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



TETRA TECH

TtNUS/TAL-09-051/0521-5.1

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, 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) as 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 Phase I 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)].

Based on the results from the Phase I investigation, 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 an artifact due 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, subsurface, 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 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 purging 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. Groundwater sample results were compared to MDEQ Tier 1 groundwater TRGs. The dioxin 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 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 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 OBGW0201 at 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 (rotasonic with surface casing) prevented contact of the drilling tools and well materials with the surface soil.

Mr. Robert Fisher
Naval Facilities Engineering Command Southeast
June 3, 2009 – Page 5 of 5

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 at the site, it is unlikely that Navy activities resulted in a release of these metals and these concentrations probably represent naturally occurring levels 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@tetrattech.com

Cordially,



Yarissa Martinez, P.E.
Task Order Manager

WDO/wdo

Enclosures

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

TABLE 1

GROUNDWATER QUALITY PARAMETERS
 NAVAL CONSTRUCTION BATTALION CENTER GULFPORT
 GULFPORT, MISSISSIPPI

Sample Location	OBMW0101 OBMW01	OBMW0201 OBMW02	OBGW0301 OBMW03	OBGW0401 OBMW04
Dated Sampled	12/11/2008	12/12/2008	12/18/2008	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, MS**

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 Location Dated Sampled Media	MDEQ TRGs	OBMW0101 OBMW01 12/11/2008 GW	OBMW0101-D OBMW01 12/11/2008 GW OBMW0101 (Duplicate)	OBMW0201 OBMW02 12/12/2008 GW	OBGW0301 OBMW03 12/18/2008 GW	OBGW0401 OBMW04 12/18/2008 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		1.07	0.857	1.51	0.885	0.161
1,2,3,4,6,7,8-HPCDD		0.057	0.047 J	0.113	0.012 J	0.008 J
1,2,3,7,8,9-HXCDD		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

µg/L = microgram per liter

ng/L = nanogram per liter

TEQ = toxicity equivalent

U = non detect

J = estimation

NA = not applicable

TRG = target remediation goal





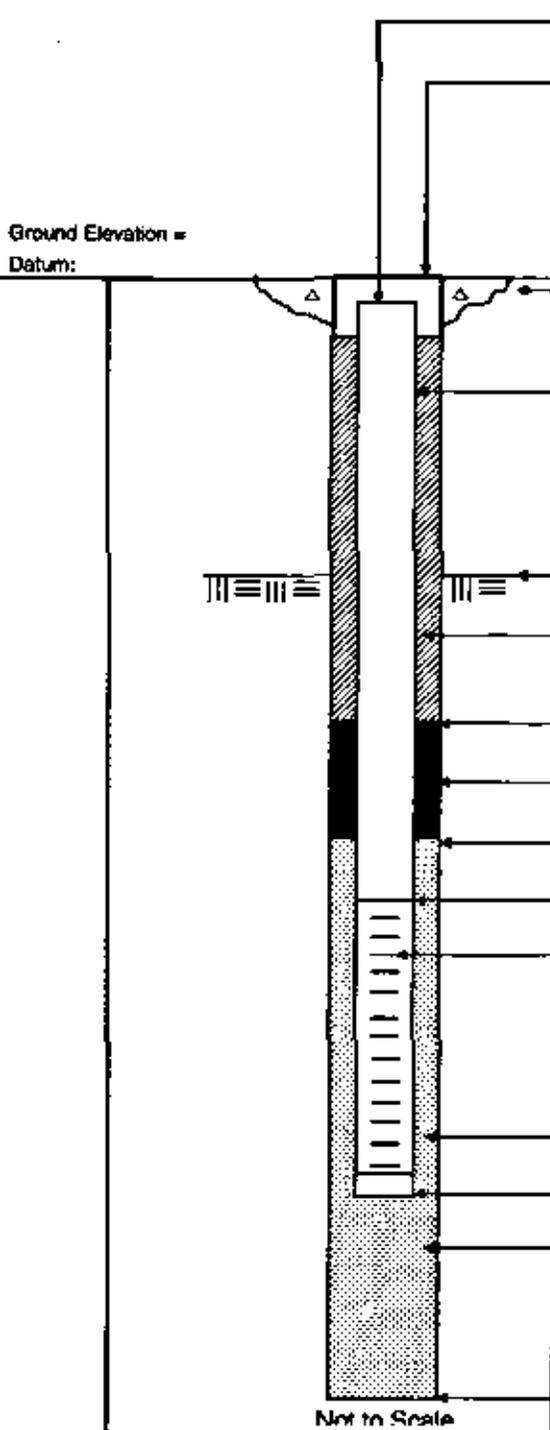
Tetra Tech NUS, Inc.

