Data Summary Report: M-Area Western Sector Remediation Project

by

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Acronym List

cc	cubic centimeters
dia	diameter
ft	foot or feet
ft bls	feet below land surface
g/cc	grams per cubic centimeter
in.	inch(es)
mm	millimeter(s)
ng/g	nanograms of constituent per gram of bulk sediment
PCE	perchloroethylene; also known as tetrachloroethylene
ppbw	parts per billion-weight based
ppm	parts per million
TCE	trichloroethylene
SRS	Savannah River Site
WSRC	Westinghouse Savannah River Corporation

1.0 INTRODUCTION

M Area is located in the northern section of the Savannah River Site (SRS). The area includes facilities that fabricated reactor fuel and target assemblies for SRS reactors and a former settling basin which has been capped and closed under Resource Conservation and Recovery Act requirements. The M-Area western and southern portions outside the former fabrication facilities comprise undeveloped areas mainly covered by pine woods. A Carolina Bay is also located in the southern sector.

Past activities in M Area resulted in release of industrial cleaning solvents, primarily trichloroethylene (TCE) and perchloroethylene (PCE), to the subsurface. SRS has pursued an aggressive path toward environmental remediation of M-Area chlorinated solvents in both the saturated and vadose zones. M Area remediation actions include vadose zone vapor recovery, groundwater recovery (pump-and-treat) in the central A/M area, and in situ air-stripping/recirculation wells located along the 500 parts per billion (ppb) TCE isocontour in the southern sector (WSRC, 1996).

This investigation provides stratigraphic and constituent concentration data for the M-Area western sector in situ remedial system location and design.

2.0 FIELD ACTIVITIES

The investigation included field geologic logging of core and geophysical logging of completed coreholes from three (the two outer and central, WS-1, WS-3, and WS-5) of five surveyed western sector locations (Figure 1). These locations were selected by inferring the groundwater plume 500 ppb TCE isocontour. The two locations not drilled (WS-2 and WS-4), will be evaluated and their locations potentially refined for future subsurface characterization based on data provided by this investigation. Core samples were collected for head-space TCE and PCE analysis. Field activities began on January 26, 1998 and concluded on February 17, 1998. Field technical and health and safety oversight were provided by Savannah River Technology Center's Environmental Restoration Technologies Section. Field activities were performed under the guidance of Westinghouse Savannah River Company (WSRC) procedure 3Q5, Hydrogeologic Data Collection (U) (WSRC, 1997) and the Site-Specific Health and Safety Plan for Western Sector Soil Borings (WSRC, 1998).

Samples for head-space analysis were collected at approximately five-foot (ft) vertical intervals in the Water Table Aquifer/M-Area Aquifer Zone (i.e., above the bottom of the Warley Hill Formation, informally called the "Green Clay") and at approximately two-ft vertical intervals in the Lost Lake Aquifer (i.e. Congaree Formation and Four Mile Member of the Fishburne Formation). Exact sample locations were additionally determined by selecting the sand zones overlying clay zones at the interface of sand and silt/clay layers. These silt/clay layers varied in thickness from less than one centimeter to

over one meter. Constituent concentrations were anticipated to potentially be higher above lower-permeability zones than below. Coreholes were terminated upon encountering the Lang Syne Member of the Rhems Formation (also known as the Ellenton Formation). A detailed review of M-Area geology is presented in *Hydrogeologic Framework for the A/M Area (U)* (WSRC, 1995).

2.1 SOIL CORING

Drilling and coring were performed by Alliance Environmental, Inc., Aiken, South Carolina. Each of the three locations were drilled by mud-rotary method (6-inch (in.)-diameter (dia.) bit) to a depth of 125 ft below land surface (bls). Mud-rotary coring (94 millimeter (mm), double-tube wireline core) was performed from 125 ft bls to the top of the Lang Syne Member. Where possible, the uppermost five ft of the Lang Syne Member was obtained to verify the entire Lost Lake Aquifer had been sampled. Recovered cores were extruded into polyvinyl chloride troughs for immediate soil sample collection for head-space analysis, followed by lithologic description, and archiving. Bentonite based drilling fluid (or "mud") was used to maintain corehole integrity. Core recovery percentage was generally good to very good, often 100 percent. Summary illustrations of lithology, TCE, and PCE concentrations in regard to elevation for locations WS-1, WS-3, and WS-5 are presented in Figures 2, 3, and 4, respectively. Daily field activity logs are included as Appendix A. Field geologic logs are included as Appendix B.

The three locations were drilled in numerical order (WS-1, WS-3, and WS-5), from southeasternmost to northwesternmost. A synopsis of the geology and drilling encountered for each location follows.

Corehole WS-1

The survey stake for WS-1 indicated a location of N100807.95, E45843.97, elevation 354.29 ft. Straight drilling to a depth of 125 ft bls and initial coring and sampling from 125 ft bls took place on January 28, 1998. Coring was completed to a total depth of 242 ft bls on January 29, 1998. The "Green Clay"/Congaree Formation contact (Water Table/Lost Lake Aquifer delineation) was picked at a clay/sand contact at 160 ft bls. A gray, clay zone was identified from 180 to 199.5 ft bls. The clay zone caused slow, difficult drilling. One ft- to 1.5 ft-thick sands occur within the clay zone between 188 and 194 ft bls. This clay likely comprises the portion of the Fourmile Member of the Fishburne Formation which separates the Lost Lake Aquifer into the Upper and Lower Lost Lake Aquifers. The Lang Syne Member (bottom of the Lost Lake Aquifer) was identified at a sharp contact (overlying poorly sorted, coarse grained material underlain by a variegated clay) at 237 ft bls.

Corehole WS-3

The WS-3 survey stake indicated a location of N101415.39, E44739.51, elevation 372.86 ft (Note: this elevation is about 20 ft higher than locations WS-1 and WS-5, therefore

geologic formations were expected to be encountered at greater depths). Straight drilling to a depth of 125 ft bls took place on February 2, 1998. Coring and sampling were performed on February 5 and 6, 1998. Coring was completed to a total depth of 277 ft bls. The "Green Clay"/Congaree Contact (Water Table/Lost Lake Aquifer delineation) was picked at a clay/sand contact at 172.6 ft bls. The "Green Clay" in WS-3 was well defined compared to WS-1. The thick, gray clay portion of the Fourmile Member identified at WS-1 was not observed in WS-3 core. Three clay zones, each from 0.25 ft- to one-ft thick, were identified between 201 and 226 ft. One or more of these clays may be equivalent to the clay identified in WS-1. At WS-3, the Lost Lake Aquifer is not considered differentiated into Upper and Lower zones due to lack of a well developed clay portion of the Fourmile Member. The Lang Syne Member (bottom of the Lost Lake Aquifer) was picked at 270.5 ft bls, where a black, clayey silt/silty clay was encountered. The Lang Syne Member contact was expected even before the core was retrieved, due to sudden hard drilling and a darkening of the drilling mud.

Corehole WS-5

The WS-5 survey stake indicated a location of N102887.97, E44259.99, elevation 355.65 ft. Straight drilling to a depth of 125 ft bls was performed on February 9, 1998. Coring to a total depth of 249 ft bls and sampling were performed on February 10 and 11, 1998. Drilling mud circulation was lost at 247 ft bls. The "Green Clay"/Congaree contact (Water Table/Lost Lake Aquifer delineation) was picked at 162 ft bls, where a dark green (probably glauconitic) zone occurs. Although clay laminae were common to a depth of 224 ft bls, and a one-ft thick clayey zone with clay beds 1 to 1.5 in. thick occurred at a depth of 202.2 to 203.2 ft, no significant clay zone (such as at WS-1) was present. As with WS-3, the Lost Lake Aquifer is not considered differentiated into Upper and Lower zones due to lack of a well developed clay portion of the Four Mile Member. Drilling mud circulation loss precluded additional coring to define the exact depth of the Lang Syne Member (bottom of Lost Lake Aquifer). The Lang Syne Member is not considered to lie far below WS-5 total depth, probably within ten feet, based on correlation with existing data.

2.2 GEOPHYSICAL LOGGING

Each borehole was geophysically logged by Graves Environmental & Geotechnical Services, Inc. following completion to total depth. Geophysical log parameters included caliper (borehole diameter), natural gamma, and resistivity. Each geophysical log was compared to the field geological log to verify the presence of sandy and clayey horizons. Comparison was good for all three coreholes. Two observations are noted: 1) Even relatively thin clay layers yield a readily distinguishable increase in natural gamma measurement; and 2) The significant clay portion of the Fourmile Member did not yield as large a gamma signature as anticipated, though two clay peaks are present and the sandy zone observed within this clay is reflected by the dip between these two gamma peaks. Corehole geophysical logs are included as Appendix C.

2.3 SOIL SAMPLING

Depth discrete soil samples were collected for TCE and PCE analysis. Samples were collected at approximately five-ft vertical intervals in the Water Table Aquifer (from 125 ft bls to the bottom of the "Green Clay"), and at approximately two-ft vertical intervals in the Lost Lake Aquifer (bottom of the "Green Clay" to top of the Lang Syne Member). Additional samples were collected and/or exact sample collection points were determined by collecting samples from sandy zones overlying clay lenses where applicable. Soil samples were collected immediately upon recovered core extrusion. Soil sample date, time of collection, sample identification, depth, and description were recorded in a field log book. Copies of applicable pages of the sample log book are included in Appendix D.

Soil samples comprised approximately 2 to 3 cc of the groundwater-saturated bulk sediment. Samples were collected immediately upon core retrieval by first removing 5 to 10 mm of the core surface to assure drilling mud and corehole slough material were avoided, then pushing a clean 12-mm-dia. sample tube (a modified plastic syringe) into the core center. Sampling syringes were cleaned between samples by brushing and rinsing with isopropanol followed by a deionized water rinse.

Upon collection, depth discrete bulk sediment samples were immediately extruded into 22.5 cc borosilicate vials. Using a mechanized pipet, 5 cc of deionized water was added as a suspending solution, and each vial was sealed by crimping an aluminum cap around a Teflon®-lined butyl rubber septum. The sample was labeled and placed in a chilled ice chest for transport to an onsite analytical laboratory. At the laboratory, refrigerated storage was maintained until samples were analyzed (a one to six day period, typically one to three days). Prior to analysis, sample-containing vials were weighed. The amount of sediment in a given sample was determined by subtracting the average vial plus water weight (previously determined) from the vial plus water and soil weight. Each vial was analyzed using a Hewlett Packard (HP) 5890 Semes II gas chromatograph equipped with an electron capture detector, and flame ionization detector, an HP 19395 headspace sampler, and a 60 m. widebore capillary column coated with an intermediate-polarity silicone phase (Supelco, Vocol).

Flow and temperature conditions recommended by the manufacturers were used. The instrument was calibrated using vials containing water of known concentrations. The conditions in the vials (headspace volume, suspension volume, etc.) were standardized to maintain the proportionality between the sediment concentration and the headspace concentration. For example, a heated sample bath (70 degrees Celsius) maximizes transfer of volatile constituents into the headspace for analysis and standardizes volatile constituent transfer conditions. For each sample, a duplicate sample was obtained in case of sample breakage. Approximately 20 percent of the duplicate samples were analyzed as a quality assurance method of evaluating "same sample" variation (Appendix D). Unlike groundwater samples, soil is not a homogeneous matrix. Greater variability in soil sample duplicate analysis (than in water) is expected. Agreement between original samples and

sample duplicates is generally good, usually less than a 25 percent difference in concentrations is reported.

Analytical results are reported in units of nanograms of constituent per gram of bulk sediment (ng/g), or ppbw (parts per billion-weight based). Analytical results are summarized in Tables 1, 2, and 3, respectively. The field sampling log and duplicate analyses summary are presented in Appendix D. Note that the samples designations for WS-3 are mis-labeled as WS-2 in the sample log. These samples were analyzed using the WS-2 designation. The correction to WS-3 is made in this text.

