

JAN 24 2003

FILE COPY

**INTERIM GROUNDWATER
MONITORING REPORT**

Hattiesburg, Mississippi

PREPARED FOR:

Hercules, Incorporated

JANUARY 2003

Prepared by:

Eco-Systems, Inc.

Consultants, Engineers, and Scientists

439 Katherine Drive, Suite 2A

Jackson, Mississippi 39232

(601) 936-4440

Jackson, MS · Houston, TX · Mobile, AL

TABLE OF CONTENTS

1.0 INTRODUCTION.....	1
2.0 FIELD ACTIVITIES.....	3
2.1 PROTOCOL SAMPLING	3
2.2 GROUNDWATER MONITORING	3
2.3 GROUNDWATER ELEVATIONS	4
3.0 LABORATORY ANALYTICAL RESULTS.....	5
3.1 PROTOCOL SAMPLING	5
3.2 GROUNDWATER MONITORING	5
4.0 FINDINGS AND CONCLUSIONS.....	7
5.0 RECOMMENDATIONS.....	8

TABLES

TABLE 1	SUMMARY OF GROUNDWATER ELEVATION DATA
TABLE 2	SUMMARY OF PROTOCOL SAMPLING ANALYTICAL RESULTS
TABLE 3	SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

FIGURES

FIGURE 1	SITE LOCATION MAP
FIGURE 2	POTENTIOMETRIC SURFACE MAP

APPENDICES

APPENDIX A	ANALYTICAL PROTOCOLS
APPENDIX B	BORING LOGS AND WELL CONSTRUCTION DIAGRAMS
APPENDIX C	SAMPLE COLLECTION LOGS
APPENDIX D	LABORATORY ANALYTICAL REPORTS

1.0 INTRODUCTION

Eco-Systems, Inc (Eco-Systems) has been retained by Hercules, Incorporated (Hercules) to conduct site investigations at the Hercules plant in Hattiesburg, Mississippi. The site location is shown on Figure 1. This report is an interim report on progress to date in conducting site investigations in accordance with *Hercules' Site Investigation Work Plan* (Eco-Systems, February 1999) and additional comments of the Mississippi Department of Environmental Quality (MDEQ) approval letter dated April 5, 1999. In addition, the locations of MW-8 and MW-9 were changed in accordance with the MDEQ approval on February 1, 2000 based on information contained in Eco-Systems' submittal on December 27, 1999.

The work described in the approved work plan centered on efforts to determine whether the pesticide Dioxathion was present in site soil and groundwater. The work plan included installation of 5 additional groundwater monitoring wells, MW-7, MW-8, MW-9, MW-10, and MW-11, to provide groundwater quality information near the former Dioxathion production area and near former wastewater sludge pits. The work also included installation of 14 temporary piezometers and 4 staff gauges. The piezometers and staff gauges were installed to provide hydrogeologic information in the uppermost saturated interval and to establish the relationship, if any, of the uppermost saturated interval to Green's Creek. Monitoring well and piezometer locations are shown on Figure 2. The staff gauges have been washed out, or otherwise destroyed, between the time of their installation and the present.

Installation of the temporary piezometers was conducted in April/May 1999. Installation of monitoring wells was conducted in February 2000. However, prior to sampling the additional monitoring wells, questions arose regarding analytical methods for Dioxathion and the quality of Dioxathion for use as a laboratory standard. In the ensuing months, Hercules, in conjunction with MDEQ's consultant, Mississippi State University (MSU) developed analytical protocols for soil and groundwater (Appendix A). Since the quality of available analytical standards was questionable, Hercules contracted with Sigma Aldrich to synthesize Dioxathion standards. In August 2002 Dioxathion had been manufactured of a suitable quality to be used as laboratory standard, and Hercules and the MDEQ had agreed to a laboratory protocol. In October 2002, groundwater samples were collected from four wells (MW-1, MW-4, MW-5, and MW-6), and those samples were analyzed by Bonner Analytical and Testing Company (BATCO) and the Mississippi State Chemical Laboratory (MSCL) to test the newly established laboratory protocol. Comparison of the results from the two laboratories was deemed acceptable by MDEQ and the site investigation was resumed.

On December 4 and 5, 2002, groundwater samples were collected from the eleven site monitoring wells, and those samples analyzed for Dioxathion. At the request of the MDEQ, samples from the wells installed in 2000 (MW-7 through MW-11) were also analyzed for volatile organic compounds (VOC) and semi-volatile organic compounds

(SVOC). Due to the extended time required to implement all phases of the work plan and the number of alterations to the original work plan that have occurred, periodic documentation of investigative efforts at the site was deemed appropriate. Boring logs and well construction diagrams for the additional monitoring wells and the temporary piezometers were provided to the MDEQ in a letter report dated August 28, 2002 and are also included in Appendix B. This *Interim Groundwater Monitoring* report has been prepared to document the results of the analytical protocol sample analysis and advise the MDEQ of the results of the groundwater monitoring conducted in December 2002.