WELL No.:

OB MWOL

MONITORING WELL SHEET

PROJECT: 1126-00521 DRILLING Co.: BLY BORING No.: OB MWOL
 PROJECT No.: OBAOC P2 DRILLER: J. Blackwood DATE COMPLETED: 12-9-08
 SITE: OBAOC DRILLING METHOD: Sonic NORTHING: _____
 GEOLOGIST: W.D. Olson DEV. METHOD: Surf/Pump EASTING: _____



Elevation / Depth of Top of Riser: 1
 Elevation / Height of Top of Surface Casing: 1
 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: 104
 Type of Backfill: grout
 Elevation / Depth of Seal: 112
 Type of Seal: bentonite pellets
 Elevation / Depth of Top of Filter Pack: 116
 Elevation / Depth of Top of Screen: 118
 Type of Screen: Sched 40 PVC
 Slot Size x Length: 0.010 x 10'
 I.D. of Screen: 2 1/2 inches
 Type of Filter Pack: Pre pack
 Elevation / Depth of Bottom of Screen: 128
 Elevation / Depth of Bottom of Filter Pack: 128
 Type of Backfill Below Well: fine sand
 Elevation / Total Depth of Borehole: 135



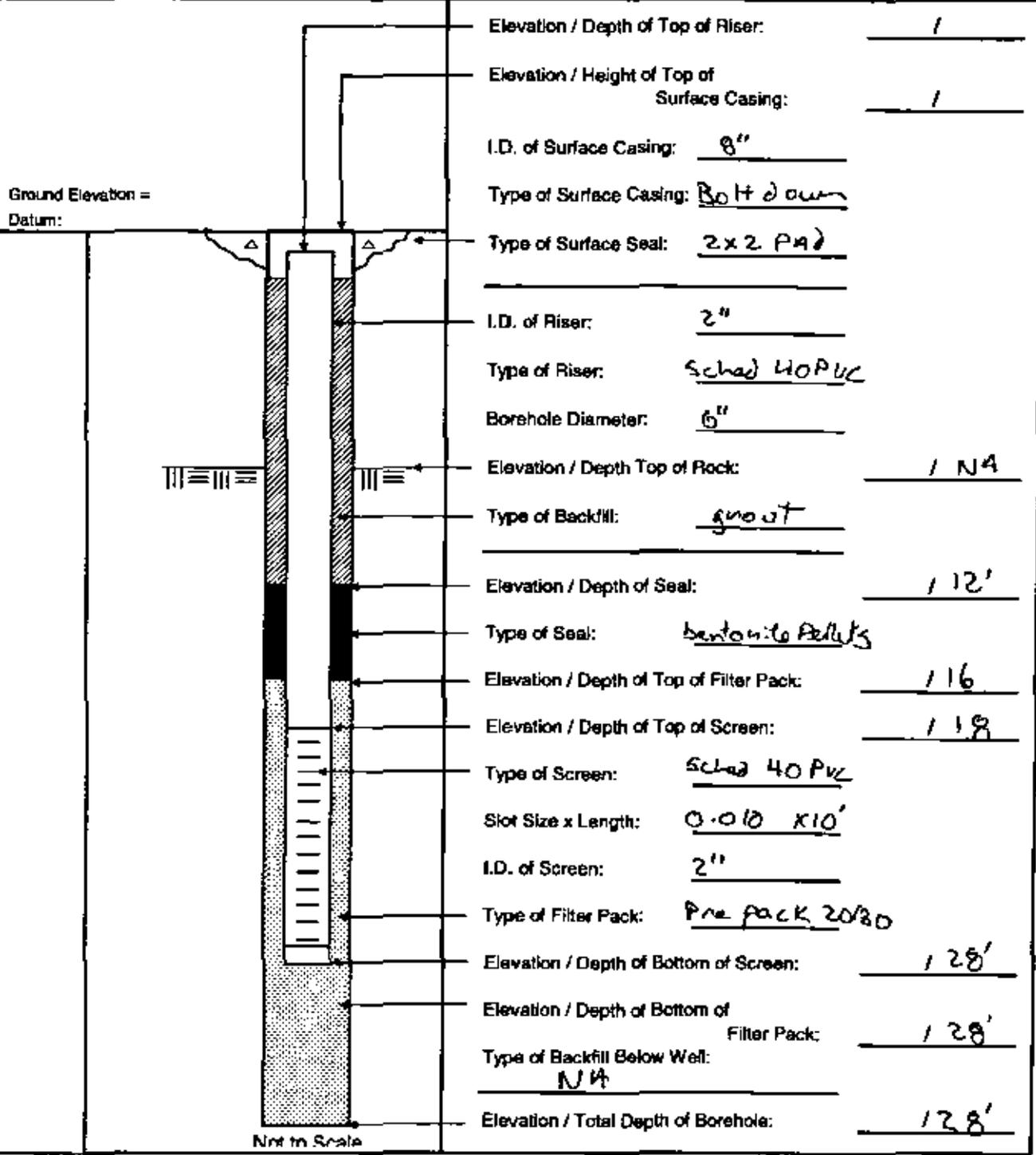
Tetra Tech NUS, Inc.