Analytical Results Discussion

Highest concentrations for all three cores are reported from the Lost Lake Aquifer rather than the Water Table Aquifer. Soil sample maximum concentrations from core WS-1 (see Figure 2, Table 1) are lower than for cores WS-3 and WS-5. Maximum concentrations are in the range of 14 to 16 ppbw. Samples from the upper Lost Lake contain higher concentrations of PCE than TCE, while samples from the lower Lost Lake generally contain higher concentrations of TCE than PCE.

Groundwater concentrations can be approximated on a weight basis using soil concentrations. Assuming that 33 percent of a sample is groundwater-filled pore space, and a weight of 1 g/cc for water and 2.6 g/cc for soil (comprising 67 percent of a sample), the coefficient by which soil concentrations can be related to groundwater concentrations should be equal to the total weight-based concentration divided by the groundwater fraction of the total weight-based concentration, i.e.,

$$\text{coefficient} = \frac{0.33(1 \text{ g/cc}) + 0.67(2.6 \text{ g/cc})}{0.33(1 \text{ g/cc})} = 6.3$$

For example, a soil weight-based concentration of 10 ppbw should reflect about 60.3 ppbw for the groundwater in the soil sample. For core WS-1, this would indicate maximum groundwater concentrations in the range of 88 to 102 ppbw.

Soil samples from core WS-3 typically yielded TCE and PCE concentrations less than 10 ppbw. The maximum concentration, 63 ppbw PCE, is from a depth of 226 ft bls, in the vertically central portion of the Lost Lake Aquifer. The next highest concentrations, 39.7 and 42.5 ppbw, are from the lower portion of the Lost Lake Aquifer, at depths of 258 and 264 ft bls, respectively (Figure 3, Table 2). These three highest concentrations should be equivalent to approximate groundwater concentrations of 397, 250, and 268 ppbw, respectively. As previously mentioned, note that in the field sample log (Appendix D), samples from WS-3 are mis-labeled as WS-2 samples. The correction to WS-3 is made in this text.

Soil samples from core WS-5 yielded the highest TCE concentrations of the three cores (Figure 4, Table 3). PCE concentrations were very low compared to TCE for WS-5.

Maximum TCE concentration was 104.7 ppbw, for a depth of 180 ft bls. The three second highest TCE concentrations, 62.3, 56.8, and 53.9 ppbw, from depths of 178, 182, and 190 ft bls, are from vertically nearby samples, all of which are in the upper portion of the Lost Lake Aquifer. The next highest TCE concentrations are 31.4, 25.6, and 16.4 ppbw, from depths of 204, 220, and 210 ft bls, respectively. Samples from the lowermost portion of the Lost Lake exhibited relatively low (<5 ppbw) TCE concentrations. The highest WS-5 estimated groundwater-equivalent TCE concentrations are in the order of 200 to 660 ppbw.

2.4 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) comprises materials such as drilling mud, well development or purge water, and personal protective equipment which may entrain, absorb, or adsorb constituents of concern in exceedence of a given action limit. For this project, the constituents of concern are TCE and PCE. The primary potential IDW material anticipated was drilling mud. The action levels established for the project were 52 parts per million (ppm) for TCE and 12 ppm for PCE. Previous experience drilling in M Area indicated that the potential for drilling mud to exceed these concentrations was very low. The corehole locations were within the dissolved plume, but without vadose zone source, in areas not expected to have groundwater TCE or PCE concentrations exceeding 1 ppm.

To verify that IDW action levels were not exceeded, drilling mud samples were obtained for head-space analysis similar to soil samples. Drilling mud analyses indicated TCE concentrations below detection limits and PCE concentrations from 0.3 to 1.3 ppbw from locations WS-1 and WS-3, respectively. Due to lost circulation, no drilling mud was available for sampling from WS-5.

Additionally, field screening was performed by WSRC Environmental Restoration personnel using an RCLS 5000 Chlorinated Vapor Organic Analyzer. Chlorinated organic vapor measurements of 1 ppm are reported for WS-1 drilling mud and core for January 28, 1998. A low-battery warning is also reported for measurements this date. The following day, a series of measurements obtained from WS-1 drilling mud and core from 144 to 189 ft bls indicated no measurable chlorinated vapor concentrations. Field documentation for IDW and breathing zone chlorinated vapor measurements are included as Appendix E.

2.5 HEALTH AND SAFETY OVERSIGHT

The primary health and safety guidance document for the Western Sector Project was Site-Specific Health and Safety Plan for Western Sector Borings (Q-SHP-G-00037, Rev. 2, January 22, 1998; WSRC, 1998). The project health and safety pre-job briefing was conducted on January 26, 1998, by the project health and safety plan author/WSRC Environmental Restoration Department Occupational Safety and Health Coordinator. This briefing was attended by the primary project personnel, including project

management, drillers, the field health and safety officer/technical oversight, and the field sampler.

The investigation area's primary constituents of concern (TCE and PCE) are volatile organic compounds, chlorinated solvents, which begin to convert to a gas-phase upon contact with the atmosphere. At no time during drilling, geologic logging, or sampling activities were any chlorinated-solvent-like odors noted. Field screening for breathing-space chlorinated organic compound concentrations were performed to verify concentrations below action levels specified in the project health and safety plan. Breathing-space measurements were performed at the same time and using the same chlorinated organic vapor measurement device as for the IDW field screening. Breathing zone measurements of 1 ppm were obtained during WS-1 field activities on January 28, 1998 (the instrument also had a low battery indication on this date). The following day, breathing-space screening indicated readings of zero ppm. Of the three project drilling locations, WS-1 was considered to be in the area of the groundwater plume which should yield the highest chlorinated compound concentrations. WS-1 was therefore considered as representing the "worst case" location in terms of health and safety risk. Because such low breathing-space concentrations were obtained at WS-1, additional breathing-space measurements from WS-3 and WS-5 locations were not required. Breathing-space measurements are included in Appendix E.

3.0 SUMMARY

The delineation of a groundwater TCE and PCE plume isoconcentration line of approximately 500 ppm, and associated detailed geologic information is required to design a groundwater remedial system for Lost Lake Aquifer in the SRS M-Area western sector. Three coreholes located approximately along this isoconcentration line were drilled by mud rotary technique between January 26, and February 17, 1998. Soil samples were obtained at 5 ft vertical intervals from 125 ft (approximate top of the Water Table Aquifer) to the approximate top of the Lost Lake Aquifer. Samples were obtained at approximately 2 ft intervals throughout the Lost Lake Aquifer. Samples were also obtained at changes in lithology where sands overlay clays.

The lithology at the southeasternmost location, WS-1, includes a significant clay zone which separates the Lost Lake Aquifer into the Upper and Lower Lost Lake Aquifer zones. The two locations to the northwest, WS-3 and WS-5, did not exhibit this well-defined clay zone, thus the Lost Lake Aquifer in these locations cannot be as readily separated into identifiable Upper and Lower zones. This is consistent with the observed trend in aquitards becoming discontinuous and pinching-out and shallower aquifers coalescing toward the northwest. For example, there is a northerly disappearance of the "Green Clay" Confining Zone and coalescence of the Water Table or M-Area Aquifer with the Lost Lake Aquifer and Middle Sand Aquifer to form the Steed Pond Aquifer (see WSRC, 1995, et. Seq.) The Lost Lake Aquifer is identified between depths from approximately 160 to 173 ft bls to 237 to 271 ft bls in the M-Area western sector.

Analytical results indicate WS-1 location TCE and PCE soil concentrations are lower than the other two locations. Maximum WS-1 soil concentrations are in the range of 14 to 16 ppbw (approximately equivalent to 88 to 102 ppbw groundwater concentrations). For WS-1, PCE concentrations exceed TCE concentrations in the upper Lost Lake Aquifer, and TCE concentrations exceed PCE concentrations in the lower Lost Lake Aquifer.

Soil samples from core WS-3 typically yield TCE and PCE concentrations less than 10 ppbw. The maximum concentration, 63 ppbw PCE, is from a depth of 226 ft bls, in the vertically central portion of the Lost Lake Aquifer. The next highest concentrations, 39.7 and 42.5 ppbw, are from the lower portion of the Lost Lake Aquifer, at depths of 258 and 264 ft bls, respectively. These three highest concentrations should be equivalent to approximate groundwater concentrations of 397, 250, and 268 ppbw, respectively.

Soil samples from core WS-5 yield the highest TCE concentrations of the three cores. PCE concentrations were very low compared to TCE. Maximum TCE concentration was 104.7 ppbw, for a depth of 180 ft bls. The three second highest TCE concentrations, 62.3, 56.8, and 53.9 ppbw, from depths of 178, 182, and 190 ft bls, are from vertically nearby samples, all of which are in the upper portion of the Lost Lake Aquifer. The next highest TCE concentrations are 31.4, 16.4, and 25.6 ppbw, from depths of 204, 210, and 220 ft bls, respectively. Samples from the lowermost portion of the Lost Lake for WS-5 exhibited relatively low (<5 ppbw) TCE concentrations. The highest WS-5 estimated groundwater-equivalent TCE concentrations are in the order of 200 to 660 ppbw.

4.0 REFERENCES

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FIGURES

Figure 1. M-Area Western Sector Corehole Location Map

WS-1

Figure 2. WS-1 Lithology and Analytical Results

WS-3

Figure 3. WS-3 Lithology and Analytical Results

Figure 4. WS-5 Lithology and Analytical Results

TABLES

<u>WS-1</u>	Soil Concentration	
	TCE	PCE
Depth, ft	ppb, w/w wt. corr.	ppb, w/w wt. corr.
127	0.0	0.2
132	0.0	0.2
137	0.0	0.2
141	0.7	2.4
142	0.4	1.7
147	0.0	0.9
152	0.0	1.0
157	0.0	1.1
162	2.6	11.7
164	3.6	16.3
166	2.2	9.2
168	3.0	12.9
170	0.9	3.8
172	0.8	3.1
174	0.6	2.8
176.5	8.2	15.4
178	4.5	9.4
180	0.0	0.3
182	2.5	2.3
183	4.6	9.4
191.5	0.0	0.5
199.5	1.5	0.4
200	14.2	3.4
205	0.0	0.7
207	0.0	0.5
210	0.0	0.7
212	9.1	8.2
215	0.6	1.2
217	3.0	2.2
219	0.7	0.8
221	1.0	0.8
225	4.0	1.8
229	14.3	10.3
230	7.8	7.1
233	0.7	0.9
235	5.7	5.2
236	1.8	1.6
MUD	0.0	1.3

Table 1. WS-1 TCE and PCE Soil Concentrations

<u>WS-3</u>	Soil Concentration	
	TCE	PCE
Depth, ft	ppb, w/w wt. corr.	ppb, w/w wt. corr.
126	0.0	0.2
131	0.0	0.2
136	0.0	0.3
142	0.0	0.3
147	0.0	0.3
147	0.0	0.3
157	0.0	0.6
160	0.0	0.5
162	0.0	0.4
164	0.0	1.0
166	0.0	1.0
168	0.6	1.5
170	1.2	1.4
172	1.6	1.2
174	1.7	0.9
176	0.8	1.6
178	1.1	2.0
180	0.0	0.8
182	0.5	1.8
184	0.4	1.5
186	0.5	1.8
188	0.4	1.4
190	0.0	0.8
192	0.7	2.1
194	0.6	2.5
196	0.0	0.7
198	1.0	3.4
200	1.1	3.8
202	1.8	5.0
204	0.6	1.9
205	0.0	0.5
209	0.0	0.4
210	0.0	0.9

Table 2. WS-3 TCE and PCE Soil Concentrations

<u>WS-3</u>	Soil Concentration	
	TCE	PCE
Depth, ft	ppb, w/w wt. corr.	ppb, w/w wt. corr.
212	0.0	0.8
214	0.0	0.6
216	0.0	0.9
218	0.0	0.9
220	0.7	1.7
222	0.0	1.7
224	0.0	0.7
226	6.8	63.0
228	1.2	8.9
230	0.0	0.4
232	0.0	0.5
234	0.0	0.5
236	0.0	0.4
238	0.0	0.5
240	0.0	1.2
242	0.0	0.4
244	0.0	1.0
246	0.0	0.6
250	0.0	0.5
252	0.0	0.1
254	1.2	7.5
256	0.0	0.1
257.5	1.6	1.8
258	40.9	39.7
260	0.0	0.7
262	0.0	0.4
264	20.8	42.5
266	5.1	0.4
270	0.0	0.2
MUD	0.0	0.3

Table 2. WS-3 TCE and PCE Soil Concentrations (continued).