2.0 FIELD ACTIVITIES

Groundwater sample collection was conducted in accordance with the work plan and the EPA Region IV's Standard Operating Procedures and Quality Assurance Manual (November 2001). Groundwater samples were collected using a peristaltic pump and Teflon® tubing. Low flow/low stress sampling techniques were utilized for wells where there was sufficient recharge. If there was insufficient recharge for low flow/low stress sampling techniques to be utilized, traditional volume-based sampling techniques were used. Copies of the sample collection logs for both the protocol sampling and the groundwater monitoring are included in Appendix C.

Groundwater samples were collected directly from the discharge tubing into containers provided by BATCO. A BATCO representative was on site during sample collection and samples to be analyzed by BATCO were delivered directly to the BATCO site representative. Samples to be analyzed by the MSCL were placed in an iced cooler and shipped via overnight courier. Chain-of-custody documentation was maintained for all samples collected.

2.1 PROTOCOL SAMPLING

Groundwater samples were collected to evaluate the Dioxathion analytical protocol on October 14, 2002 from monitoring wells MW-1, MW-4, and MW-5. Quality assurance/quality control (QA/QC) samples were also collected. The QA/QC samples included a rinsate blank, a matrix spike and a matrix spike duplicate sample. All samples were analyzed for Dioxathion by both BATCO and MSCL. At the request of the MDEQ, samples were also collected from monitoring wells MW-5 and MW-6 for VOC and SVOC analyses. Samples submitted for VOC and SVOC analysis were analyzed by BATCO. Representatives of the MDEQ were on site during protocol sample collection but did not elect to split samples.

2.2 GROUNDWATER MONITORING

On December 4 and 5, 2002, Eco-Systems collected groundwater samples from the eleven groundwater monitoring wells at the site. As with the protocol sampling, QA/QC samples were also collected and include rinsate blank, trip blank, blind duplicate, matrix spike and matrix spike duplicate samples. At the request of the MDEQ, the sample collected from MW-4 was analyzed for VOCs and samples collected from monitoring wells MW-7, MW-8, MW-9, MW-10 and MW-11 were analyzed for VOCs and SVOCs. Samples were delivered to the BATCO site representative for analysis. Representatives of the MDEQ were on site December 4, 2002 and collected a split sample from monitoring well MW-11.

2.3 GROUNDWATER ELEVATIONS

Water level information was collected from the existing monitoring wells and piezometers on December 4, 2002. As mentioned in Section 1.0, staff gauges installed in Green's Creek in 1999 have been destroyed. Depth to water measurements were subtracted from well casing elevations to determine groundwater elevations. Groundwater elevations are summarized in Table 1. A potentiometric surface map based on the December 4, 2002 groundwater elevations has been prepared and is included as Figure 2.

Groundwater in the uppermost, saturated interval beneath the site tends to mimic surface topography. In the active portions of the plant operations, which are located in the southeastern portion of the site, the potentiometric surface indicates the presence of a southwest to northeastward trending divide. The potentiometric surface map indicates that groundwater northwest of the divide would tend to move northwestward towards Green's Creek. Likewise, groundwater southeast of the divide would tend to move southeastward. On the north side of Green's Creek, the potentiometric surface indicates that groundwater in the uppermost, saturated interval moves generally southward towards Green's Creek.

3.0 LABORATORY ANALYTICAL RESULTS

Samples were analyzed for Dioxathion according to the analytical protocol established by Hercules and approved by the MDEQ. Samples submitted for VOC and SVOC analysis were analyzed according to U.S. EPA SW-846 methods 8260 and 8270, respectively, for the target compound list (TCL) compounds. Analytical data for detected parameters are summarized in Table 2 and Table 3. Copies of the analytical reports are included in Appendix D.

The following sections are intended to provide a brief overview of the laboratory analytical results, and not an exhaustive discussion of the analytical data.

3.1 PROTOCOL SAMPLING

Samples collected for evaluation of the Dioxathion protocol were analyzed for cis-Dioxathion, trans-Dioxathion, and Dioxenethion. Analysis of the protocol samples by MSCL was conducted by both high performance liquid chromatography/mass spectrometry (HPLC/MS) methods and ultraviolet (HPLC/UV) methods. Analysis of the protocol samples by BATCO was conducted by Gas Chromatography/Mass Spectrometry (GC/MS). The results of the Dioxathion analyses are shown in Table 2.