WELL No.:

OBMW02

MONITORING WELL SHEET

PROJECT: BACECA DRILLING Co.: RLY BORING No.: OBMW02
 PROJECT No.: 112600521 DRILLER: J. Blackwood DATE COMPLETED: 12-9-09
 SITE: OBAC P2 DRILLING METHOD: Sonic NORTHING: _____
 GEOLOGIST: W.D. Olson DEV. METHOD: Surge/Air EASTING: _____





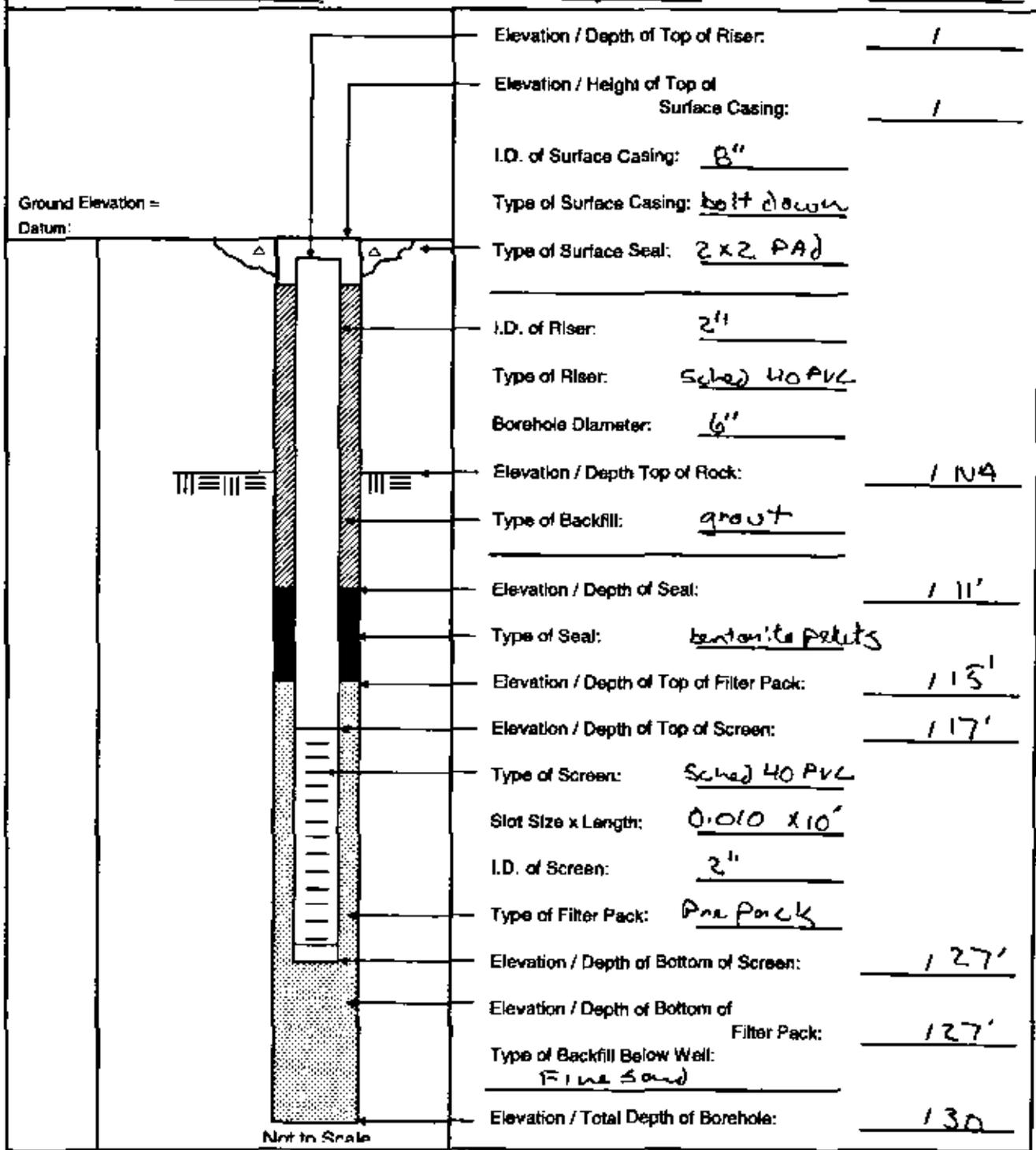
Tetra Tech NU5, Inc.