<u>WS-5</u>	Soil Concentration	
	TCE	PCE
Depth, ft	ppb, w/w wt. corr.	ppb, w/w wt. corr.
127	0.0	0.1
129	0.0	0.1
131	0.0	0.1
136	0.0	0.1
140	1.7	0.1
142	0.6	0.1
146	2.7	0.3
150	0.0	0.2
152	0.0	0.1
154	0.0	0.2
156	0.0	0.2
158	0.0	0.1
160	0.7	0.2
162	1.5	0.4
164	0.9	0.2
166	2.8	0.4
170	1.7	0.3
172	0.7	0.2
174	12.0	1.6
176	1.0	0.4
178	62.3	4.7
180	104.7	9.8
182	56.8	4.2
184	1.6	0.2
186	3.6	0.4
188	10.3	0.2
190	53.9	0.3
192	0.8	0.4
194	1.7	0.8
196	0.4	0.3
200	1.7	0.3
202	1.7	0.2
204	31.4	0.2
206	6.2	0.2
208	0.7	0.3
210	16.4	0.1

Table 3. WS-5 TCE and PCE Soil Concentrations

<u>WS-5</u>	Soil Concentration	
	TCE	PCE
Depth, ft	ppb, w/w wt. corr.	ppb, w/w wt. corr.
210	16.4	0.1
211	0.5	0.1
212	0.5	0.2
214	0.0	0.3
216	7.2	0.3
218	3.9	0.2
220	25.6	0.3
222	3.5	0.3
224	0.7	0.3
226	2.1	0.3
228	0.5	0.1
230	0.0	0.3
232	0.0	0.3
234	0.0	0.3
236	0.0	0.3
238	2.1	0.4
240	4.8	0.3
242	1.1	0.3
244	3.3	0.4
246	0.0	0.4

Table 3. WS-5 TCE and PCE Soil Concentrations (continued)

APPENDIX A

Daily Activities Logs

TECHNICAL OVERSIGHT SIGNATURE

DATE 1-26-98

DAILY ACTIVITIES REPORT

PROJECT <i>M Area Western Sector</i>		DRILLING SUBCONTRACTOR <i>Alliance</i>	
WELL NUMBER <i>CST WS-1 wsg</i>		DRILLER <i>Mike Coleman</i>	
TECHNICAL OVERSIGHT <i>WE Jones</i>		OVERSIGHT FIRM <i>SRTC</i>	
LOCATION <i>M Area West</i>		DATE <i>1-28-98</i>	PAGE <i>1 of 1</i>

START	STOP	DESCRIPTION OF ACTIVITIES; REMARKS
0800		Well Bldg. ^{Drillers} Helped Richard Mooney given H&S Briefing - ^{H&S} parts ok.
0830		Drillers at corehole #1 location setting up - moved drill location ~3 ft Southeast of stake labeled N100807.95. E45843.97 Elev 354.29 to area w/ less gravel thickness.
0935		R. White onsite - will update Claudette Hodgins re: need for extra jobbing water.
0945		RW departed site.
0955		Started drilling.
1030		D. Thomas onsite
1045		Drillers steam cleaning drill stem
1100		D.T. offsite
1210		T.D. 20 ft
1215		Added 2 nd 20 ft drill rod.
1230		T.D. 40 ft. Added 3 rd 20 ft rod. Drilling rate increased
1245		T.D. 60 ft. Added 4 th 20 ft rod. Rod chatter @ 50 ft
1305		T.D. 80 ft. Added 5 th 20 ft rod.
1322		T.D. 100 ft. Added 6 th 20 ft rod.
1330		T.D. 120 ft.
1338		Water truck offsite. Writer appointed Mike Coleman H&S Officer & departed site to make phone call. Phoned S. Baxley - J. Simmons just departed Area.
1360		Writer returned site. Drillers offsite
1403		Drillers returned site.
1445		Started coring. B. Van Pelt
1655		Drillers departed site. (SS departed site @ 1645) Writer departed site.

TECHNICAL OVERSIGHT SIGNATURE

*WE Jones*DATE *1-28-98*

START	STOP	DESCRIPTION OF ACTIVITIES; REMARKS
0800		Writer onsite
0815		Drillers onsite. Writer gave J. Hallman H ₂ S briefing
0830		Writer departed site for Well Building to check J.H.'s certs. Drillers working on rig's clutch.
0850		Writer returned site.
0900		Drillers conditioning mud for wiper run
0945		Wiper run completed. Drillers began tripping out.
1000		C. Bergren & C. Hopkins onsite for milk down. departed ~1015.
1043		Well logger onsite - Matt Rizer, rep. Graves
1350		Logging completed. M.R. & drillers departed site. Drillers agree to page writer if WS-1 is to be granted this date
1415		Writer departed site for Well Bldg.

TECHNICAL OVERSIGHT SIGNATURE

DATE 7-30-98

DAILY ACTIVITIES REPORT

PROJECT <i>M Area Western Sector</i>		DRILLING SUBCONTRACTOR <i>Alliance</i>	
WELL NUMBER <i>105-1 / Wh-3</i>		DRILLER <i>Mike Calaman</i>	
TECHNICAL OVERSIGHT <i>W E Jones</i>		OVERSIGHT FIRM <i>ERTC</i>	
LOCATION <i>M Area</i>		DATE <i>2-2-90</i>	PAGE <i>1 of 1</i>

START	STOP	DESCRIPTION OF ACTIVITIES; REMARKS
0800		Writer onsite, drillers onsite.
0830		Tennik pipe down hole - circulating mud in hole to 240 ft.
0840		D. Thomas onsite.
0856		D.T. departed site.
0920		Mixed 9 bags cement & bentonite powder grout weight 13.6 lbs second batch 13.8 lbs, 3rd batch 14.3 lbs → grout return @ surface
1030		Drilling moved to road. Drillers skid cleaning rods & rig up.
1100		Set up rig to drill @ ~3 ft west of stake for WS-3 N101415139 E44739.51 Elev 372.86
1130		Began drilling WS-3
1240		Kelly down T.D. 20 ft. Added 2nd drillrod.
1330		T.D. 40 ft. Gravel has plugged descender. My Tennik dropped off loc. (cut house)
1340		Added 3rd drillrod.
1350		T.D. 60 ft. Added 4th rod.
1408		T.D. 80 ft. Light rain began. 5th rod added.
1430		T.D. 100 ft. 6th rod added.
1446		T.D. 120 ft. Conditioning mud - circulating & adding bentonite.
1500		Tripping out of hole.
1510		Core bit attached & tripping back in hole.
1550		Drillers & writer departed site

TECHNICAL OVERSIGHT SIGNATURE

*W E Jones*DATE *2-2-90*

TECHNICAL OVERSIGHT SIGNATURE

W. B. Jones

DATE 2-5-98

TECHNICAL OVERSIGHT SIGNATURE

DATE 2-6-98

DAILY ACTIVITIES REPORT

PROJECT M Area Western Sector		DRILLING SUBCONTRACTOR Alliance	
WELL NUMBER WS-3 / WS-5		DRILLER Mike Coleman	
TECHNICAL OVERSIGHT WE Jones		OVERSIGHT FIRM SRTC	
LOCATION M Area		DATE 02-09-98	PAGE 1

START	STOP	DESCRIPTION OF ACTIVITIES; REMARKS
0800		Writer & drillers onsite
0915		Mixing grout & powdered bentonite. 8 bags cement wt. 13.2 lbs/gal
0942		2 nd grout mix 9 bags cement → 14.2 lbs/gal
1010		3 rd grout mix in tub - 9 bags → 14.7 lbs/gal
1020		Grout returns to surface
1050		Pulling tremie pipe.
1105		Derrick down. Preparing to mob. to WS-5 location. Writer temporarily off site for gas & trash bags.
1145		Writer returned site. Drillers steam cleaned drill rod.
1230		Drillers mob. to WS-5 location.
1330		C. Hopkins & J. Kuper stopped by site.
1355		C.H. & J.K. departed site.
1405		Water truck returned site - preparing to drill.
1415		Began drilling. J. Simmons stopped by site for about 20 min.
1442		Added rod - depth 20 ft.
1454		2 nd rod added - T.D. 40 ft.
1510		3 rd rod added - T.D. 60 ft.
1521		4 th rod added - T.D. 80 ft.
1527		Added bag of Quick Gel
1532		5 th rod added - T.D. 100 ft.
1538		Kelly down - T.D. 122 ft. Conditioning mud & hole.
1602		2 nd bag Quick Gel added.
1625		Drillers & writer departed site

TECHNICAL OVERSIGHT SIGNATURE

WE Jones

DATE

2-9-98

DAILY ACTIVITIES REPORT

PROJECT <i>M Area Western Sector</i>		DRILLING SUBCONTRACTOR <i>Alliance</i>	
WELL NUMBER <i>WS-5</i>		DRILLER <i>WE Jones</i>	
LOCATION <i>M Area</i>		OVERSIGHT FIRM <i>SRTC</i>	PAGE <i>1 of 1</i>
DATE	2-10-98		
START	STOP	DESCRIPTION OF ACTIVITIES; REMARKS	
0800		Waters on site. Driller took water truck to Well Bldg.	
0830		Drillers steam cleaning core bit & rod.	
0905		Circulating mud - will begin coring @ 125 ft. H&S discussion w/ drillers.	
0920		Bag Quik-Gel added to mud.	
0945		Began coring.	
1605		Water truck departed site. T.D. 209.	
1645		Waters & drillers departed site.

TECHNICAL OVERSIGHT SIGNATURE

W E Jones

DATE

2-10-98

DAILY ACTIVITIES REPORT

PROJECT <i>M Area Western Sector</i>		DRILLING SUBCONTRACTOR <i>Alliance</i>	
WELL NUMBER <i>WS-5</i>		DRILLER <i>Mike Coleman</i>	
TECHNICAL OVERSIGHT <i>WE Jones</i>		OVERSIGHT FIRM <i>SRTC</i>	
LOCATION <i>M Area</i>		DATE <i>2-11-98</i>	PAGE <i>1 of 1</i>

START	STOP	DESCRIPTION OF ACTIVITIES; REMARKS
0800		Writer, J. Simmons & drillers on site
0840		Rod back in hole. Conditioning mud & circulating in hole. H&S discussion w/ crew
0845		Added bag Quick Gel to mud.
0855		Dropped core barrel to 209 ft. & began coring.
1100		lost circulation., driller added 5 bags Gel & 600 gal. water. Tripped 809 ft rods out of hole.
1115		Water truck off site. Driller called J. Rinder
1125		J. S. off site
1150		Tanella Jamison on site. J. J. stated she contacted Bob Van Pelt & he said to log (geophysical) & grout hole.
1155		J. Rinder on site.
1225		Tripped remaining rods out. J. J. off site.
1300		Geophysical logging truck on site. J. R. departed site. Lt. rain.
1440		Logger & drillers departed site. Rain continues.
1445		Writer departed site.