VOCs and SVOCs were not detected in the groundwater samples collected from MW-5 and MW-6.

3.2 GROUNDWATER MONITORING

Samples collected during the groundwater monitoring event were analyzed using GC/MS methods by BATCO. Concentrations of cis-Dioxathion were detected in the groundwater samples collected from monitoring wells MW-4 and MW-9. Concentrations of trans-Dioxathion were detected in the groundwater sample collected from monitoring well MW-8. Concentrations of total Dioxathion (i.e. the sum of the concentrations of cis-Dioxathion and trans-Dioxathion) above the target remediation goal (TRG) of 54.8 were not detected in the groundwater samples collected from the site. The TRGs are found in the Tier 1 Target Remedial Goal Table of the Final Regulations Governing Brownfields Voluntary Cleanup And Redevelopment In Mississippi, published by the Mississippi Commission on Environmental Quality and adopted May 1999 and revised March 2002.

Concentrations of Dioxenethion were detected in the groundwater samples collected from monitoring wells MW-4, MW-6, MW-7, MW-8, MW-9, and MW-11. There is not a TRG for Dioxenethion.

Neither Dioxathion isomers nor Dioxenethion were detected in the groundwater samples collected from MW-1, MW-2, MW-3, MW-5, and MW-10.

Eight VOCs were detected in the groundwater sample collected from MW-4. Four of the eight VOCs, benzene, carbon tetrachloride, chloroethane, and chloromethane were detected at concentrations exceeding their respective TRGs.

Twenty-eight VOCs were detected in the groundwater sample collected from MW-8. Fourteen of the 28 VOCs were detected at concentrations above their respective TRGs.

Three VOCs were detected in the groundwater sample collected from MW-9. One of the three VOCs detected in the sample collected from MW-9 was above its TRG.

Two VOCs were detected in the groundwater sample collected from MW-11. One of the two VOCs detected in the groundwater sample collected from MW-11 was above the applicable TRG.

VOCs were not detected in the groundwater samples collected from monitoring wells MW-7 and MW-10.

One SVOC was detected in the groundwater sample collected from MW-8 at a concentration less than its TRG. SVOC were not detected in the groundwater samples collected from MW-7, MW-9, MW-10, and MW-11.

4.0 FINDINGS AND CONCLUSIONS

The findings and conclusions of this report are based on, or reasonably ascertainable from, published information, field observations, and the results of specific laboratory analyses.

- Groundwater beneath the site tends to mimic surface topography. In the active portions of the plant operations, the potentiometric surface indicates the presence of a southwest to northeast trending divide. Groundwater northwest of the divide would tend to move northwestward towards Green's Creek. Groundwater southeast of the divide would tend to move southeastward. North of Green's Creek, the potentiometric surface indicates that groundwater in the uppermost saturated interval moves generally southward towards Green's Creek.
- Dioxathion isomers, Dioxenethion, VOCs and SVOCs were not detected in the groundwater samples collected from monitoring well MW-5. Monitoring well MW-5 is located immediately downgradient of the landfill. The analytical results for the samples collected from monitoring well MW-5 do not indicate that Dioxathion isomers, Dioxenethion, VOCs and/or SVOCs are migrating from the landfill via groundwater in the uppermost saturated interval.
- Concentrations of Dioxathion isomers were detected in samples collected from MW-4, MW-8 and MW-9 at concentrations less than the TRG. Monitoring well MW-8 is located northwestward of the former Dioxathion production area. Monitoring well MW-11 is located southward, and downgradient, of the wastewater sludge pits. Concentrations of Dioxenethion were detected in the groundwater samples collected from MW-4, MW-6, MW-7, MW-8, MW-9, and MW-11. There is no TRG for Dioxenethion.
- Concentrations of VOCs above their respective TRGs were detected in groundwater samples collected from MW-4, MW-8, and MW-9. Monitoring well MW-4 is located southward, and downgradient, of the wastewater sludge pits. As stated above, monitoring well MW-8 is located northwestward of the former Dioxathion production area. Monitoring well MW-9 is located eastward of the former Dioxathion production area.

5.0 RECOMMENDATIONS

Based on the information obtained during the completed portions of the site investigation Eco-Systems recommends the following:

- Groundwater samples should be collected from monitoring wells MW-4, MW-8, MW-9, and MW-11 to confirm the presence and concentrations of VOCs. These confirmation samples are scheduled to be collected on February 11, 2003.