WELL No.:

08mw03

MONITORING WELL SHEET

PROJECT: 88/EECA DRILLING Co.: RLY BORING No.: 08mw03
 PROJECT No.: 1260052/ DRILLER: J. Blackwood DATE COMPLETED: _____
 SITE: GRAC P2 DRILLING METHOD: Sonic NORTHING: _____
 GEOLOGIST: W.D. O'Shea DEV. METHOD: Surge/Purge EASTING: _____



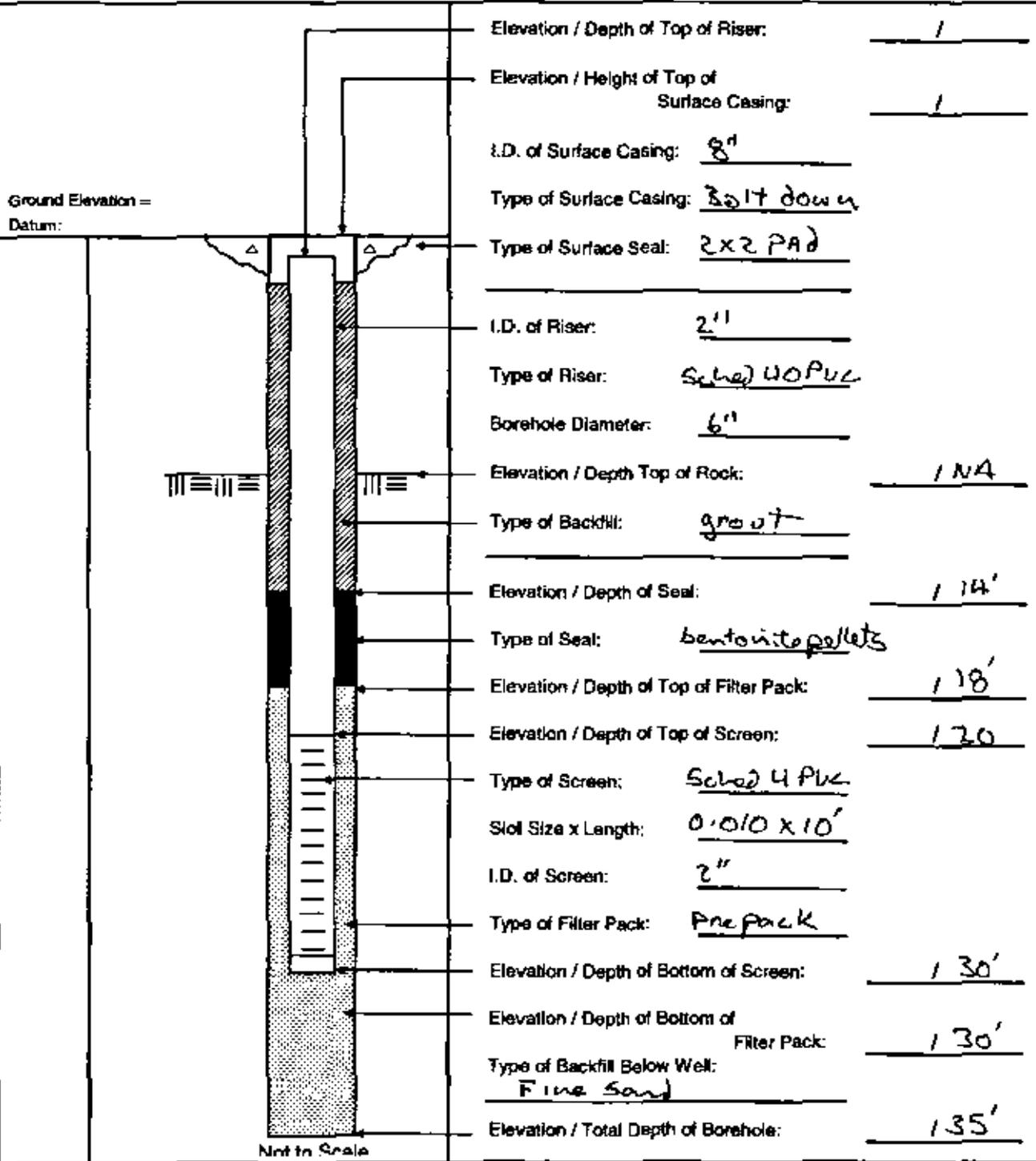


Tetra Tech NUS, Inc.

WELL No.: 08mw04

MONITORING WELL SHEET

PROJECT: GRK REC4 DRILLING Co.: BLV BORING No.: 08mw04
 PROJECT No.: 12600521 DRILLER: J. Blackwood DATE COMPLETED: _____
 SITE: OBAOC P2 DRILLING METHOD: Sonic NORTHING: _____
 GEOLOGIST: W.D. Olson DEV. METHOD: Surge/Pump EASTING: _____





BORING LOG

PROJECT NAME: _____
 PROJECT NUMBER: _____
 DRILLING COMPANY: _____
 DRILLING RIG: _____

1230521
 B/L
 SONIC SAK

BORING NUMBER: - MWOL
 DATE: 12-9-08
 GEOLOGIST: W.A. Olson
 DRILLER: J. Blackwood

Sample No. and Type or ROD	Depth (FL) or Run No.	Blows / or ROD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/FL) or Screened Interval	Soil Depth/ Consistency or Rock Hardness	Color	Material Classification	U S C S	Remarks	PID/FID Reading (ppm)			
										Sample	Sampler BZ	Borehole*	Driller BZ**
							DK brown FS			0	0	0	0
							TAN FS						
				wet 0.5'						0	0	0	0
							gray clayey sandy silt			0	0	0	0
							gray FS w/silt and clay and gray silt w/FS and clay			0	0	0	0
							gray clayey silt w/sand						
							gray FS w/silt grain to fine fine to med sand w/ wall and LPS zone						

25

* When rock coring, enter rock brokenness.
 ** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Remarks: Cased off to 10.5' w/ 7" casing

Drilling Area Background (ppm):

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



BORING LOG

PROJECT NAME: STAB BORING NUMBER: MUGL
 PROJECT NUMBER: (26 052) DATE: 12/98
 DRILLING COMPANY: B/L GEOLOGIST: W.A. Olson
 DRILLING RIG: SOUL SAX DRILLER: J. Rickwood

25
30
35

Sample No. and Type or ROD	Depth (Ft.) or Run No.	Blows / 5' or ROD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION			U S C S *	Remarks	PHOT Reading (ppm)									
					Soil Density / Consistency or Rock Hardness	Color	Material Classification			Sample	Sampler BZ	Scrubber	Driller BZ						
				X															
				TD															

* When rock coring, enter rock brokeness.
 ** include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.
 Remarks: _____ Drilling Area Background (ppm):
 Converted to Wall: Yes No Well I.D. #: _____



BORING LOG

PROJECT NAME: NRAC BORING NUMBER: M1004
 PROJECT NUMBER: 11260521 DATE: 12/10/13
 DRILLING COMPANY: B/L GEOLOGIST: W.D. Chan
 DRILLING RIG: Sonic DRILLER: T. Blockwood

Sample No. and Type or ROD	Depth (FL) or Run No.	Meters / ft or ROD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/FL) or Screened Interval	MATERIAL DESCRIPTION			U.S.C.S.	Remarks	MDFID Reading (ppm)									
					Soil Density/ Constatano T or Rock Hardness	Color	Material Classification			Sample	Sampler BZ	Borehole*	Driller BZ**						
	5																		
	10																		
	15																		
	20																		
	25																		
	30																		

