / Sample Length | Lithology Change (Depth/Ft.) or Screened Interval | MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness | Color | Material Classification | USCS * | Remarks | PID/FID Reading (ppm): Sample | Sampler BZ | Borehole** | Driller BZ** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Dk brown FS | | | Ø | Ø | Ø | Ø |
| | | | | | | | TAN FS | | | | | | |
| | | | | wet @ 5' | | | | | | | | | |
| | | | | | | | | | | Ø | Ø | Ø | Ø |
| | | | | | | | Ho gray clayey sandy silt | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| 10 | | | | | | | gray FS w/silt and clay and gray silt w/FS and clay | | | Ø | Ø | Ø | Ø |
| 15 | | | | | | | | | | | | | |
| 20 | | | | | | | gray clayey silt w/sand | | | | | | |
| | | | | | | | gray FS w/silt greater to tan fine to med sand w/well rnd crs sand | | | | | | |
| 25 | | | | | | | | | | | | | |

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Cased off to P5' w/ 7" casing

Drilling Area Background (ppm):

Converted to Well: Yes X No ____ Well I.D. #: ____

Tetra Tech NUS, Inc.

# BORING LOG



PROJECT NAME: Ste8
PROJECT NUMBER: (126 052)
DRILLING COMPANY: B/L
DRILLING RIG: Sonic SPX

BORING NUMBER: MW QL
DATE: 12-/98
GEOLOGIST: W.A. Olson
DRILLER: J. Blackwood

| | Sample No. and Type or RQD | Depth (Ft.) or Run No. | Blows / 6" or RQD (%) | Sample Recovery / Sample Length | Lithology Change (Depth/Ft.) or Screened Interval | MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness | Color | Material Classification | USCS * | Remarks | PID/FID Reading (ppm): Sample | Sampler BZ | Borehole** | Driller BZ** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | | | | | | | | Same | | | | | | |
| 30 | | | | | X | | | green silt hard | | | | | | |
| 35 | | | | | TD | | | | | | | | | |

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes ____ No ____ Well I.D. #: ____

Tetra Tech NUS, Inc.

# BORING LOG



PROJECT NAME: OBAOC
PROJECT NUMBER: 112G0521
DRILLING COMPANY: B/L
DRILLING RIG: Sonic
BORING NUMBER: M100A
DATE: 12-10-[illegible]
GEOLOGIST: [illegible]
DRILLER: J. Blackwood

| Depth (Ft.) | Sample No. and Type or RQD | Depth (Ft.) or Run No. | Blows / 6" or RQD (%) | Sample Recovery / Sample Length | Lithology Change (Depth/Ft.) or Screened Interval | MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness | Color | Material Classification | USCS* | Remarks | PID/FID Reading (ppm): Sample | Sampler BZ | Borehole** | Driller BZ** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | gray silt cohesive | | | | | | |
| 10 | | | | | | | | darker gray silt w/sand and clay softer | | | | | | |
| 15 | | | | | | | | ltgrg sand and silt some clay | | | | | | |
| 20 | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | |
| | | | | | | | | ltbrn fine pined sand w/shells | | | | | | |
| 30 | | | | | | | | | | | | | | |

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

white to green silt & silt to 35'

Remarks: 7" casing to 5'

Drilling Area Background (ppm):

Converted to Well: Yes ____ No ____ Well I.D. #: ____

Tetra Tech NUS, Inc.

# GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name:
Project No.:

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: DB-MW01-01
Sample Location: MW01
Sampled By: C. Olson
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

**SAMPLING DATA:**

| | Color (Visual) | pH (S.U.) | S.C. (mS/cm) | Temp. (°C) | Turbidity (NTU) | DO (mg/l) | ORP (mV) | ~~Other~~ SWL |
|---|---|---|---|---|---|---|---|---|
| Date: 12/11/08 | | | | | | | | |
| Time: 1415 | | | | | | | | |
| Method: H/S | dark gry | 6.50 | 0.266 | 20.09 | 221 | 0.08 | -261.4 | 2.82 |

**PURGE DATA:**

| | Volume | pH | S.C. | Temp. | Turbidity | DO | ORP | ~~Other~~ SWL | Time |
|---|---|---|---|---|---|---|---|---|---|
| Date: 12/11/08 | | | | | | | | | |
| Method: low flow | 15 KL | 6.75 | 0.295 | 19.94 | 404 | 0.91 | -259.3 | 2.73 | 1225 |
| Monitor Reading (ppm): 0.0 | 30 | 6.63 | .282 | 20.20 | 375 | 0.17 | -266.3 | 2.76 | 1255 |
| Well Casing Diameter & Material | 45 | 6.55 | .271 | 20.06 | 271 | 0.10 | -244.8 | 2.79 | 1325 |
| Type: 2.0" PVC | 60 | 6.52 | .268 | 20.10 | 234 | 0.08 | -217.4 | 2.81 | 1355 |
| Total Well Depth (TD): 28.38 | 70 | 6.51 | .268 | 20.10 | 226 | 0.08 | -233.6 | 2.81 | 1405 |
| Static Water Level (WL): 2.59 | ~~75~~ 77.5 | 6.50 | .267 | 20.09 | 219 | 0.07 | -256.1 | 2.82 | 1410 |
| One Casing Volume(gal/L): | 80 | 6.50 | .266 | 20.09 | 221 | 0.08 | -261.4 | 2.82 | 1415 |
| Start Purge (hrs): 1155 | | | | | | | | | |
| End Purge (hrs): 1415 | | | | | | | | | |
| Total Purge Time (min): | | | | | | | | | |
| Total Vol. Purged (gal/L): 80 | | | | | | | | | |

**SAMPLE COLLECTION INFORMATION:**

| Analysis | Preservative | Container Requirements | Collected |
|---|---|---|---|
| VOA | HCl | 3 x 40 mL vial | Yes |
| SVOC | — | 2 x 1L Amber | Yes |
| Pest/PCB | — | 2 x 1L Amber | Yes |
| Herb | — | 2 x 1L Amber | Yes |
| metals | $HNO_3$ | 1 x 500 mL PE | Yes |
| Dioxin | — | 2 x 1L Amber | Yes |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**OBSERVATIONS / NOTES:**

well stone = 161.1 to 5.0

**Circle if Applicable:**

MS/MSD  Duplicate ID No.:

**Signature(s):** C Olson

Tetra Tech NUS, Inc.

# GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name:
Project No.:

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 08-MW02-01
Sample Location: MW02
Sampled By: C. Odom
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

**SAMPLING DATA:**

| | Color (Visual) | pH (S.U.) | S.C. (mS/cm) | Temp. (°C) | Turbidity (NTU) | DO (mg/l) | ORP (mV) | ~~Other~~ SWL | Time |
|---|---|---|---|---|---|---|---|---|---|
| Date: 12/12/08 | | | | | | | | | |
| Time: 1130 | | | | | | | | | |
| Method: HF 5m | | | | | | | | | |