TECHNICAL OVERSIGHT SIGNATURE

*W. Jones*DATE *2-11-98*

TECHNICAL OVERSIGHT SIGNATURE

DATE 2-12-98

DAILY ACTIVITIES REPORT

PROJECT 207 Area Western Bedos		DRILLING SUBCONTRACTOR Alliance	
		DRILLER Mike Coleman	
WELL NUMBER WS-5	TECHNICAL OVERSIGHT WE Jones	OVERSIGHT FIRM ZBTC	
LOCATION M Area		DATE 2-13-98	PAGE 1 of 1
START	STOP	DESCRIPTION OF ACTIVITIES; REMARKS	
0800		Water @ well Bldg. Driller filling water truck.	
0830		Water @ drillers on site.	
0845		Tremie pipe hard to push @ 120 ^{to 125} ft - hole may have collapsed below water table. Driller will go back in with core rod & reopen hole/reestablish circulation - then try to get to surface.	
0855		Tripped out tremie pipe (driller has total of 270 ft tremie. Tripping in drilling rod.	
0915		120 ft drill rod in hole. waiting for grout/bentonite to return.	
0945		Cement & gel load returns	
0950		mix 1 bag gel in mudpan - circulated @ 140 ft.	
0955		added rod - T.D. 140 ft; added rod - T.D. 160 ft; added rod - T.D. 180; added rod - T.D. 200; added rod - T.D. 220 ft; added rod - T.D. 240. - removed rod - T.D. 220	
		kelly down - grout returns ~ 225 ft. circulating mud.	
1038		Tripping out drill pipe.	
1045		Tripping in tremie pipe.	
1055		Tremie pipe T.D. 225 ft.	
1110		9 bag mix cement w/ bentonite - 13.4 lbs/gal.	
1120		6 bag cement mix w/ bentonite - 13.7 lbs/gal.	
1135		Removed 100 ft tremie. 6 bag mix cement	
1150		Drillers having pump difficulties. Grout w/ 13.3 lbs/gal	
1205		Pump working. Driller going around (mud w/ grout) returned to surface.	
1220		Tripping out tremie.	
1245		Drillers & writer departed site.	
WS Jones			

TECHNICAL OVERSIGHT SIGNATURE WS Jones DATE 2-13-98

DAILY ACTIVITIES REPORT

PROJECT <i>M Area Western Sector</i>		DRILLING SUBCONTRACTOR <i>Alliance</i>	
		DRILLER <i>Mike Corman</i>	
WELL NUMBER <i>WS-5</i>	TECHNICAL OVERSIGHT <i>WE Jones</i>	OVERSIGHT FIRM <i>3RTC</i>	
LOCATION <i>M Area</i>		DATE <i>2-16-98</i>	PAGE <i>181</i>
START	STOP	DESCRIPTION OF ACTIVITIES; REMARKS	
<i>0745</i>		<i>Writer onsite. Cold & raining.</i>	
<i>0800</i>		<i>Driller's onsite, ^{driller} tagged. WS-5 grant @ 44 ft bks. Driller's disconnected rig & loaded rig up. Took rig to shop @ 1100, to return for greasing later.</i>	
<i>1100</i>		<i>Writer & Driller's offsite.</i>	
<i>1300</i>		<i>Writer received call from driller - will top off wells to morrow due to rain. Writer requested they finish today - driller said his supervisor instructed him not to in rain.</i>	
<i>WS Jones</i>			

TECHNICAL OVERSIGHT SIGNATURE *WS Jones* DATE *2-16-98*

TECHNICAL OVERSIGHT SIGNATURE

DATE 2-17-98

APPENDIX B

Field Geologic Logs

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>1-28-98</i>	SHEET <i>1</i> OF <i>7</i>
WELL NO. <i>WS-1</i>		REFERENCE DATUM <i>344.29 Elev</i>	DRILLING CONTRACTOR <i>Alliance</i>
LOGGED BY <i>WE Jones</i>		SRP COORDINATES <i>E 45843.97 N 100907.95</i>	DRILLER <i>Mike Coleman</i>
		COMPANY <i>3RTC</i>	DRILLING METHOD <i>Mud Rotary</i>

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
	120				
	1				
	2				
	3				
	4				
	5				
1	6		100	Clay 100% gray & purple Sand (90%) w/ fine clay laminae (white) sand brownish 5YR 6/8; fr-med grained	
	7				sampled
	8				
	9			Silt (50%) Clay (5%) fine sand (5%) w/ mica brown tan 5YR 5/8	
	1300			Clay (20%) gray inter laminated w/ brown sand fine	
	1				
2	2		100	Sand (fnto crs) 80%; Clay & silt (20%) yl brn 5YR 6/8; poorly sorted becoming finer downward; no clay by 33 ft	sample
	3				
	4				
3	5			Sand (100%) fnto med w/ trace dark minerals & mica; white to yltan 5YR 8 to 5YR 7/8; med sorted	sample
	6				
	7				
	8				
	9				
4	140			Sand (80%) fnto crs silt & clay (20%) yellow tan 5YR 7/8 Clay 50% gray & brn silt (50%) to sand	

FIELD GEOLOGIC LOG

PROJECT		M Area Western Sector		DATE	1-28-96/1-29-98	SHEET	2 of 7
WELL NO.		WS-1		REFERENCE DATUM	354.29 elev		
LOGGED BY		WE Jones		SRP COORDINATES	N 100 807.95 E 458 43.97		
				COMPANY	SRTC		
				DRILLING CONTRACTOR	Alliance		
				DRILLER	Mike Coleman		
				DRILLING METHOD	Mud Rotary		

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
4	140	---	100		
	1	---		Sand fn to v fn (80%) silt & clay (20%) brn to y laminae 2mm to 1cm to 42.2 ft	sample @ 41
	2	---		Clay (50% to 70%) silt (30 to 40%) & (0-10%) cxs lt grn to rd brn 7.5 yr 7 to 7.5 yr 6/8 sand angular to subangular	sample @ 42
	3	---			
5	4	---	100	Clay brown, grn-green & white Sand (80-90%) silt & clay (10-20%) to mica fn to med w/occ cxs, yellow to brn 10 yr 88 to 7.5 yr 5 ft	
	5	---			
	6	---			sample @ 46.5
	7	---			
6	150	---	100	Sand (60-70%) v fine & silt & clay (30-40%) white to brn laminae, well sorted sand Sand (80-90%) v fine to fine silt & clay (10-20%) white to brn laminae 2mm to 1cm & thicker zones, same color as above; to mica silt & clay decreasing downward	
	1	---			
	2	---			sample @ 152
	3	---			
7	4	---		sand size increasing to fn-med w/ occ cxs	
	5	---			
	6	---		occ. glauconite	sample 157
	7	---			sample 157
8	160	---		Clay (90%) fn-med sand (10%) white & purple inter laminae 5 yr 8/19 10 R 3/6	End "green clay"?

FIELD GEOLOGIC LOG

PROJECT		M Area Western Sector		DATE	1-29-98	SHEET	3 of 7
WELL NO.		WJ-1		REFERENCE DATUM	354.29 Elev		
LOGGED BY		W.E. Jones		SRP COORDINATES	N100807.95		
				COMPANY	3RCL		
				DRILLING CONTRACTOR	Affiance		
				DRILLER	Ronald Coleman		
				DRILLING METHOD	Mud Rotary		

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
00	160		100	Sand (90%) fn-med w/occ. crs; variegated white to purple; zones 2-3 in w/crs sand abundant	
	1			Cly & silt (10%); well-med sorted	
	2				sample 162
	3			Sand (80-90%) fn-med w/occ. med; white & tr brn w/occ. purple Cly & silt (10-20%) laminae	
9	4		100	3-10 mm grading downward into thicker color zones 2+ cm; well-med sorted	sample 164
	5				
	6				
	7				sample 166
	8				
	9				
	10			Clay 100% gray w/ls brn laminae (thin) acc med-fn silt	sample 168.1
	170			Clay (50-70%) w/ls brn sand laminae v. sandy @ 170 fn tr brn	sample 170
10	1		100	Cly (100%) gry & yl brn	
	2			Sand (90%) fn gry & yl brn	sample 171.5
	3				
	4				
11	5		100	Cly 1/4 gry w/brn laminae	
	6			Sand fn-med white to orange brn tr clay	sample 174
	7			Cly (100%) gry 7.5 YR 7, tight	
	8				sample 176.5
	9				
	10				
	11				
	12				
12	180		90	Sand (90%) fn-v. fn w/white orng brn laminae silt (10%) 7.5 YR NB & 7.5 YR 6/B, well sorted	sample 178
				Cly (90-100%) gry w/acc. orng brn fn sand laminae	
				Sand (90-100%) fn-med white to orange brn laminae; tr drk minerals	sample 180

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>1-29-98</i>	SHEET <i>4</i> of <i>7</i>
WELL NO. <i>W4-1</i>		REFERENCE DATUM <i>354.29 Elev</i>	DRILLING CONTRACTOR <i>Alliance</i>
LOGGED BY <i>WE Jones</i>		SRP COORDINATES <i>N100807.95</i>	DRILLER <i>Mike Coleman</i>
		COMPANY <i>307C</i>	DRILLING METHOD <i>rod Rotary</i>

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
12	18 0		90	Clay (100%) gray, 5YR 7/1, w/occ 1-3mm laminae of Fe-cemented fn sand; zones of clay are splintery & semi-indurated	sample 180
	1				
	2				sample 182
	3				
13	4		80	as above - some zones very indurated	
	5				
	6				hard drilling no samples this run
	7				
14	19 0		70	Clay as above	hard drilling
	1				
	2			Sand (100%) fn, tan 5YR 7/4 well sorted	sample 191.5
	3			Clay (100%) gray, 5YR 7/1, w/stringers of med grained Fe cemented sand	
15	4		100	Clay gray as above - no stringers	hard drilling
	5			indurated sandstone cobble @ 194 ft	
	6			semi indurated clay zones; variegated purple & gray @ 194 ft	
	7				
16	20 0		70	sandy stringer @ 199.2 ft	
				gray & purple @ 199.2 ft	
				Sand (90%) fn - med - becoming coarse @ 199.7 ft; silty in upper portion	

FIELD GEOLOGIC LOG

PROJECT		DATE		SHEET	
m Area Western Sector		1-29-96		5 of 7	
WELL NO.		REFERENCE DATUM		DRILLING CONTRACTOR	
WH-1		354.29 Elev		Alliance	
LOGGED BY		SRP COORDINATES		DRILLER	
WE Jones		N 10807.95 E 45843.97		Mike Coleman	
		COMPANY		DRILLING METHOD	
		SRTC		Mud Rotary	

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
16	200			Sand (continued) gray 5YR 7/1 to orange brn 5YR 6/8; med-poorly sorted; ccs sand angular to subangular	
	1		20		
	2				
	3				
17	4			Clay gray & green 5YR 6/1 & 5Y 5/1	
	5			Sand (80-90%) fn-med; silt (10-20%) tan to orange brown, 5YR 8/4 to 5YR 7/4	sample @ 205
	6			Sand 100% fn-med, tan to orange brn, poorly sorted w/ common ccs sand	
	7		60	Clay brn & gry 5YR 5/4 & 5YR 7/1	sample @ 207 above clay
18	8				
	9				
	210		70	Clay gray as above, purple & drk brn occ laminar Sand (80%) silt (10%) orange brn 5YR 6/8 well sorted	sample @ 210
	1			Clay, white, & tan to drk brn sand inter laminated	
19	2			Clay (below sandy lens) lt gry w/ purple & brown laminae increasing downward	sample @ 212
	3			Sand fn-med, tan to orange brn w/ white clay stringers	
	4				
	5			Clay white to gray / sandy yellow brn laminae	sample @ 215
20	6		70	Sand (100%) med-ccs, tan 5YR 7/6, poorly sorted	sample @ 216 above clayey sand
	7			Clay grayish brn & drk brn laminae	
	8			Sand as above clay	
	9				
	220		40	Thin Clay @ 2 Aft gray Sand fn-med, tan 7.5YR 7/4 well sorted to mica & drk minerals; occ white clay stringers	sample @ 219 below thin clay