* When rock coring, enter rock brokenness. white to green silt & silt to 35'
 ** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency @ elevated response read.
 Remarks: 7" casing to 5' Drilling Area Background (ppm):

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



GROUNDWATER SAMPLE LOG SHEET

Project Site Name: _____
 Project No.: _____

Domestic Well Data
 Monitoring Well Data
 Other Well Type: _____
 QA Sample Type: _____

Sample ID No. DB-M401-01
 Sample Location: M401
 Sampled By: C. Oam
 C.O.C. No.: _____
 Type of Sample:
 Low Concentration
 High Concentration

SAMPLING DATA:

Date: <u>12/11/08</u>	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	ORP (mV)	Other SW
Time: <u>1415</u>								
Method: <u>H/S</u>	<u>clear</u>	<u>6.50</u>	<u>0.266</u>	<u>20.09</u>	<u>221</u>	<u>0.08</u>	<u>-261.4</u>	<u>2.92</u>

PURGE DATA:

Date: <u>12/11/08</u>	Volume	pH	S.C.	Temp.	Turbidity	DO	ORP	Other	Time
Method: <u>low flow</u>	<u>95 KL</u>	<u>6.75</u>	<u>0.295</u>	<u>19.94</u>	<u>404</u>	<u>0.91</u>	<u>-252.3</u>	<u>2.73</u>	<u>1235</u>
Monitor Reading (ppm): <u>0 0</u>	<u>30</u>	<u>6.63</u>	<u>.282</u>	<u>20.20</u>	<u>375</u>	<u>0.12</u>	<u>-266.3</u>	<u>2.76</u>	<u>1255</u>
Well Casing Diameter & Material	<u>45</u>	<u>6.55</u>	<u>.271</u>	<u>20.06</u>	<u>271</u>	<u>0.10</u>	<u>-244.8</u>	<u>2.79</u>	<u>1325</u>
Type: <u>2.0" PVC</u>	<u>60</u>	<u>6.52</u>	<u>.269</u>	<u>20.10</u>	<u>234</u>	<u>0.08</u>	<u>-217.4</u>	<u>2.81</u>	<u>1355</u>
Total Well Depth (TD): <u>28.38</u>	<u>70</u>	<u>6.51</u>	<u>.268</u>	<u>20.10</u>	<u>226</u>	<u>0.08</u>	<u>-233.6</u>	<u>2.81</u>	<u>1405</u>
Static Water Level (WL): <u>2.59</u>	<u>80</u>	<u>6.50</u>	<u>.267</u>	<u>20.09</u>	<u>219</u>	<u>0.07</u>	<u>-256.1</u>	<u>2.82</u>	<u>1410</u>
One Casing Volume (gal): <u>50</u>	<u>50</u>	<u>6.50</u>	<u>.266</u>	<u>20.09</u>	<u>221</u>	<u>0.08</u>	<u>-261.4</u>	<u>2.82</u>	<u>1415</u>
Start Purge (hrs): <u>1155</u>									
End Purge (hrs): <u>1415</u>									
Total Purge Time (min):									
Total Vol. Purged (gal): <u>50</u>									

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
VOA	HCl	3 x 40ml vial	Yes
SVOC	-	2 x 1L Amber	Yes
Pest/PCB	-	2 x 1L Amber	Yes
Metals	-	2 x 1L Amber	Yes
metals	HNO3	1 x 500ml PE	Yes
Dioxin	-	2 x 1L Amber	Yes

OBSERVATIONS / NOTES:

1 well volume = 16 liters

Circle if Applicable:
 MS/MSD Duplicate ID No.:

Signature(s):
G Oam

GROUNDWATER SAMPLING LOG

SITE NAME: ECSP	SITE LOCATION: Kennedy Space Center
WELL NO: OBKOC MWO3	SAMPLE ID: ECSP-OBKOC301 DATE: 12/18/2008

PURGING DATA

WELL DIAMETER (Inches): 2 1/4	TUBING DIAMETER (Inches): 3/16	WELL SCREEN INTERVAL DEPTH: 5 feet to 7 feet	STATIC DEPTH TO WATER (feet): 1.75	PURGE PUMP TYPE OR BAKER: PERISTALTIC							
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) X WELL CAPACITY only fill out if applicable)				3.73 gal							
$= 12.5 \text{ feet} - 1.75 \text{ feet} \times 23.25 \text{ Gallons/foot} =$				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)	CUMUL. VOLUME PURGED (liters)	PURGE RATE (lpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (µS/cm)	DISSOLVED OXYGEN (mg/L)	TURBIDITY (NTU)	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	0.596	0.59	64.0	gray	25.1
070	2	5	400	7.71	5.64	20.15	0.435	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