**PURGE DATA:**

| | Volume | pH | S.C. | Temp. | Turbidity | DO | ORP | ~~Other~~ SWL | Time |
|---|---|---|---|---|---|---|---|---|---|
| Date: 12-18-08 | | | | | | | | | |
| Method: low flow | 15 | 6.30 | .257 | 20.30 | 563 | 0.12 | -130.4 | 3.16 | 0840 |
| Monitor Reading (ppm): | 30 | 6.24 | .255 | 20.18 | 835 | 0.08 | -169.2 | 3.18 | 0900 |
| Well Casing Diameter & Material | 36 | 6.30 | .256 | 18.27 | 862 | 0.07 | -146.5 | 3.11 | 0940 |
| Type: 2.0" PVC | 42 | 6.29 | .247 | 19.17 | 635 | 0.14 | -149.6 | 3.08 | 1010 |
| Total Well Depth (TD): 26.45 | 57 | 6.27 | .247 | 20.23 | 507 | 0.08 | -178.9 | 3.15 | 1040 |
| Static Water Level (WL): 1.95 | 67 | 6.27 | .247 | 20.24 | 481 | 0.07 | -174.6 | 3.18 | 1110 |
| One Casing Volume(gal/L): | 69.5 | 6.27 | .247 | 20.16 | 459 | 0.08 | -179.7 | 3.18 | 1105 |
| Start Purge (hrs): 0810 | 72.5 | 6.27 | .247 | 20.24 | 436 | 0.09 | -181.0 | 3.18 | 1115 |
| End Purge (hrs): 1130 | 79.5 | 6.27 | .246 | 20.27 | 421 | 0.07 | -181.3 | 3.18 | 1120 |
| Total Purge Time (min): | 79.5 | 6.26 | .246 | 20.30 | 408 | 0.07 | -182.5 | 3.20 | 1125 |
| Total Vol. Purged (gal/L): 82 | 82 | 6.27 | .247 | 20.31 | 396 | 0.07 | -181.2 | 3.20 | 1130 |

**SAMPLE COLLECTION INFORMATION:**

| Analysis | Preservative | Container Requirements | Collected |
|---|---|---|---|
| VOA | HCl | 3 x 40 mL vial | |
| SVOC | — | 2 x 1L Amber | |
| Pest/PCB | — | 2 x 1L Amber | |
| Herb | — | 2 x 1L Amber | |
| metals | HNO3 | 1 x 500 mL PE | |
| Dioxin | — | 2 x 1L Amber | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**OBSERVATIONS / NOTES:**

1 well volume = 16L

**Circle if Applicable:**

| MS/MSD | Duplicate ID No.: |
|---|---|
| | |

Signature(s): C. Odom

# GROUNDWATER SAMPLING LOG

| | | |
|---|---|---|
| SITE NAME: ~~LC34~~ | SITE LOCATION: ~~Kennedy Space Center~~ | |
| WELL NO: OBKOC MW03 | SAMPLE ID: ~~LC34~~ OBGW0301 | DATE: 12/18/2008 |

## PURGING DATA

| | | | | |
|---|---|---|---|---|
| WELL DIAMETER (inches): 2 4 | TUBING DIAMETER (inches): 3/16 | WELL SCREEN INTERVAL DEPTH: feet to 15 feet 25 | STATIC DEPTH TO WATER (feet): 1.75 | PURGE PUMP TYPE OR BAILER: PERISTALTIC |

**WELL VOLUME PURGE: 1 WELL VOLUME** = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
only fill out if applicable)
= ( 25 feet – 1.75 feet) X 23.25 liters/foot = 3.73 gal liters

**EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL.** = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + ( gallons/foot X feet) + liters = liters

| INITIAL PUMP OR TUBING DEPTH IN WELL (feet): | FINAL PUMP OR TUBING DEPTH IN WELL (feet): | PURGING INITIATED AT: | PURGING ENDED AT: | TOTAL VOLUME PURGED (gallons): |
|---|---|---|---|---|
| | | | | |

| TIME | VOLUME PURGED ~~(liters)~~ g | CUMUL. VOLUME PURGED ~~(liters)~~ g | PURGE RATE (lpm) | DEPTH TO WATER (feet) | pH (standard units) | TEMP. (°C) | COND. (µS/cm) | DISSOLVED OXYGEN (mg/L) | TURBIDITY (NTUs) | COLOR (describe) | ORP (mv) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0750 | 0 | 0 | 200 | 1.72 | — | — | — | — | — | — | — |
| 0820 | 1 | 1 | 400 | 4.30 | 5.61 | 19.59 | 0.521 | 2.28 | 80.1 | gray | 82.5 |
| 0840 | 2 | 3 | 400 | 6.65 | 5.63 | 20.16 | 0.556 | 0.59 | 64.0 | gray | 25.1 |
| 0900 | 2 | 5 | 400 | 7.71 | 5.64 | 20.15 | 0.635 | 0.43 | 63.6 | — | -18.7 |
| 0920 | 2 | 7 | 400 | 8.48 | 5.57 | 20.24 | 0.611 | 0.37 | 55.2 | — | -49.8 |
| 0940 | 2 | 9 | 400 | 9.00 | 5.53 | 20.33 | 0.576 | 0.33 | 53.6 | — | -65.3 |
| 1000 | 2 | 11 | 400 | 9.43 | 5.49 | 20.36 | 0.566 | 0.24 | 46.7 | — | -76.6 |
| 1005 | 0.5 | 11.5 | 400 | 9.55 | 5.47 | 20.39 | 0.561 | 0.23 | 46.5 | — | -79.4 |
| 1010 | 0.5 | 12 | 400 | 9.66 | 5.47 | 20.42 | 0.566 | 0.23 | 46.7 | — | -80.2 |
| | | | | | | | | | | | |