Pending review and approval of MDEQ, Eco-Systems recommends the following:

- Staff gauges should be re-installed in Green's Creek to provide necessary information to evaluate the relationship, if any, between the uppermost saturated interval and Green's Creek.
- Schedule technical discussion between Hercules/BATCO and MDEQ/MSCL to consider raising the method detection limit for Dioxathion from 1 ppb to 10 ppb.
- Proceed with the completion of Hercules' Site Investigation Work Plan (Eco-Systems, February 1999) with the following modifications:
 - Field observations and topography will be used to establish the boundaries of the landfill instead of excavating test pits.
 - Schedule technical discussion between Hercules and MDEQ to define the objectives of the geophysical investigation that has been requested by MDEQ.
- Surface water samples should be collected from the staff gauge locations along Green's Creek to evaluate the potential for discharge to the creek of groundwater containing Dioxathion and VOCs.
- Investigate the potential for non-aqueous phase liquids (NAPLs) in areas of elevated VOC concentrations.

TABLES



TABLE 1
SUMMARY OF GROUNDWATER ELEVATION DATA
December 4, 2002
Hercules, Incorporated
Hattiesburg, Mississippi

WELL NO.	TOC ELEVATION (ft.) ¹	WATER DEPTH (ft) ²	GROUNDWATER ELEVATION (ft.)
PERMANENT MONITOR WELLS			
MW-1	174.12	5.15	168.97
MW-2	160.07	5.50	154.57
MW-3	160.03	6.04	153.99
MW-4	159.75	9.92	149.83
MW-5	160.99	8.05	152.94
MW-6	174.05	7.73	166.32
PIEZOMETERS			
TP-1	172.18	4.54	167.64
TP-2	171.72	10.81	160.91
TP-3	169.74	8.90	160.84
TP-4	163.64	3.92	159.72
TP-5	160.54	7.42	153.12
TP-6	158.63	6.69	151.94
TP-7	167.17	8.77	158.40
TP-8	183.79	13.65	170.14
TP-9	163.44	6.35	157.09
TP-10	179.69	13.81	165.88
TP-11	162.26	8.26	154.00
TP-12	159.95	9.87	150.08
TP-13	156.99	6.83	150.16
TP-14	164.35	6.90	157.45

¹ TOC = "top of casing" measured relative to mean sea level (ft. MSL).

² Water depth is a relative depth measured from the TOC.

³ Date water level survey was completed is presented in parentheses for each site.

TABLE 2
SUMMARY OF PROTOCOL SAMPLING ANALYTICAL RESULTS
October 14, 2002
Hercules, Incorporated
Hattiesburg, Mississippi

Well	Isomer	Concentrations in parts per billion (ppb)		
		MSCL ¹		BATCO ²
		HPLC/MS	HPLC/UV	GC/MS
MW-1	Dioxenethion	nd ³	nd	nd
	cis-Dioxathion	nd	nd	nd
	trans-Dioxathion	nd	1.5	nd
MW-4	Dioxenethion	32	25	19.22
	cis-Dioxathion	nd	nd	4.80
	trans-Dioxathion	nd	nd	1.61
MW-5	Dioxenethion	nd	nd	5.09
	cis-Dioxathion	nd	nd	1.70
	trans-Dioxathion	0.92	10	1.44
Rinsate	Dioxenethion	nd	nd	nd
	cis-Dioxathion	nd	nd	nd
	trans-Dioxathion	nd	nd	nd

1 - MSCL = Mississippi State Chemical Laboratory

2 - BATCO = Bonner Analytical & Testing Company

3 - nd = Analyte not detected at or above the practical quantitation limit.