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02, 1" = 0.04, 1.25" = 0.06, 2" = 0.18, 3" = 0.37, 4" = 0.65, 6" = 1.02, 8" = 1.47, 12" = 5.88
 TUBING INSIDE DIA. CAPACITY (Gal./ft.): 1/8" = 0.0008, 3/16" = 0.0014, 1/4" = 0.0026, 5/16" = 0.004, 3/8" = 0.006, 1/2" = 0.010, 5/8" = 0.018

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: ITRUS			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			DUPLICATE: Y N					
Filtration Equipment Type:			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		
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 = Baker, 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 62-100, 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: 08A0C mw04 SAMPLE ID: LCM-086W-0401 DATE: 12/18/2008

PURGING DATA

WELL 2 TUBING DIAMETER (inches): 3/16 WELL SCREEN INTERVAL 2-30 PURGE PUMP TYPE
 DEPTH: feet to TO WATER (feet): 2.16 OR BALLER: PERISTALTIC
 WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) X WELL CAPACITY
 only fill out if applicable)

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME * (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
 (only fill out if applicable) 4.155 gal

TIME	VOLUME PURGED (liters)	CLIMUL VOLUME PURGED (bars)	DEPTH TO WATER (feet)	DEPTH TO WATER (feet)	PURGE RATE (lpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (µS/cm)	DISSOLVED OXYGEN (mg/L)	TURBIDITY (NTU)	COLOR (discolor)	ORP (mv)
1130	0	0	2.15		400								
1150	2	2	3.11	6.80	400	2.10	2.10	0.287	0.15		> 1000	brn	-106.5
1210	2	4	3.26	6.69	400	2.17	2.17	0.277	0.12		> 1000	brn	-123.6
1230	2	6	3.31	6.68	400	2.36	2.36	0.271	0.08		71000	brn	-128.9
1250	2	8	3.70	6.65	400	2.53	2.53	0.267	0.06		71000	brn	-124.2
1310	2	10	3.30	6.62	400	2.61	2.61	0.263	0.05		71000	BRN	-140.0
1330	2	12	3.58	6.60	400	2.39	2.39	0.260	0.05		871	BRN	-139.5
1350	2	14	3.64	6.57	400	2.33	2.33	0.258	0.05		731	BRN	-140.0
1355	1/2	14 1/2	3.66	6.56	400	2.41	2.41	0.257	0.05		761	BRW	-137.4
1400	1/2	15	3.69	6.56	400	2.33	2.33	0.256	0.06		714	BRW	-139.4

WELL CAPACITY (Gallon 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.): $1.6" = 0.0006$; $3/16" = 0.0014$; $1/4" = 0.0029$; $3/16" = 0.004$; $1/2" = 0.008$; $5/8" = 0.016$; $3/4" = 0.024$

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION (TTNUS)	SAMPLER(S) SIGNATURE(S)	SAMPLING INITIATED AT:	SAMPLING ENDED AT:
		TUBING	
PUMP OR TUBING DEPTH IN WELL (feet):	SAMPLE PUMP (SM)	MATERIAL CODE: T	
FLOW RATE (ml per minute):	FIELD-FILTERED: Y N	Duplicate: Y N	
FIELD DECONTAMINATION: Y N	FILTRATION EQUIPMENT TYPE:		
SAMPLE PRESERVATION			
SAMPLE ID CODE	SAMPLE CONTAINER SPECIFICATION	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE
CONTAINER CODE	MATERIAL CODE		
VOLUME	PRESERVATIVE USED	FINAL PH	
3	HCL		SM
340ml	TOTAL VOL ADDED IN FIELD (ml)		

MATERIAL CODES: AG = Amber Glass, CD = Clear Glass, PE = Polyethylene, PP = Polypropylene, B = Silicone, T = Teflon, O = Other (Specify)