2.33
1.17
.23
.73

**WELL CAPACITY** (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
**TUBING INSIDE DIA. CAPACITY** (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

## SAMPLING DATA

| | | | |
|---|---|---|---|
| SAMPLED BY (PRINT) / AFFILIATION: /TTNUS | SAMPLER(S) SIGNATURES: | SAMPLING INITIATED AT: | SAMPLING ENDED AT: |
| PUMP OR TUBING DEPTH IN WELL (feet): | SAMPLE PUMP (SM) FLOW RATE (mL per minute): | TUBING MATERIAL CODE: T | |
| FIELD DECONTAMINATION: Y N | FIELD-FILTERED: Y N FILTER SIZE: ____ µm Filtration Equipment Type: ____ | DUPLICATE: Y N | |

| SAMPLE CONTAINER SPECIFICATION | | | | SAMPLE PRESERVATION | | | INTENDED ANALYSIS AND/OR METHOD | SAMPLING EQUIPMENT CODE |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID CODE | # CONTAINERS | MATERIAL CODE | VOLUME | PRESERVATIVE USED | TOTAL VOL ADDED IN FIELD (mL) | FINAL pH | | |
| | 3 | CG | 3x40ml | HCL | | | 8260B (Voc's) | SM |
| | | | | | | | | |
| | | | | | | | | |
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| | | | | | | | | |

**MATERIAL CODES:** AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

**SAMPLING/PURGING EQUIPMENT CODES:** APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); VT = Vacuum Trap; O = Other (Specify)

**NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.**

**2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)**

**pH:** ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

# GROUNDWATER SAMPLING LOG

| | | |
|---|---|---|
| SITE NAME: LC34 | SITE LOCATION: Kennedy Space Center | |
| WELL NO: OBAOC MW04 | SAMPLE ID: LC34-OB GW 0401 | DATE: 12/18/2008 |

## PURGING DATA

| | | | | |
|---|---|---|---|---|
| WELL DIAMETER (inches): 2" | TUBING DIAMETER (inches): 3/16 | WELL SCREEN INTERVAL DEPTH: 20-30 feet to feet | STATIC DEPTH TO WATER (feet): 2.16 | PURGE PUMP TYPE OR BAILER: PERISTALTIC |

**WELL VOLUME PURGE:** 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
only fill out if applicable)
= ( feet – feet) X liters/foot = liters

**EQUIPMENT VOLUME PURGE:** 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable) 4.45 gal = gallons + ( gallons/foot X feet) + liters = liters

| INITIAL PUMP OR TUBING DEPTH IN WELL (feet): | FINAL PUMP OR TUBING DEPTH IN WELL (feet): | PURGING INITIATED AT: | PURGING ENDED AT: | TOTAL VOLUME PURGED (gallons): |
|---|---|---|---|---|
| | | | | |