FIELD GEOLOGIC LOG

PROJECT		M Area Western Sector		DATE	1-29-98	SHEET	6 of 7
WELL NO.		WS-1		REFERENCE DATUM	354.29 Elev		
LOGGED BY		WE Jones		SRP COORDINATES	N100807.95 E45843.97		
				COMPANY	SRTC		
				DRILLING CONTRACTOR	Alliance		
				DRILLER	Mike Coleman		
				DRILLING METHOD	mud Rotary		

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
20	22.0				
	1			white sand clay ~ 1/4 in thick @ 22.1 ft	sampled @ 22.1 above clay
	2		40		
	3				
21	4				
	5			3' wet clay gray 7.5 YR N7	
	6			sand med-crs, tan 7.5 YR 8/2, poorly sorted	
	7			occ drk mineralized very coarse sand - coarse grained clay & ferruginous sand	sampled above clay 22.5 above clay
22	8		40		
	9				
	23.0			Clay gray 7.5 YR N7 sand (100%) med-crs	change to 3 ft run to improve recovery
	1		66	sand med-crs tan 7.5 YR 7/2, poorly sorted occ thin white clay stringers; mica	sampled above clay zone @ 23.0 & 23.1
23	2			sand v. fine brn 7.5 YR 6/6 well sorted rare white clay stringers	
	3		100	no recovery	
	4			sand fm med tan to gray 7.5 YR 7/2 to 7.5 YR N7 poor-med sorted; rare thin clay string	sampled @ 23.3
	5			becoming coarser downward; occ v. crs	sampled @ 23.5 & 23.6.5
24	6		100		
	7			poorly sorted, coarse-med grained & v. crs	
	8				
	9		100	Clay variegated white & purple in upper 1/2 ft (23.2-23.75) grading downward to lt brownish purple 10R 6/2; very finely laminated; occ fn sand-sized mica	El Estero Fm.
25	24.0			manganese-cemented cobble @ top (23.7 ft)	

PROJECT		DATE		SHEET	
MArea Western Sector		1-29-98		7 of 7	
		REFERENCE DATUM		DRILLING CONTRACTOR	
		354.29 Elev		Alliance	
WELL NO.		SRP COORDINATES		DRILLER	
WS-1		N100807.95 E45843.97		Mike Colomann	
LOGGED BY		COMPANY		DRILLING METHOD	
WE Jones		BRTC		Mud Rotary	

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
25	24 0	---		as above - gray-purple clay w/ common fn	no sample
		---		sand-sized mica	Ellenton Fm
	1	---			
	2	---			
	3	End Coring			
	4				
	5				
	6				
	7				
	8				
	9				
	25 0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	0				

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>2-5-90</i>	SHEET <i>1 of 8</i>
WELL NO. <i>WS-3</i>		REFERENCE DATUM <i>Elev. 372.86</i>	DRILLING CONTRACTOR <i>Alliance</i>
LOGGED BY <i>WE Jones</i>		SRP COORDINATES <i>N101415.59 E44739.51</i>	DRILLER <i>Mike Coleman</i>
		COMPANY <i>WSRC</i>	DRILLING METHOD <i>Mod Rotary</i>

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
	12 0				
	1				
	2				
	3				
	4				
	5	sterile core			
	6			Drk brn Fe cemented c/s sand cobbles @ top (125 ft)	
	7			Sand (70-80%) fn-css silt & clay (20-30%)	sample @ 126 ft
	8			tan yellow 10 YR 7/8 poorly sorted; trace mica	
1	9				
	10				
2	11			Sand fn-med color as above silt-clay content increased to 30-35% acc c/s sand	
	12				Sample @ 131 ft
	13			Sand (50%) fn-med w/css, Clay (50%) some white & dk gray clay laminae thin; yellow as above	
	14		80	Clay (60%) fn-med sand (10%) yellow as above	
	15				
	16				
3	17			Clay as above; becoming sandier downward @ 135.5	
	18				
	19			Sand (60-80%) fine silt & clay (20-40%) tan yellow as above; well sorted	sample @ 136 ft
	20		80	gray green laminae ~ 8 mm @ 137.5 ft	
	21			some brown-orange mottling @ 138 ft	
	22				
	23				
	24				
4	25			Clay yellow 10 YR 8/8 ~ 2 in thick	
	26		80	Sand (80%) fn-med clay & silt (20%) yellow 10 YR 8/8 mod-well sorted	

FIELD GEOLOGIC LOG

PROJECT		DATE		SHEET	
M Area Western Sector		2-5-98		2 of 8	
WELL NO.		REFERENCE DATUM		DRILLING CONTRACTOR	
WS-3		Elev. 372.86		Alliance	
LOGGED BY		SRP COORDINATES		DRILLER	
WE Jones		N101415.59 E44739.51		Mike Leman	
		COMPANY		DRILLING METHOD	
		WSRC		Mud Rotary	
RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
4	14 0			silty clayey sand as above	
	1				
	2		80	Sand (70-80%) fn-med occs y/bn to y/r w/b	
	3			silt & clay (20-30%) coarsening downward	
5	4			Sand (70%) coarse - v. ccs silt & clay (10%) y/tan	142.5 ft sample
	5			Clay variegated white & brown 7.5YR NB 7.5YR 6/8	
	6			Clay as above w/ ccs sand & mica	
	7		60	Sand (60%) fn-med reddish brown 7.5YR 6/8, clay silt (10%)	
6	8			Sand (60-70%) fn bn 5YR 5/6 w/ white 5YR 6/1 clay laminae; occ med sand; poorly sorted	Sample @ 146
	9				147 ft
	10			Clay (80%) y/tan fn sand (20%) v. initial @ 145	
	11		90	Sand (80-90%) fn-med red brown 5YR 6/8 occ dark minerals clay (10-20%) occ in fn white laminae	
7	12				
	13			Sand (50%) v. fn silt (50%) yellow brown 10YR 6/8	Sample @ 152 ft
	14			as above w/ zones of brown 5YR 5/6 & pale green clayey laminae from 1 cm to 1 mm thick	
	15		80	Clay (60%) sand (40%) fn-med y/tan to y/r 7/8	Sample @ 157 ft
8	16 0		100	Sand (70%) fn-med clay (30%) y/tan 10YR 7/8 med sorted	Sample @ 160

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>2-5-98</i>	SHEET <i>3 of 8</i>
WELL NO. <i>WS-3</i>		REFERENCE DATUM <i>Elev. 372.86</i>	DRILLING CONTRACTOR <i>Alliance</i>
LOGGED BY <i>WE Jones</i>		SRP COORDINATES <i>N 121 415.59 E 44739.51</i>	DRILLER <i>Mike Coleman</i>
		COMPANY <i>WSRC</i>	DRILLING METHOD <i>Mud Rotary</i>

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
8	160			as above, coarsening downward & becoming poorly sorted	sampled @ 165
	1				167
	2		100	Sand (60%) fine grs. Clay & silt (40%) brn 7.5YR 5/6 w/ small gray lenses poorly sorted	
	3			Sand (70%) fine grs. w/ lcs. Clay & silt (30%) y/bn 10YR 6/8 poorly sorted	sampled @ 168.5
9	4			occ c/s sand	
	5			grading downward into clay	
	6		100	Clay silty w/ tr fin sand greenish yellow 2.5Y 7/4 occ fns sand sized mica	
	7				
	8				
	9			brownish zone near 169 ft	
	10			interbedded brn red 5YR 4/6 zone @ 169.8 ft	
	11			brn/y/green beds 2-3 in thick	
10	170			fine sand content increasing downward	
	1			occ c/s brn/y/green laminar 5-15 mm	
	2		100	Tight gray green 2.5Y 7/2 clay	bottom gr. clay?
	3			Sand fin (70-80%) silt (20-30%) y/green tan 2.5Y 7/6	
11	4			occ mica	
	5			Sand (90-100%) fin interbedded H brn 10YR 6/8 to gray 10YR 8/6 mica common	
	6				
	7		100	Thin gray clay w/ 5cm sand cleaner than above	
	8				
12	180		100	Sand fin, well-sorted, orange to gray	
				occ mica	

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>2-5-98</i>	SHEET <i>4 of 8</i>
WELL NO. <i>WS-3</i>		REFERENCE DATUM <i>Elev. 372.86</i>	DRILLING CONTRACTOR <i>Alliance</i>
LOGGED BY <i>WE Jones</i>		SRP COORDINATES <i>N101415.59 E44739.51</i>	DRILLER <i>Mike Coleman</i>
		COMPANY <i>WSRL</i>	DRILLING METHOD <i>Mud Rotary</i>

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
12	18.0		100	as above	
	1			Fine brn/gray laminae	
	2			Sand fin-med w/lt csc (40-50%) silt	
	3			clay (10-20%) orange brn 7.5 YR 7/6 gray 10 YR 8/2 laminae ~3 mm med-poorly sorted	
13	4		100	Clayey zone #12.5 ft	
	5			Sand fin-csc inter laminated w/ clayey zones, very poorly sorted w/ brown & gray	
	6			Clay Sand fin-med (60-70%) Clay (30-40%)	
	7			variegated gray & orange brn as above	
14	8		100	Sand (80%) fin silt (20%) brn red to lt brn	
	9			5 YR 5/6 to 5 YR 6/6	
	10			Sand (90%) fin vlt brn to orange tan 7.5 YR 7/6 to 7.5 YR 6/6	
	11			well sorted	
15	12		100	color gray brn # 7.5 YR 7/4 w/ lt orange brn	
	13			laminae 7.5 YR 7/6	
	14				
	15				
16	16		80	occ thin white clay stringers	
	17				
	18				
	19			color orange - clay stringers increasing	

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>				DATE <i>2-5-98</i>	SHEET <i>54</i> of <i>8</i>
REFERENCE DATUM <i>Elev. 372.86</i>				DRILLING CONTRACTOR <i>Alliance</i>	
WELL NO. <i>WS-3</i>				SRP COORDINATES <i>N101415.59 E44739.51</i>	
LOGGED BY <i>WE Jones</i>				DRILLER <i>Mike Coleman</i>	
COMPANY <i>WSRC</i>				DRILLING METHOD <i>Mud Rotary</i>	

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
16	200			<i>as above</i>	
	1				
	2		80	<i>Clay gray 7.5% NR 8 interbedded w/ orange bn fn sand</i>	<i>sample @ 201 above clay zone.</i>
	3			<i>Sand (90-100%) fn w/ white clay laminae zones</i>	
17	4			<i>well sorted, oolitic</i>	
	5				
	6		30	<i>Sand as above</i>	
	7			<i>white clay</i>	<i>sampled above clay @ 205 ft</i>
18	8				
	9				
	210		66	<i>Sand fn w/ trace debris 11 horn - tan 10% R 7/8</i>	<i>sampled above clay laminae @ 209.5 & 210.5</i>
	1			<i>white clay laminae 2-3mm well sorted</i>	
19	2			<i>color darker 10% R w/ horn well sorted</i>	
	3			<i>Sand as above</i>	<i>sampled above clay laminae @ 212.5 ft</i>
	4		100	<i>white clay laminae @ 212.5 ft</i>	
	5				
20	6			<i>Sand as above - coarser st fn med sand</i>	
	7				
	8		100	<i>Sand (85-90%) fn med orange fn 7.5% R 7/8</i>	
	9			<i>med sorted, Qtz (10-15%)</i>	
21	220		75	<i>silt increased to 20%</i>	

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>2-5-98</i>	SHEET <i>6</i> of <i>8</i>
WELL NO. <i>WS-3</i>		REFERENCE DATUM <i>Elev. 372.86</i>	DRILLING CONTRACTOR <i>Alliance</i>
LOGGED BY <i>WE Jones</i>		SRP COORDINATES <i>N 101415.59 E 44739.51</i>	DRILLER <i>Mike Coleman</i>
		COMPANY <i>WSRL</i>	DRILLING METHOD <i>Mud Rotary</i>