TABLE 3
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

December 4 and 5, 2002

Hercules, Incorporated
Hattiesburg, Mississippi

Analytes	Concentrations in parts per billion (ppb)											TRG ¹
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	
<i>Dioxathion</i>												
cis-Dioxathion	nd	nd	nd	3.34	nd	nd	nd	nd	12.8	nd	5	
trans-Dioxathion	nd	nd	nd	nd	nd	nd	nd	53.9	nd	nd	nd	
<i>total</i>	nd	nd	nd	3.34	nd	nd	nd	53.9	12.8	nd	5	54.8
Dioxenethion	nd ²	nd	nd	12.9	nd	1.12	9.57	94.3	5.9	nd	50.3	na
<i>Volatiles</i>												
1,1-dichloroethene	na ³	na	na	nd	na	na	nd	17	5.92	nd	nd	7
benzene	na	na	na	14	na	na	nd	6900	9.15	nd	114	5
trichloroethene	na	na	na	nd	na	na	nd	5.8	nd	nd	nd	5
toluene	na	na	na	nd	na	na	nd	28	nd	nd	nd	1000
chlorobenzene	na	na	na	1.81	na	na	nd	290	nd	nd	nd	100
bromodichloromethane	na	na	na	nd	na	na	nd	6.84	nd	nd	nd	0.168
bromomethane	na	na	na	nd	na	na	nd	4.07	nd	nd	nd	8.52
carbon tetrachloride	na	na	na	10	na	na	nd	16000	nd	nd	nd	5
chloroethane	na	na	na	63	na	na	nd	66	nd	nd	nd	3.64
chloroform	na	na	na	nd	na	na	nd	1800	nd	nd	nd	0.155
chloromethane	na	na	na	1.72	na	na	nd	39.2	nd	nd	nd	1.43
dibromochloromethane	na	na	na	nd	na	na	nd	4.45	nd	nd	nd	0.126
1,2-dichlorobenzene	na	na	na	nd	na	na	nd	2.71	nd	nd	nd	600
1,3-dichlorobenzene	na	na	na	nd	na	na	nd	3.75	nd	nd	nd	5.48
1,4-dichlorobenzene	na	na	na	nd	na	na	nd	3.8	nd	nd	nd	75
1,2-dichloroethane	na	na	na	nd	na	na	nd	20	nd	nd	3.11	5
cis-1,2-dichloroethene	na	na	na	nd	na	na	nd	19	nd	nd	nd	70
ethyl benzene	na	na	na	nd	na	na	nd	55.6	nd	nd	nd	700
isopropylbenzene	na	na	na	1.26	na	na	nd	4.6	2.48	nd	nd	679
p-isopropyltoluene	na	na	na	nd	na	na	nd	23.9	nd	nd	nd	na
methylene chloride	na	na	na	nd	na	na	nd	26.1	nd	nd	nd	5
naphthalene	na	na	na	5.38	na	na	nd	9.14	nd	nd	nd	6.2
tetrachloroethene	na	na	na	nd	na	na	nd	8.51	nd	nd	nd	5

TABLE 3
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
December 4 and 5, 2002
Hercules, Incorporated
Hattiesburg, Mississippi

Analytes	Concentrations in parts per billion (ppb)											TRG ¹
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	
<i>Volatiles - continued</i>												
1,2,3-trichlorobenzene	na	na	na	1.81	na	na	nd	2.55	nd	nd	nd	na
1,2,4-trichlorobenzene	na	na	na	nd	na	na	nd	2.86	nd	nd	nd	70
1,2,4-trimethylbenzene	na	na	na	nd	na	na	nd	1.81	nd	nd	nd	12.3
xylenes (total)	na	na	na	nd	na	na	nd	79	nd	nd	nd	10000
vinyl chloride	na	na	na	nd	na	na	nd	1.62	nd	nd	nd	2
<i>Semi-Volatiles</i>												
4-methylphenol	na	na	na	nd	na	na	nd	13.16	nd	nd	nd	183

1 - Target Remediation Goals are taken from the Tier 1 Target Remedial Goal Table of the Final Regulations Governing Brownfields Voluntary Cleanup and Redevelopment in Mississippi, MDEQ, March 2001.

Bold Text indicates concentrations above applicable TRGs

2 - nd = Analyte not detected at or above the practical quantitation limit.