| TIME | VOLUME PURGED (liters) | CUMUL. VOLUME PURGED (liters) | PURGE RATE (lpm) | DEPTH TO WATER (feet) | pH (standard units) | TEMP. (°C) | COND. (µS/cm) | DISSOLVED OXYGEN (mg/L) | TURBIDITY (NTUs) | COLOR (describe) | ORP (mv) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1130 | 0 | 0 | 400 | 2.25 | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| 1150 | 2 | 2 | 400 | 3.11 | 6.80 | 21.10 | 0.287 | 0.15 | >1000 | brn | -106.5 |
| 1210 | 2 | 4 | 400 | 3.26 | 6.69 | 21.17 | 0.277 | 0.12 | >1000 | brn | -123.6 |
| 1230 | 2 | 6 | 400 | 3.31 | 6.68 | 21.36 | 0.271 | 0.08 | >1000 | brn | -128.9 |
| 1250 | 2 | 8 | 400 | 3.40 | 6.65 | 21.53 | 0.267 | 0.06 | >1000 | Brn | -124.7 |
| 1310 | 2 | 10 | 400 | 3.50 | 6.62 | 21.61 | 0.263 | 0.05 | >1000 | BRN | -140.0 |
| 1330 | 2 | 12 | 400 | 3.58 | 6.60 | 21.39 | 0.260 | 0.05 | 871 | BRN | -139.5 |
| 1350 | 2 | 14 | 400 | 3.64 | 6.57 | 21.33 | 0.258 | 0.05 | 731 | BRN | -140.0 |
| 1355 | 1/2 | 14 1/2 | 400 | 3.66 | 6.56 | 21.41 | 0.257 | 0.05 | 761 | BRN | -139.4 |
| 1400 | 1/2 | 15 | 400 | 3.69 | 6.56 | 21.33 | 0.256 | 0.06 | 714 | BRN | -139.4 |

**WELL CAPACITY** (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
**TUBING INSIDE DIA. CAPACITY** (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

## SAMPLING DATA

| | | | |
|---|---|---|---|
| SAMPLED BY (PRINT) / AFFILIATION: /TTNUS | SAMPLER(S) SIGNATURES: | SAMPLING INITIATED AT: | SAMPLING ENDED AT: |
| PUMP OR TUBING DEPTH IN WELL (feet): | SAMPLE PUMP (SM) FLOW RATE (mL per minute): | TUBING MATERIAL CODE: T | |
| FIELD DECONTAMINATION: Y N | FIELD-FILTERED: Y N FILTER SIZE: ____ µm Filtration Equipment Type: ____ | DUPLICATE: Y N | |

| SAMPLE CONTAINER SPECIFICATION | | | | SAMPLE PRESERVATION | | | INTENDED ANALYSIS AND/OR METHOD | SAMPLING EQUIPMENT CODE |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID CODE | # CONTAINERS | MATERIAL CODE | VOLUME | PRESERVATIVE USED | TOTAL VOL ADDED IN FIELD (mL) | FINAL pH | | |
| | 3 | CG | 3x40ml | HCL | | | 8260B (Voc's) | SM |
| | | | | | | | | |
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**MATERIAL CODES:** AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

**SAMPLING/PURGING EQUIPMENT CODES:** APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); VT = Vacuum Trap; O = Other (Specify)

**NOTES:** 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
**pH:** ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

330 1.36
2.16
22 64

12 2.78
1.39
-18

W 4 5

# SGS Environmental Services Inc.
## CHAIN OF CUSTODY RECORD

Locations Nationwide
- Alaska
- New Jersey
- North Carolina
- West Virginia
- Maryland
- New York
- Ohio

www.us.sgs.com

(1)

CLIENT: TTWUS

CONTACT: Bill Olson PHONE NO: 850 385 9899

PROJECT: CTO 49 Gulfport SITE/PWSID#:

REPORTS TO: EMAIL:

INVOICE TO: QUOTE #:

P.O. #:

SGS Reference #:

page _____ of _____

(2)

| LAB NO. | SAMPLE IDENTIFICATION | DATE | TIME | MATRIX/ MATRIX CODE | # CONTAINERS | SAMPLE TYPE C= COMP G= GRAB M= Multi Incremental Samples | Preservatives Used: 4° | | | | | | | | | | REMARKS/ LOC ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Analysis Required (3): Dioxins/Furans | | | | | | | | | | |
| | OBmw0101 | 12-11/08 | 1430 | GW | 2 | G | 2 | | | | | | | | | | |
| | OBmw0101D | 12-11/08 | 1430 | GW | 2 | G | 2 | | | | | | | | | | |
| | OBmw0201 | 12-12/08 | 1130 | GW | 2 | G | 2 | | | | | | | | | | |
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(5)

| Collected/Relinquished By:(1) | Date | Time | Received By: |
|---|---|---|---|
| [signature] | 12-12/08 | 1600 | |
| Relinquished By: (2) | Date | Time | Received By: |
| Relinquished By: (3) | Date | Time | Received By: |
| Relinquished By: (4) | Date | Time | Received For Laboratory By: |

(4)

DOD Project? YES NO

Cooler ID _____

Special Deliverable Requirements:

Requested Turnaround Time and-or Special Instructions:

Samples Received Cold? YES NO

Cooler TB

Temperature °C: _____ - _____

Chain of Custody Seal: (Circle)

INTACT BROKEN ABSENT

Katahdin ANALYTICAL SERVICES
600 Technology Way
Scarborough, ME 04074
Tel: (207) 874-2400
Fax: (207) 775-4029

# CHAIN of CUSTODY

**PLEASE BEAR DOWN AND PRINT LEGIBLY IN PEN**



| | | | |
|---|---|---|---|
| Client: T+NUS | Contact: B. Nilolsow | Phone #: (850) 385-9899 | Fax #: (850) 385-986 |
| Address: 1558 Village Sq. Blvd - 2 | City: Tallahassee | State: FL | Zip Code: 32309 |
| Purchase Order # | Proj. Name / No.: CTO 49 Gulfport | Katahdin Quote # | |
| Bill (If different than above) | Address | | |
| Sampler (Print / Sign): Neto D. Olsen | | Copies To: | |

**LAB USE ONLY** WORK ORDER #:

KATAHDIN PROJECT NUMBER _____

REMARKS: _____

SHIPPING INFO: ☐ FED EX ☐ UPS ☐ CLIENT

AIRBILL NO: _____

TEMP°C _____ ☐ TEMP BLANK ☐ INTACT ☐ NOT INTACT

ANALYSIS AND CONTAINER TYPE PRESERVATIVES

| * | Sample Description | Date / Time coll'd | Matrix | No. of Cntrs. | TCL VOC (Filt. ☐Y ☒N) | TCL SVOC (Filt. ☐Y ☒N) | TCL Pest/PCB (Filt. ☐Y ☒N) | TAL metals (Filt. ☐Y ☒N) | APPX IX Hands (Filt. ☐Y ☐N) | (Filt. ☐Y ☐N) | (Filt. ☐Y ☐N) | (Filt. ☐Y ☐N) | (Filt. ☐Y ☐N) | (Filt. ☐Y ☐) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OBmw0101 | 12-11/08 1430 | GW | 10 | 3 | 2 | 2 | 1 | 2 | | | | | |
| | OBmw0101D | 12-11/08/1430 | GW | 10 | 3 | 2 | 2 | 1 | 2 | | | | | |
| | OBmw0201 | 12-12/08 1130 | GW | 10 | 3 | 2 | 2 | 1 | 2 | | | | | |
| | OBTB121208 | 12-12/08/ | QA | 2 | 2 | | | | | | | | | |
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COMMENTS

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Relinquished By: (Signature) | Date / Time | Received By: (Signature) |
|---|---|---|---|---|---|
| [illegible] | 12/12/08 | | | | |
| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Relinquished By: (Signature) | Date / Time | Received By: (Signature) |
| | | | | | |

THE TERMS AND CONDITIONS ON THE REVERSE SIDE HEREOF SHALL GOVERN SERVICES. EXCEPT WHEN A SIGNED CONTRACTUAL AGREEMENT EXISTS