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
21	220		75	sand as above	
	1				
22	2		100	sand as above clay laminar / cement	sand as above clay laminar @ 221
	3			silt decreased to 5-10%	
	4				
23	5		60	Sand (90%) fm brn 7.5R 3/8 well sorted	
	6			10% silt	
	7			Clay gray 7.5R N7 w/ red brn 2.5R 4/4 Fe cemented	
	8			fm sand	
	9			Sand fm (80-90%) silt & clay (10-20%) w/ brn 7.5R 7/8	
	10			purple red 7.5R 3/6 laminar @ 227 ft. sand	
	11			crasse in 226.6-227 interval	
24	230		100	Sand as above fm-mid poorly sorted	
	1			silt decreased to ~10%; fr det minerals	
	2			fr mica	
	3				
	4				
25	5			gray & orange brn sand laminar	
	6				
	7				
	8				
	9				
26	240			sand as above	

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>2-5-98/2-6-98</i>	SHEET <i>7 of 8</i>
WELL NO. <i>W3-3</i>		REFERENCE DATUM <i>Elev. 372.86</i>	DRILLING CONTRACTOR <i>Alliance</i>
LOGGED BY <i>WE Jones</i>		SRP COORDINATES <i>N101215.39 E44739.51</i>	DRILLER <i>Mike Coleman</i>
		COMPANY <i>WSRC</i>	DRILLING METHOD <i>Mod Rotary</i>

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
26	24 0		80	<i>sand as above</i>	
	1			<i>color darkens slightly to 7.5YR 6/8</i>	
	2				
	3				
27	4		60	<i>sand (90-95%) fm orange tan 7.5YR 7/6</i>	
	5			<i>well sorted, to dk min.</i>	
	6				
	7			<i>white clay stringer</i>	
28	25 0		100	<i>Claystone, gray 7.5YR N/6, ~1.5 in thick</i>	
	1			<i>Sand (50-60%) orange brn 7.5YR 6/8 fm med</i>	<i>sampled above</i>
	2			<i>med sorted, 4% mica; white clay stringer</i>	<i>clay stringer @ 252 ft</i>
	3				
29	4		100	<i>orange brn/tan brn color inter laminated ~2mm</i>	
	5			<i>occ white clay stringer</i>	<i>sampled @ 252 ft</i>
	6				<i>sampled @ 253.5 ft</i>
	7			<i>dk brn zone w/white clay stringers</i>	
30	8		100		
	9			<i>med dk brn zone @ 254.3 ~1-2 cm thick</i>	
	10				
	11			<i>white clay stringer</i>	
31	12		100	<i>dk brn indurated Fe cemented ~5-6 mm thick</i>	<i>sampled above Fe zone</i>
	13			<i>258.5-259 includes yellow clay ~1 inch thick</i>	<i>@ 257.5 & @ 258</i>
	14			<i>interbedded w/sand & gray clay ~1 in thick underlain</i>	
	15			<i>by inter laminated dk brown to purple & orange</i>	
32	26 0		80	<i>brown med sand, Fe staining & weakly indurated</i>	
				<i>sand similar to above 258 ft reappears @ 259</i>	

FIELD GEOLOGIC LOG

PROJECT	M Area Western Sector	DATE	2-6-98	SHEET	8 of 8
WELL NO.	WS-3	REFERENCE DATUM	Elev. 372.86		
LOGGED BY	WE Jones	SRP COORDINATES	N101415.59 E44739.51		
		COMPANY	WSRC		
		DRILLING CONTRACTOR	Alliance		
		DRILLER	Mike Calerman		
		DRILLING METHOD	Mud Rotary		

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
32	260			Sand (80-90%) 1/4 brn 7.5YR 7/4 fm-med	
	1		80	med sorted gray clays ~1cm thick @ 260.2	
	2			coarse sand-dk brn zone @ 260.8 ~ 2cm thick	
	3			white & red clay stringers from 260.8 to 261.6	
	4			Clay gray 7.5YR N/6 with thin (2mm) laminae of dk purple 7.5R 2.5/2 fm sand	Top of Ellenton?
33	5			Sand (70-80%) fm-med 1/4 tan w/purple & gray clay	
	6			Clay gray w/purple & dk brn to y/ brn sand	
	7		40	zones 1 inch to 1 mm thick	
	8			Sand fm y/ brn 5YR 5/6 w/ purple clay laminae	
	9			1mm	
34	270			Clay gray 7.5YR N/6 w/ purple laminae ~1mm	
	1		100	Sand (60-70%) fm-med well sorted gray to	harder drilling - change
	2			brn 5YR 7/1 to 5YR 7/6; clay laminae @ 270-271.5 in mud color - darker	sampled sand @ 270 ft
	3			Clay (50%) very silty (40-50%) with fm-med	Classic Ellenton fm.
	4			sandy zones dk gray to black 7.5YR N3/6 to	hard drilling
	5			7.5YR N/6 w/ fm to c.s. mica common; indurated	
	6			@ 271.5 ft; v. finely bedded	
	7				hard drilling contd.
	8			becoming sandier downward	
	9		150	grading downward into Sand (50-60%) fm-med	
	10			Clay & silt (40-50%) dark gray to gray 7.5YR 3/0	
	11			to 7.5YR 4/0	
	12			clay & silt content decreases downward to	
	13			10 to 30%	
	14				
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FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>2-10-96</i>	SHEET <i>1</i> of <i>7</i>
WELL NO. <i>WS-5</i>		REFERENCE DATUM <i>Elev. 355.65</i>	DRILLING CONTRACTOR <i>Alliance</i>
LOGGED BY <i>WE Jones</i>		SRP COORDINATES <i>N102887.97 E44259.99</i>	DRILLER <i>Mike Coleman</i>
		COMPANY <i>WSRC</i>	DRILLING METHOD <i>Mod Rotary</i>

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
	120				
	1				
	2				
	3				
	4				
	5	Begin Logging			
1	6			Clay (100%) gray 5YR 1 w/occ. glb. zones 10YR 6/4 brn zones silty to v. fine sand	sample @ 126 ft
	7		100	thin brn laminae @ above common	
	8				
	9			Sandy zone @ 128.6 - 128.8	sample in sandy zone @ 128 ft
	10			laminar decrease	
2	130			color to H. brn 5YR 7/4	
	1		100	Sand fine (70%) silt & clay (30%) H. red brn to y/bn 5YR 6/6 to 5YR 7/6, mod sorted, to mica	
	2			becoming fn-med grained & less silty & sandy	sample @ 132 ft
	3			occ. thin white laminae; occ. drk laminae (glauconite?)	
	4				
3	5			Clay (100%) H. brn 5YR 7/4	
	6		40	Sand fn-ess (60%-70%) silt & clay (30-40%) poorly sorted, tang. H. red brn & white inter laminae common 5YR 6/6 to 5YR 7/6	
	7			Sand (med-ess 90%) silt 10% y/bn 7.5YR 7/6 poorly sorted	
	8				
	9				
4	140			Sand, fn-med (80%) silt (15%) y/bn 5YR 5/6 mod-well sorted;	
				thin white & drk brn clay laminae @ 140 ft	

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>2-10-98</i>	SHEET <i>2</i> of <i>7</i>
REFERENCE DATUM <i>Elev. 355.65</i>		DRILLING CONTRACTOR <i>Alliance</i>	
WELL NO. <i>WS-5</i>	SRP COORDINATES <i>N102887.97 E44259.99</i>	DRILLER <i>Mike Coleman</i>	
LOGGED BY <i>WE Jones</i>	COMPANY <i>WSRC</i>	DRILLING METHOD <i>Mod Rotary</i>	

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
4	140			Sand (fn) as above	
	1			white clay stringer	
	2		95	Clay interlaminated dk brn 5YR 4/6 & white	sampled above clay
	3			Sand (fn) 90%, silt (10%) reddish yellow brn 5YR 4/6	
	4			well sorted; acc white & dk brn clay stringer	
	5			Clay (100%) dk brn 5YR 5/8 w/ white laminae 1-2 mm	sampled above clay
5	5			Sand fn lt brn 5YR 6/6	
	6			Clay interlaminated w/ fn sand dk brn & white	
	7		70	Clay (100%) interlaminated dk brn & white	
	8			Sand (fn med) (80%) silt & clay (20%) lt y brn 5YR 6/6	
	9			Clay (100%) dk brn w/ white laminae	sampled above clay
	10			Sand (80%) silt (20%) red brn 5YR 5/6 to	
	11			lt brn 5YR 7/3 fn, well sorted, acc white clay stringer	
	12			silt decreasing downward	
6	150			Sand as above	
	1		90	Clay dk brn w/ white laminae in upper 2 in	
	2			Sand (90-100%) fn orange yellow 7.5YR 7/8	
	3			well sorted	
	4			Clay interlaminated dk brn to lt brn 7.5YR 5/6 to 7.5YR 7/4	
	5			Sand (fn, 80-90%) silt (10-20%) y/brn 5YR 7/6	
	6			well sorted	
7	5			Clay brn 5YR 6/7	
	6		80	Sand (fn-med; 80-90%) silt & clay (10-20%) lt brn 7.5YR 6/6; med sorted, acc dk micas	
	7			Sand (70-80%) fn-med, clay (20-30%) w/ brn & white laminae	
	8			cohesive	
	9			Sand (80-90%) fn-med silt & clay (10-20%) med-	
	10			poorly sorted; dk brn to y/brn 7.5YR 6/6	
8	160			Sand as above	

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>2-10-98</i>	SHEET <i>3 of 7</i>
REFERENCE DATUM <i>Elev. 355.65</i>		DRILLING CONTRACTOR <i>Alliance</i>	
WELL NO. <i>WS-5</i>	SRP COORDINATES <i>N102887.97 E44259.99</i>	DRILLER <i>Mike Caliman</i>	
LOGGED BY <i>WE Jones</i>	COMPANY <i>WSRC</i>	DRILLING METHOD <i>Mod Rotary</i>	

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
8	160		80	Sand (fn-med, 70-90%) silt & clay (10-30%) yl brn 7.5 VR 7/8, mod sorted; occ white & gry clay laminae 1-3 mm thick	
	1			clay laminae	
	2			drk green (glauconitic?) zone 161.6 to 161.8 ft clay laminae	bottom Green clay?
	3				
9	4		40	Sand (60%) Clay & silt (40%) tan 7.5 VR 7/8 fn-crs poorly sorted	
	5			Sand (80%) fn-crs silt & clay (20%) drk brn 7.5 VR 1/4 ferruginous, poorly sorted	
	6			Sand (80-90%) fn-crs tan 7.5 VR 7/8	
	7			Sand as above w/ white & drk brn silt/clay laminae 1 mm	
10	170		100	Sand (fn-med, 70-80%) silt & clay (20-30%) 7.5 VR 1/8 y l brn	
	1			w/ white clay laminae 1-3 mm thick	
	2			Sand (90%) silt & clay (10%) fn-crs, poorly sorted, yl brn 7.5 VR 6/8; occ drk minerals	
	3			occ. tan clay laminae 1-3 mm; becoming fn- med grained downward & mod sorted	
11	4		100	Sand (90-100%) silt & clay (0-10%) fn-med, mod- well sorted, lt. gry brn 1 VR 6/4, occ drk minerals	
	5			white clay laminae 174.0-174.5 ft	
	6			sand becoming fn-crs & poorly sorted drk brown from 174-175.6 ft	
	7			pebbles 176.1 ft	
12	180		100	Sand becoming fn-med white & red brn laminae	
	1			Sand (fn-med) 80-90% Clay & silt (20-20%) inter laminated red brn & lt. brn	
	2			occ crs sand	
	3				

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>2-10-98</i>	SHEET <i>4 of 7</i>
REFERENCE DATUM <i>Elev. 355.65</i>		DRILLING CONTRACTOR <i>Alliance</i>	
WELL NO. <i>WS-5</i>	SRP COORDINATES <i>N102887.97 E44259.99</i>	DRILLER <i>Mike Coleman</i>	
LOGGED BY <i>WE Jones</i>	COMPANY <i>WSRC</i>	DRILLING METHOD <i>Mud Rotary</i>	