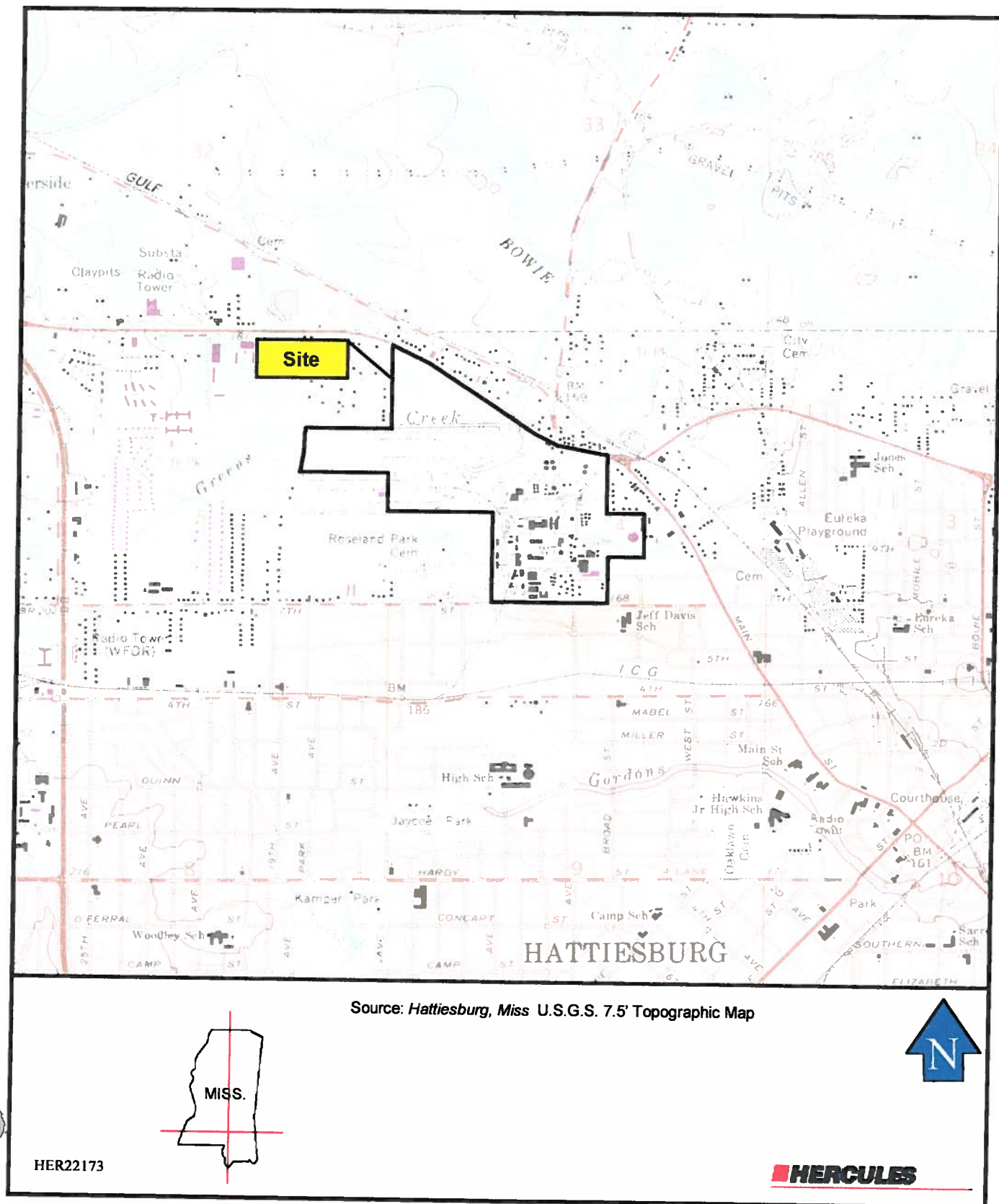
3 - na = Not analyzed

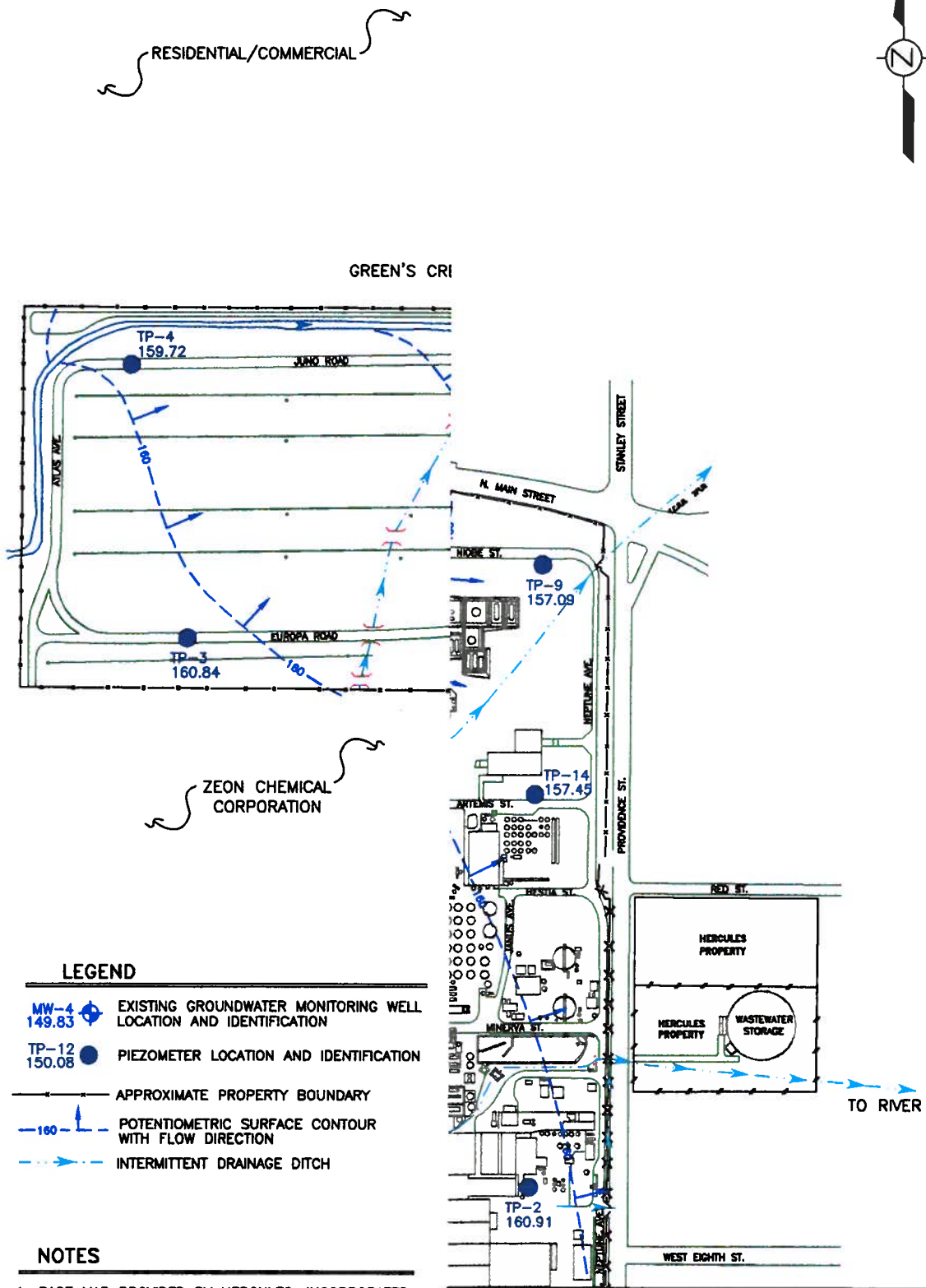
FIGURES





SITE LOCATION MAP
HERCULES, INC.
HATTIESBURG, MS





MONITORING WELL,
PIEZOMETER AND
POTENTIOMETRIC INFORMATION

HERCULES CHEMICAL CO.
HATTIESBERG, MISSISSIPPI

PROJECT NO.
HER99072

CAD FILE
HER99072-FIG02-A.dwg

DRAWING
1

FIGURE
2

APPENDICES

**APPENDIX A
ANALYTICAL PROTOCOLS**



SAMPLING AND ANALYSIS PROTOCOL FOR THE DETERMINATION OF DIOXATHION IN WATER

Recent results of analyses of well water samples from the Hercules Incorporated plant in Hattiesburg, Mississippi, have exhibited a wide range in the levels of dioxathion reported. Discussions among representatives from the analytical laboratories demonstrated that the samples analyzed to date were not true split samples and that the analytical methods were applied differently. In order to minimize the effects from different water samples and from inconsistent application of the analytical methods, the following protocol has been assembled by agreement between Hercules Incorporated and the Mississippi State Chemical Laboratory. This protocol will be used in a study to determine the proper sampling and analysis methods to be used for all future water monitoring programs at the Hattiesburg plant.

1.) SAMPLE COLLECTION