**CUSTOMER COPY**

SGS

# EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD

**SHIP TO: 227 French Landing Drive, Suite 550 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426**

42881

| Send Results to: | Send Invoice to: | Analysis Requirements: | Lab Use Only: |
|---|---|---|---|
| Name Bill Olson | Name Gulf Port CT049 | Dioxins/Furans | VOA Headspace Y N NA |
| Company T+NUS | Company Site 8B/C | | Field Filtered Y N NA |
| Address 1558 Village Sq. Blvd-2 | Address | | Correct Containers Y N NA |
| City Tallahassee | City | | Discrepancies Y N NA |
| State, Zip FL 32309 | State, Zip | | Cust. Seals Intact Y N NA |
| Phone 850 385 9899 | Phone | | Containers Intact Y N NA |
| Fax | Fax | | Airbill #: |
| E-mail | E-mail | | CAR #: |
| Project No./Name: | Sampler's (Signature): | | |

| Lab Use Only Lab # | Date/Time Sampled | Sample Description | Sample Matrix | Dioxins/Furans | Comments | No. of Bottles | Lab Use Only Containers/Pres. |
|---|---|---|---|---|---|---|---|
| | 12-18/08 1015 | OBGW0301 | GW | 2 | | | |
| | 12-18/08 1405 | OBGW0401 | GW | 2 | | | |
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| | | | | | | | |

| Sample Kit Prep'd by: (Signature) | Date/Time | Received By: (Signature) |
|---|---|---|
| Relinquished by: (Signature) [signature] | Date/Time 12-8/08 1630 | Received By: (Signature) |
| Relinquished by: (Signature) | Date/Time | Received By: (Signature) |
| *Received for Laboratory by: (Signature)* | Date/Time | *Temperature* |

REMARKS:

Details:

Page ____ of ____

Cooler No. ____ of ____

Date Shipped ____

Shipped By ____

Turnaround ____

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

RAHNSIV

# EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD

SHIP TO: 227 French Landing Drive, Suite 550 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426

42880

| Send Results to: | Send Invoice to: |
|---|---|
| Name: TIO GW | Name: GULF COAST CO 49 |
| Company: + US | Company: SB/C |
| Address: 55B Village Sq Blvd | Address: |
| City: Tallahassee | City: |
| State, Zip: FL 32309 | State, Zip: |
| Phone: 850-85-98 | Phone: |
| Fax: | Fax: |
| E-mail: | E-mail: |
| Project No./Name: | Sampler's (Signature): |

**Analysis Requirements:** TPH, TCL SVOC, PE, CB, RS, IX, Metals + Hg

**Lab Use Only:**

| | | | |
|---|---|---|---|
| VOA Headspace | Y | N | NA |
| Field Filtered | Y | N | NA |
| Correct Containers | Y | N | NA |
| Discrepancies | Y | N | NA |
| Cust. Seals Intact | Y | N | NA |
| Containers Intact | Y | N | NA |

Airbill #:

CAR #:

| Lab Use Only Lab # | Date/Time Sampled | Sample Description | Sample Matrix | TPH | TCL SVOC | PE | CB | RS | IX | Metals + Hg | Comments | No. of Bottles | Lab Use Only Containers/Pres. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 12-8-09 1015 | OB GW 30 L | GW | | 2 | 2 | 2 | | | 1 | | 10 | |
| | 12-8-09 1025 | OB GW 40 L | GW | 3 | 2 | 2 | 2 | | | 1 | | 10 | |
| | 12-8-09 1000 | OB TB 120 | QA | 1 | 2 | | | | | | | 2 | |

| Sample Kit Prep'd by: (Signature) | Date/Time | Received By: (Signature) |
|---|---|---|
| Relinquish d by: (Signature) | Date/Time 12/8/09 630 | Received By: (Signature) |
| Relinquished by: (Signature) | Date/Time | Received By: (Signature) |
| *Received for Laboratory by: (Signature)* | Date/Time | *Temperature* |

REMARKS:

Details:

Page 1 of 1

Cooler No. 1 of 1

Date Shipped

Shipped By

Turnaround

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

Tetra Tech NUS Inc.