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
12	18 0		100	<i>sand as above</i>	
	1				
	2			<i>Sand (60-80%) silt & clay (20-40%) fn - ccs tan 10YR 6/8, poorly sorted, acc. pebble; white & brn clay zones</i>	
	3				
13	4		85	<i>Sand (60-80%) silt (10-30%) y/bn 7.5YR 6/4 to red brn 7.5YR 5/8 fn - med; well-med sorted, acc. brn clay laminae ~3mm, cc mica</i>	
	5				
	6			<i>Sand (90-100%) silt (0-10%) fn, well sorted, yellowish tan 10YR 7/6; tr. mica; tr. dk. mm. s.</i>	
	7			<i>Sand as above; white clay laminae 1-2mm thick</i>	
14	8		100		
	9				
	10				
	11				
15	12		66	<i>Sand (70-90%) silt & clay (10-30%), white to orange tan; clay in thick @ 19.5</i>	
	13			<i>foraminifera sand dk. brn, semi-indurated @ 19.8 to 19.1. fn - med</i>	
	14				
	15				
16	16		75	<i>Sand (90%) silt (10%) orange to y/bn, fn - med w/white clay laminae acc.</i>	
	17				
	18				
	19				
17	20		50	<i>Sand (80-90%) silt & clay (10-20%) fn well sorted brown 7.5YR 4/4 gray & brn clay laminae 3-8mm</i>	
	21				
	22				
	23				
18	24		100	<i>Sand (90%) silt (10%) fn - med, lt. brn 7.5YR 7/4 med-well sorted, w/white & brn clay laminae tr. mica</i>	
	25				
	26				
	27				
19	28		19	<i>sand as above but fine, well sorted</i>	
	29				

FIELD GEOLOGIC LOG

PROJECT <i>M Area Western Sector</i>		DATE <i>2-10-98</i>	SHEET <i>5 of 7</i>
WELL NO. <i>NS-5</i>		REFERENCE DATUM <i>Elev. 355.65</i>	DRILLING CONTRACTOR <i>Alliance</i>
LOGGED BY <i>WE Jones</i>		SRP COORDINATES <i>N 12887.97 E 4259.99</i>	DRILLER <i>Mike Coleman</i>
		COMPANY <i>WSRC</i>	DRILLING METHOD <i>Mud Rotary</i>

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
19	200			Clay laminae white	
	1		100		
	2			Clay laminae gray & brn 1-3 mm	
20	3			ferruginous sand @ 202-202.1	
	4		100	Clay (100%) interbedded w/ yellow brn silty fr sand	
	5			Clay light & gray, beds 1-1.5 m thick	
	6			Sand (90-100%) fr, Hitan 7.5YR 8/2 well sorted	
	7			occ. white clay stringer	
	8			sand becoming darker brown 7.5YR 7/6	
21	9			clay laminae 3-6 mm white	
	10		50	clay laminae 3-6 mm white	
	11				
	12				
22	13			Sand (90%) silty clay (10%) reddish brn 5YR 6/2	
	14		90	fr-med, med sorted, white clay laminae ~7 mm @ 209.3 ft	
	15			Sand (90-100%) silty (0-10%) fr-med, v. Hitan 7.5YR 8/2	
	16			fr. mica, white clay laminae	
	17				
	18			Sand as above	
23	19		100	Sand fr fr gray 7.5YR 8/10 under laminae	sampled above clay
	20			big white clay lumps ~1 cm thick	
	21			Sand (100%) fr-med Hitan 7.5YR 7/2 well sorted	
	22			Sand (100%) fr-crs, poorly sorted Hitan 7.5YR 7/2	
	23			white & brn clay laminae	
24	24			Sand (90-100%) silty clay (0-10%) Hitan 7.5YR 7/2	
	25		100	well sorted; white clay laminae in places	
	26			Sand (70-80%) clay (20-30%) orange 7.5YR 7/6 poorly sorted	
	27			gray clay laminae ~1 cm thick @ 216.5	
	28			Sand (90-100%) silty (0-10%) fr-crs Hitan to brn	
	29			7.5YR 7/6 to 7.5YR 5/6, poorly sorted; clay laminae occ.	
75	30		100	ferruginous brn 2B, 2-2B, 4	
	31			Sand (60-70%) clay (30-40%) fr-med orange	
	32			7.5YR 7/6 med - poorly sorted	
	229				

FIELD GEOLOGIC LOG

PROJECT		DATE		SHEET	
M Area Western Sector		2-10-98/2-11-98		6 of 7	
WELL NO.		REFERENCE DATUM		DRILLING CONTRACTOR	
WS-5		Elev. 355.65		Alliance	
LOGGED BY		SRP COORDINATES		DRILLER	
WE Jones		N102887.97 E44259.99		Mike Coleman	
		COMPANY		DRILLING METHOD	
		WSRC		Mud Rotary	
RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
25	22.0	---	100		
	1	---			
	2	---		color less orange-mudstone 7.5/R 7/4, clay silt decreasing downward	
	3	---		Sand (80-90%) silt (10-20%) orange brn 7.5/R 7/6 fr-med, acc brn & white laminae, acc dark mud cracks	
26	4	---	900	acc brn laminae	
	5	---		color to tn brn 7.5/R 7/4 w/ brn laminae	
	6	---		fr. mica, brn	
	7	---			
	8	---		clay silt content decreasing downward	
	9	---		color lightening to tan	
	10	---		color darkening to 7.5/R 7/6	
	11	---			
27	23.0	---	100		
	1	---		acc laminae color to brn, orange brn, & red brn	
	2	---		fr. mica	
	3	---		fr. mica	
28	4	---	75	Sand (100%) H. tan & brn 7.5/R 7/2 & 7.5/R 6/6 poorly sorted, semi-indurated	
	5	---	indurated zone above, w/ fissile chert-like material		
29	6	---	100	Sand (90-100%) silt (0-10%) fr-med, well sorted	
	7	---		fr to orange brn 7.5/R 7/2 to 7.5/R 7/6	
	8	---		group	
	9	---			
	10	---		Sand (80-90%) silt (10-20%) orange brn 7.5/R 7/6	
30	24.0	---	80	fr-med, med sorted	
		---		acc, white clay laminae	
		---		fine sand	

FIELD GEOLOGIC LOG

PROJECT		M Area Western Sector		DATE	2-11-98	SHEET	7 of 7
WELL NO.		WS-5		REFERENCE DATUM	Elev. 355.65		
LOGGED BY		WE Jones		SRP COORDINATES	N 102 887.97 E 44259.99		
				COMPANY	WSRC		
				DRILLING CONTRACTOR	Alliance		
				DRILLER	Mike Coleman		
				DRILLING METHOD	Mud Rotary		

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
31	240	1 1 1	80	Sand (fin) as above; sandy	
	1	1 1 1		occ. white clay stringers	
	2	1 1 1			
	3	1 1 1			
32	4	X	30		
	5	2 1 1		Sand as above	
	6	Fe 1		Sand (90%) 2 1/2 Cl (10%) brn 7.5/R 5/6 ft	
	7	Fe 1		fin brn 7.5/R 1/2 ft; fin-med; indurated; ferruginous	
	8	X		zones @ 245 & 246 ft; white clay laminae	
	9	X		@ 245.5 ft	Post-cementation
	10	X			247 ft
	11	X			
	12	X			
	250	T.D.			
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				

APPENDIX C

Geophysical Logs

GRAVES

ENVIRONMENTAL & GEOTECHNICAL SERVICES

MS-1

COMPANY	: ALLIANCE	OTHER SERVICES:	
WELL	: MS-1	-	
LOCATION/FIELD	: M-AREA WESTERN SECTOR		
COUNTY	: AIKEN		
STATE	: SC		
SECTION	:	TOWNSHIP	: - RANGE :
DATE	: 01/30/98	PERMANENT DATUM	: ELEVATIONS
DEPTH DRILLER	: 242	ELEV. PERM. DATUM:	: KB :
LOG BOTTOM	: 242.00	LOG MEASURED FROM:	: GL DF :
LOG TOP	: 0.00	DRL MEASURED FROM:	: GL : -
CASING DRILLER	: -	LOGGING UNIT	: 426
CASING TYPE	: -	FIELD OFFICE	: JACKSON, S.C
CASING THICKNESS:	-	RECORDED BY	: M. RIZER
BIT SIZE	: 5	BOREHOLE FLUID	: MUD/H2O FILE : PROCES
MAGNETIC DECL.	: -	RM	: TYPE : 9041A
MATRIX DENSITY	: -	RM TEMPERATURE	: LOG : 5
FLUID DENSITY	: -	MATRIX DELTA T	: - PLOT : 4444
NEUTRON MATRIX	: -	FLUID DELTA T	: - THRESH: 50000
REMARKS	:		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

0
10
20
30
40
50

50
60
70
80
90
100
110
120
130
140
150

GRAVES

ENVIRONMENTAL & GEOTECHNICAL SERVICES

WS-3

COMPANY : ALLIANCE
WELL : WS-3
LOCATION/FIELD : WESTERN SECTOR
COUNTY : AIKEN
STATE : SC
SECTION :

OTHER SERVICES:

-

TOWNSHIP

: -

RANGE :

DATE : 02/06/98 PERMANENT DATUM : ELEVATIONS
DEPTH DRILLER : 277' ELEV. PERM. DATUM: - KB :
LOG BOTTOM : 277.30 LOG MEASURED FROM: GL DF :
LOG TOP : 0.00 DRL MEASURED FROM: GL : -

CASING DRILLER : - LOGGING UNIT : 426
CASING TYPE : - FIELD OFFICE : JACKSON, S.C
CASING THICKNESS: - RECORDED BY : M. RIZER

BIT SIZE : 5 BOREHOLE FLUID : MUD/H2O FILE : PROCES
MAGNETIC DECL. : - RM : TYPE : 9041A
MATRIX DENSITY : - RM TEMPERATURE : LOG : 5
FLUID DENSITY : - MATRIX DELTA T : - PLOT : 4444
NEUTRON MATRIX : - FLUID DELTA T : - THRESH: 50000
REMARKS :

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

CALIPER		
4	INCH	14
SP		
-200	MU	200
GAM(NAT)		
0	API-GR	200

RES		
0	OHM	1600
RES(64N)		
0	OHM-M	3600
RES(16N)		
0	OHM-M	3600

GRAVES

ENVIRONMENTAL & GEOTECHNICAL SERVICES

WS-5

COMPANY : ALLIANCE
WELL : WS-5
LOCATION/FIELD : WESTERN SECTOR
COUNTY : AIKEN
STATE : SC
SECTION :

OTHER SERVICES:

-

TOWNSHIP :

RANGE :

DATE : 02/11/98 PERMANENT DATUM : ELEVATIONS
DEPTH DRILLER : 249' ELEV. PERM. DATUM: - KB :
LOG BOTTOM : 249.50 LOG MEASURED FROM: GL DF :
LOG TOP : 0.00 DRL MEASURED FROM: GL : -

CASING DRILLER : - LOGGING UNIT : 426
CASING TYPE : - FIELD OFFICE : JACKSON, S.C
CASING THICKNESS: - RECORDED BY : M. RIZER

BIT SIZE : 5 BOREHOLE FLUID : MUD/H2O FILE : PROCES
MAGNETIC DECL. : - RM : TYPE : 9041A
MATRIX DENSITY : - RM TEMPERATURE : LOG : 8
FLUID DENSITY : - MATRIX DELTA T : - PLOT : 4444
NEUTRON MATRIX : - FLUID DELTA T : - THRESH: 50000
REMARKS :