Water samples will be withdrawn from the well using a peristaltic pump with Teflon tubing. The contents of the bailer will be placed into a large glass or Teflon container (one gallon, or more, in size). The container should have a Teflon-lined screw cap. Successive bailers of water will be removed from the well and placed into the container until there is enough water to supply split samples to each laboratory participating in the study. The contents of the large container will then be mixed thoroughly. After the composited water sample in the large container has been mixed, equal amounts of water will be poured into each sample jar. The sample jars should have Teflon-lined screw caps. This procedure will be repeated for each well.

Each analytical batch of a given matrix (up to 20 samples) will require the analysis of a method blank, Laboratory Control Standard (LCS), Matrix Spiked sample (MS) and Matrix Spike Duplicate (MSD). Alternately, a duplicated sample may be substituted for the (MSD). The MS and the MSD are counted as part of the analytical batch (aka Sample Delivery Group) which may be held open for up to seven (7) days.

Water samples collected from Wells #1, #4 and #5 will be submitted in duplicate to each laboratory. That is, two separate sample jars from Well #1, Well #4 and Well #5 will be filled and sent to each laboratory for analysis.

NOTE: The sample collected for the MS/MSD will require six (6) one-liter samples.

2.) EXTRACTION OF SAMPLES

All samples will be extracted with methylene chloride following the details described in the latest revision of U.S. EPA SW-846 Method 3510 C. The solvent should be exchanged into hexane, and all extracts will be adjusted to a final volume of ten milliliters (10 mL) before analysis.