# BORING LOG

Page 1 of ___

PROJECT NAME: AB AOC
PROJECT NUMBER: 112G00521
DRILLING COMPANY: B/L
DRILLING RIG: Sonic spider

BORING NUMBER: MW03
DATE: 12-10/08
GEOLOGIST: W. A. Olson
DRILLER: J. Blackwood

| Sample No. and Type or RQD | Depth (Ft.) or Run No. | Blows / 6" or RQD (%) | Sample Recovery / Sample Length | Lithology Change (Depth/Ft) or Screened Interval | MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness | Color | Material Classification | USCS * | Remarks | PID/FID Reading (ppm): Sample | Sampler BZ | Borehole** | Driller BZ** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | Jawfs w/shell | | | | | | |
| | | | | | | | gray clayey | | | | | | |
| | | | | | | | silt w/fine sand | | | | | | |
| 10 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| 15 | | | | | | | sandier @ 15' | | | | | | |
| | | | | | | | gray silty sand | | | | | | |
| | | | | | | | w/clay, | | | | | | |
| | | | | | | | loose | | | | | | |
| 20 | | | | | | | gray sandy silt | | | | | | |
| | | | | | | | grades to gray | | | | | | |
| | | | | | | | silt | | | | | | |
| 25 | | | | | | | | | | | | | |
| | | | | | | | grades | | | | | | |
| | | | | | | | to green silt | | | | | | |
| 30 | | | | | | | | | | | | | |

TD

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes ____ No ____ Well I.D. #: ____

# APPENDIX B

# RESPONSE TO MDEQ COMMENTS

# RESPONSE TO COMMENTS

Responses to MDEQ comments dated June 19, 2009 for the Draft Phase II Off-Base Groundwater Investigation Report dated June 3, 2009:

**MDEQ Comment 1:**

> It is noted that dioxin concentrations detected in the new (permanent) groundwater monitoring wells were lower than those reported from the Phase I (March 2008) Direct Push sampling event. OPC concurs that elevated TCDD dioxin concentrations detected during the Phase I event can probably be attributed to soil particulates introduced into the groundwater sample during the DPT sampling process. It is also noted that three dioxin congeners (other than TCDD) were reported at concentrations above regulatory levels.

***Response to MDEQ Comment 1:***

While hexa-, hepta-, and octochlorinated dibenzo dioxins were detected in groundwater samples, tetrachlorodibenzodioxin (TCDD) was absent in all the groundwater samples from the permanent monitoring wells. The absence of TCDD does not support an HO source for the dioxin detected in the groundwater samples.

In addition, the TEQs for all the samples were less than the target remediation goal (TRG) for TCDD, accepted as the most toxic of the chlorinated dibenzodioxin congeners. The fact that the TRG for the HxCDD congener is less than the TCDD TRG indicates that the Toxicity Equivalence Factor (TEF) approach for evaluating dioxin concentrations is more representative of site conditions.

**MDEQ Comment 2:**

> Four metals (lead, beryllium, aluminum, and iron) were detected above regulatory screening levels. The text (page 5, paragraph 2) states that "these concentrations probably represent naturally occurring levels of these metals". Coastal plain strata of Mississippi do not contain geologic units that contain lead or beryllium that would support dissolved phase groundwater concentrations that exceed MCLs. Although these occurrences may be attributable to other sources of contamination, these concentrations do not reflect "natural" or in situ mineral assemblage (parent material) dissolution. If another source of contamination is proposed then that source should be identified. Aluminum and iron do not have primary MCLs but secondary screening levels were exceeded for those metals also, potentially exceeding ecological screening levels.

***Response to MDEQ Comment 2:***

The text will be revised. Based on site history, there is no evidence to suggest that the presence of these metals in site groundwater has resulted from Navy activities. Therefore, no other source of contamination is suggested.