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

CALIPER		
4	INCH	14
SP		
-200	NU	200
GAM(NAT)		
0	API-GR	200

RES		
0	OHM	1600
RES(64N)		
0	OHM-M	3600
RES(16N)		
0	OHM-M	3600

0
10
20
30
40
50
60
70
80

0	API-GR	200
	GAM(NAT)	
-200	MU	200
	SP	
4	INCH	14
	CALIPER

0	OHM-M	3600
	RES(16N)	
0	OHM-M	3600
	RES(64N)	
0	OHM	1600
	RES	

APPENDIX D

Soil Sampling Field Log and Duplicate Analyses Comparison Summary

Date	Time	Sample I.D.	Depth	Description
1-28-98	1525	WS-101	127'	Silt/Fine Sand
	1540	WS-102	132'	Fine Sand/Silt
	1550	WS-103	137'	" " "
	1610	WS-104	141'	" " "
	1611	WS-105	142'	Fine Sand/Silt/clay
1-29-98	0930	WS-106	147'	Med Sand
	0945	WS-107	152'	Fine Sand/clay Tras
	1000	WS-108	157'	Fine Sand
	1010	WS-109	162'	Fine Sand/Silt
	1011	WS-110	164'	" " "
	1020	WS-111	166'	" " "
	1021	WS-112	168'	" " "
	1043	WS-113	170'	" " "
	1044	WS-114	172'	Fine Sand/Silt/clay
	1108	WS-115	174'	Fine Sand/Silt
	1109	WS-116	176.5'	Fine Sand/clay
	1110	WS-117	178'	Sample was Destroyed
	1128	WS-118	180'	Fine Sand/Silt
	1129	WS-119	182'	Sandy Clay
	1130	WS-120	183.5'	" "
	1150 ^{184'} 189'	NO Sample Taken - All Clay like		
	1215	WS-121	191.5'	Fine Sand
	1255 ^{194'} 199'	NO Sample Taken All clay sample		
	1310	WS-122	199.5'	med Sand/Silt
	1311	WS-123	200'	med Sand/clay sample was Destroyed
	1355	WS-124	205'	Fine Sand
	1356	WS-125	207'	" "
	1410	WS-126	210'	med Fine Sand
	1411	WS-127	212'	" " "
	1430	WS-128	215'	" " "
	1431	WS-129	217'	" " "

Date	Time	Sample I.D.	Depth	Description
1-30-98	1005	WS-1	Drilling mud	
	1401	WS-1-37	1001	
	1600	WS-1-34	1002	
	1544	WS-1-35	1003	
	1536	WS-1-34	1004	
	1535	WS-1-33	1005	
	1500	WS-1-32	1006	
	1450	WS-1-31	1007	
-29-98	1449	WS-1-30	1008	
			1009	Fine sand
			1010	" "
			1011	" "
			1012	Med Sand/clay
			1013	Fine sand
			1014	Med Fine Sand
			1015	" "
			1016	" "
			1017	" "
			1018	" "
			1019	" "
			1020	" "
			1021	" "
			1022	" "
			1023	" "
			1024	" "
			1025	" "
			1026	" "
			1027	" "
			1028	" "
			1029	" "
			1030	" "
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			1038	" "
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			1093	" "
			1094	" "
			1095	" "
			1096	" "
			1097	" "
			1098	" "
			1099	" "
			1100	" "

Date	Time	Sample I.D.	Depth	Description
2-5-98	0930	WS-2-01	126'	Med Sand/Silt
	0943	WS-2-02	131'	Med-Fine Sand/Silt
	0953	WS-2-03	136'	Fine Sand/Silt
	1010	WS-2-04	142'	Med Sand/Silt
	1025	WS-2-05	147'	Med-Fine Sand/Silt
	1100	WS-2-06	153'	" " " "
	1110	WS-2-07	157'	U. Fine Sand/Silt
	1118	WS-2-08	160'	Med Sand/Silt
	1119	WS-2-09	162'	" " "
	1130	WS-2-10	164'	Fine Sand/Silt
	1131	WS-2-11	166'	" " "
	1132	WS-2-12	168'	U. Fine Sand/Silt
	1155	WS-2-13	170'	Very Fine Sand/Silt
	1156	WS-2-14	172'	" " " "
	1208	WS-2-15	174'	" " " "
	1209	WS-2-16	176'	" " " "
	1210	WS-2-17	178'	" " " "
	1217	WS-2-18	180'	" " " "
	1218	WS-2-19	182'	Med Sand/Silt
	1225	WS-2-20	184'	U. Fine-Fine Sand/Silt
	1226	WS-2-21	186'	" " " "
	1227	WS-2-22	188'	" " " "
	1237	WS-2-23	190'	" " " "
	1238	WS-2-24	192'	" " " "
	1310	WS-2-25	194'	" " " "
	1311	WS-2-26	196'	" " " "
	1312	WS-2-27	198'	" " " "
	1319	WS-2-28	200'	" " " "
	1320	WS-2-29	202'	" " " "
	1335	WS-2-30	204'	Very Fine Sand/Silt
✓	1336	WS-2-31	205'	" " " "

Date	Time	Sample No.	Depth	Description
2-5-98	1415	WS-2-32	209'	Very Fine Sand/Silt
	1416	WS-2-33	210'	" " " "
	1424	WS-2-34	212'	" " " "
	1425	WS-2-35	214'	Fine Sand/Silt
	1433	WS-2-36	216'	" " " "
	1434	WS-2-37	218'	" " " "
	1442	WS-2-38	220'	" " " "
	1450	WS-2-39	222'	" " " "
	1500	WS-2-40	224'	Fine Sand
	1501	WS-2-41	226'	Very Fine Sand/Silt
	1502	WS-2-42	228'	Destroyed Fine Sand
	1540	WS-2-43	230'	Fine Sand
	1541	WS-2-44	232'	" "
	1555	WS-2-45	234'	" "
	1556	WS-2-46	236'	" "
	1557	WS-2-47	238'	" "
	1605	WS-2-48	240'	" "
	1606	WS-2-49	242'	" "
	1624	WS-2-50	244'	" "
	1625	WS-2-51	246'	" "
2-6-98	0910	WS-2-52	250'	" "
	0922	WS-2-53	252'	" "
	0923	WS-2-54	254'	Fine Sand/Silt
	0932	WS-2-55	256'	Fine Sand
	0942	WS-2-56	258 1/2'	Fine Sand/Silt
	0943	WS-2-57	258'	" " "
	0959	WS-2-58	260'	Fine-Med Sand
	1000	WS-2-59	262'	" " "
	1015	WS-2-60	264'	Fine Sand/Silt/Clay
	1016	WS-2-61	266'	" " " "
	1200	WS-2-62	270'	Very Fine Sand/Silt/Clay
	1315	WS-2	Drilling Mud	

Date Time Sample I.D. Depth Description

2-10-98

2-9-98

0950	WS-5-01	127'	Fine Sand/Silt/clay
0951	WS-5-02	129'	" " " "
1010	WS-5-03	131'	" " " "
1035	WS-5-04	136'	Med Sand
1050	WS-5-05	140'	Fine Sand/Silt
1051	WS-5-06	142'	" " "
1100	WS-5-07	146'	Fine Sand/Silt/clay
1115	WS-5-08	150'	" " " "
1116	WS-5-09	152'	" " " "
1126	WS-5-10	154'	Med Sand
1127	WS-5-11	156'	Fine-Med Sand/Silt
1128	WS-5-12	158'	" " " "
1138	WS-5-13	160'	" " " "
1139	WS-5-14	162'	" " " "
1149	WS-5-15	164'	Med Sand/Silt
1150	WS-5-16	166'	" " "
1234	WS-5-17	170'	Med Sand
1235	WS-5-18	172'	" "
1300	WS-5-19	174'	Med Sand/Silt
1301	WS-5-20	176'	" " "
1302	WS-5-21	178'	" " "
1314	WS-5-22	180'	" " "
1315	WS-5-23	182'	" " "
1334	WS-5-24	184'	Med-Fine Sand
1335	WS-5-25	186'	Fine Sand
1400	WS-5-26	188'	Fine Sand/Silt/clay
1430	WS-5-27	190'	" " " "
1438	WS-5-28	192'	" " " "
1445	WS-5-29	194'	Med-Fine Sand
1500	WS-5-30	196'	Fine Sand
1535	WS-5-31	200'	" "
1536	WS-5-32	202'	" "

Samples mark with wrong Date

Date Time Sample ID Depth Description

2-10-98	1544	WS-5-33	204'	Fine sand/silt
2-11-98	1545	WS-5-34	206'	Fine sand/silt
2-11-98	1546	WS-5-35	208'	Fine sand/silt
2-11-98	0910	WS-5-36	210'	V. fine sand
0930	0930	WS-5-37	211'	"
0931	0931	WS-5-38	212'	med-fine sand
0930	0930	WS-5-39	214'	"
0931	0931	WS-5-40	216'	med-fine sand/silt
0940	0940	WS-5-41	218'	"
0941	0941	WS-5-42	220'	"
0942	0942	WS-5-43	222'	"
0953	0953	WS-5-44	224'	Fine sand
0954	0954	WS-5-45	226'	Fine sand/silt
0955	0955	WS-5-46	228'	Fine sand
1018	1018	WS-5-47	230'	"
1019	1019	WS-5-48	232'	"
1030	1030	WS-5-49	234'	"
1040	1040	WS-5-50	236'	Fine sand/silt
1041	1041	WS-5-51	238'	"
1048	1048	WS-5-52	240'	"
1049	1049	WS-5-53	242'	"
1050	1050	WS-5-54	244'	"
1059	1059	WS-5-55	246'	"
No Recovery 248'				

Sample/Duplicate Comparison					
Soil Concentration					
	Depth, ft	TCE ppb, w/w		PCE ppb, w/w	
		Original	Duplicate	Original	Duplicate
WS-1	142	0.4	0.3	1.7	1.2
	147	0.0	0.0	0.9	0.6
	164	3.6	2.1	16.3	6.7
	168	3.0	2.8	12.9	14.4
	183.5	4.6	4.8	9.4	12.4
	191.5	0.0	0.0	0.5	0.3
	221	1.0	1.4	0.8	0.6
	229	14.3	14.3	10.3	8.7
WS-3	147	0.0	0.0	0.3	0.3
	168	0.6	0.5	1.5	1.2
	178	1.1	**	2.0	**
	186	0.5	0.3	1.8	1.2
	194	0.6	0.4	2.5	1.7
	202	1.8	1.5	5.0	3.7
	205	0.0	0.0	0.5	0.4
	226	6.8	3.9	63.0	52.7
	236	0.0	0.0	0.4	0.2
	250	0.0	0.0	0.5	0.1
	258	40.9	41.5	39.7	35.4
	262	0.0	0.0	0.4	0.3
WS-5	264	20.8	16.3	42.5	33.8
	140	1.7	2.5	0.1	0.1
	150	0.0	0.0	0.2	0.1
	162	1.5	1.0	0.4	0.2
	180	104.7	78.8	9.8	4.2
	184	1.6	0.8	0.2	0.1
	194	1.7	1.8	0.8	0.2
	204	31.4	9.2	0.2	0.2
	208	0.7	0.4	0.3	0.2
	220	25.6	21.7	0.3	0.1
	238	2.1	1.5	0.4	0.2
	244	3.3	2.2	0.4	0.1

** - Malfunction on sample injection

APPENDIX E

Atmospheric Monitoring/Investigation Derived Waste Field Screening Log

ENGINEERING COMPUTATION SHEET

Title of Project Western Sector characterization
Subject MON. for VOCs in breathing zone & drilling
mud and core Computer _____

Project No. _____
Works _____
Date 1/28/98 Sheet No. 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Time: 14:15; Temp ~ 50°F, sunny, winds ~10-15 mph
Location: WSE-1
Monitoring up wind of drill rig and Water Truck using Chlorinated
Vapor Organic Analyzer RLS-5000 owned by SRS - ESS.
Low battery message @ 14:50 reading of 1.0 ppm
down wind of Truck and Rig 14:55 - 1.0 ppm
Readings of drilling activities inside at depth of 125 ft
125 ft interval: 14:58
Breathing zone (BZ): 1.0 ppm
drill mud: 1.0 ppm
Sample core: 1.0 ppm
Problem with unit turning off due to low battery; well recharge
tonight.
Offsite 15:30

Bob Van Fleet