SAMPLING/PURGING EQUIPMENT CODES: APP = After Peristaltic Pump, B = Baller, BP = Backer Pump, ESP = Electric Submersible Pump, PP = Peristaltic Pump, RPP = Reverse Flow Peristaltic Pump, SH = Straw Method (Using Gravity Drain), VI = Vacuum Truck, Q = 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 RANGES OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
 pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: $\pm 5\%$ Dissolved Oxygen: all readings $\leq 20\%$ saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or $\pm 10\%$ (whichever is greater) Turbidity: all readings ≤ 20 NTU, optionally ± 5 NTU or $\pm 10\%$ (whichever is greater)

230.166
 2.16
 27.64
 12.78
 1.39
 W U K



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1 CLIENT: **T+205**

CONTACT: **Bill Olson** PHONE NO: **252 385 9899**

PROJECT: **CTO 49 Gulfport** SITE/PSID:

REPORTS TO: EMAIL:

INVOICE TO: QUOTE #:

P.O. #:

SGS Reference #: _____ page _____ of _____

#	CONTAINERS	SAMPLE TYPE C= COMP G= GPAB M= Mail I= Instrumental B= Samples	PRESERVATION USED	ANALYSIS REQUIRED	REMARKS/ LOC ID
	2	G		Dioxins/ Furans	
	2	G			
	2	G			

5 Collected/Relinquished By: (1) **W. Olson** Date: **12-22-08** Time: **1600**

Received By: _____ Date: _____ Time: _____

Relinquished By: (2) _____ Date: _____ Time: _____

Relinquished By: (3) _____ Date: _____ Time: _____

Relinquished By: (4) _____ Date: _____ Time: _____

Special Deliverable Requirements:

Requested Turnaround Time and/or Special Instructions:

DOD Project? YES NO
Cooler ID _____

Samples Received Cold? YES NO
Cooler TB _____

Temperature: _____

Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT

R-411131V

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:		Analysis Requirements:								Lab Use Only:							
Name <u>Bill Price</u>		Name <u>Environmental Corp</u>		TCL VOC	TCL SVOC	TCL PEST/PLB	HERBS	APPL IX	TAC Metals							VOA Headspace	Y	N	NA
Company <u>TWIS</u>		Company <u>Env</u>														Field Filtered	Y	N	NA
Address <u>1558 Village Sq Blvd - 2</u>		Address _____														Correct Containers	Y	N	NA
City <u>Tennessee</u>		City _____														Discrepancies	Y	N	NA
State, Zip <u>EC 32309</u>		State, Zip _____														Cust. Seals Intact	Y	N	NA
Phone <u>850 235-7809</u>		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													Comments	No. of Bottles	Lab Use Only Containers/Pres.
	12-18-08	OBGW030L	GW	3	2	2	2	1									10	
	12-18-08	OBGW040L	GW	3	2	2	2	1									10	
	12-18-08	QBTB1218	QA	1	2												2	

Sample Kit Prep'd by: (Signature)		Date/Time	Received By: (Signature)	REMARKS:	Details:	
Relinquished by: (Signature)		Date/Time	Received By: (Signature)		Page <u>1</u> of <u>1</u>	
Relinquished by: (Signature)		Date/Time	Received By: (Signature)		Cooler No. <u> </u> of <u> </u>	
Received for Laboratory by: (Signature)		Date/Time	Temperature		Date Shipped _____	
					Shipped By _____	
					Turnaround _____	

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



BORE LOG

PROJECT NAME: AB AOC BORING NUMBER: MW03
 PROJECT NUMBER: 1260521 DATE: 12-10-09
 DRILLING COMPANY: B/L GEOLOGIST: W.A. Olson
 DRILLING RIG: Sonic sander DRILLER: J. Blackwood

5
10
15
20
25
30

Sample No. and Type or ROD	Depth (FT) or Run No.	Blows / 6" or RQC (%)	Sample Recovery / Sample Length	Lithology Change (Depth) or Screened Interval	Soil Density / Compaction or Rock Hardness	Color	Material Classification	U S C S	Remarks	PROFID Reading (ppm)					
										Sample	Singular BZ	Boresole	Driller BZ		
							TAWS w/shell gray clays silt w/ fine sand								
							sander @ 15' gray silt, sand w/ clay 100521								
							gray sandy silt grades to gray silt								
							grades to green silt								

* When rock coring, enter rock brokenness. TD

- Include monitor reading in 8 foot intervals @ borehole. Increase reading frequency if elevated response read.

Remarks: _____

Drilling Area Background (ppm):

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