3.) CLEANUP OF EXTRACTS

In order to minimize interferences in the determination of dioxathion, sample extracts that appear to contain interferences will be cleaned up using the latest revision of U.S. EPA SW-846 Method 3620, Florisil Cleanup. The volume of eluting solvent necessary for quantitative recovery of dioxathion from the Florisil column will be determined in each laboratory using the dioxathion and dioxenethiol reference standards supplied for calibration of the GC methods.

4.) SULFUR CLEANUP

If there is significant interference from sulfur compounds, the extracts may be cleaned up according to U.S. EPA SW-846 Method 3660, copper option.

5.) ANALYSIS OF EXTRACTS

Previous work performed by Bonner Analytical and Testing (BATCO) has revealed that trans dioxathion undergoes thermal degradation in the Gas Chromatograph column therefore the protocol is changed to a lower temperature analytical method. For All sample extracts will be analyzed by High Performance Liquid Chromatography (HPLC)) using a Photo Diode Array (PDA), operated in . U.S. EPA SW-846 Method 8321 A will be used as general guidance for HPLC methodology. . A five-point calibration curve will be used to calculate the results of analyses. The lowest point on the calibration curve should be equal to, or slightly higher than, the limit of detection of the GC-PDA system. The highest point on the calibration curve should be the end of the linear portion of the PDA response profile. All laboratories will follow the QA/QC criteria described in the analytical method. Those results will be stored at each laboratory for review at a later date, if necessary.

Instrumentation

HPLC – Hewlett Packard Model 10980 Series II Liquid Chromatograph with Diode Array Detector
Fluorescence Detector Hewlett Packard Series 1100 HPLC Column:
Supelco Discovery C18, 250 mm X 4.6 mm ID, 5 µm Particle Size.

Method Parameters

Mobile Phase : Isocratic, 30% Deionized water and 70 % Acetone
Flow: 1.2 mls/min
Injection Volume: 25 µLs
Run Time: 20 Minutes
Oven Temperature 35 °C
Detector Wavelengths
Diode Array: Excitation at 200, 210 and 270 nms
Fluorescence: Excitation at 250 nms, Emission at 410 nms

Surrogate/Internal Standards: A surrogate will be chosen that does not coelute with any dioxathion isomer. Internal standards may or may not be used.

6.) CONFIRMATION OF ANALYSES

The preferred method for qualitative and quantitative confirmation of dioxathion and dioxenethiol is Liquid Chromatography/Mass Spectra analysis (LC/MS), however the present time Bonner Analytical and Testing does not own an LC/MS instrument. Therefore, for qualitative and quantitative confirmation of the dioxathion results, all sample extracts will be analyzed by Bonner Analytical and Testing using gas chromatography-mass spectrometry (GC-MS) using the latest revision of U.S. EPA SW-846 Method 8270, or an equivalent mass spectrometry system that is deemed appropriate to give equivalent results. A five-point calibration curve will be used to calculate the results of analyses. The lowest point on the calibration curve should be equal to, or slightly higher than, the limit of detection of the GC-MS system. The highest point on the calibration curve should be the end of the linear portion of the MS detector response profile. All laboratories will follow the QA/QC criteria described in the analytical method. Those results will be stored at each laboratory for review at a later date, if necessary. If significant differences are observed between Bonner Analytical & Testing's results and Mississippi States University Chemical Laboratory's results, BATCO will send the extracts of these samples to a third party laboratory to investigate the reasons for these differences.

GC column: 30-meter X 0.25-mm (or 0.32-mm) DB-5 fused silica capillary column, as specified in Paragraph 4.1.2 in U.S. EPA SW-846 Method 8270.

GC oven and injector conditions: As specified in Paragraph 7.3 in SW-846 Method 8270.

The specifications given in Method 8270, Section 4.0, "APPARATUS AND MATERIALS," and Section 5.0, "REAGENTS," will be followed. The guidance in Section 7.0, "PROCEDURE" will be used to perform the GC separations and GC/MS identification and quantitation. Specific criteria for peak identification are given in Section 7.6 of the method. The characteristic ions, both primary and secondary ions, listed in Table 1 of the method will be used. For cis and trans dioxathion and dioxenethiol, the primary ion is m/z 97 with secondary ions at m/z 125, 270, and 153. Instrument tuning criteria are given in Table 3 of the method. For the Internal Standard, chrysene-d₁₂ is recommended because it meets the retention time criteria set forth in Section 7.3.2.

7.) GENERAL COMMENTS

- a.) All samples will be extracted and analyzed within the normal holding times for organophosphorus compounds.
- b.) The dioxathion standard to be used by all laboratories will be supplied by the Hercules Incorporated.

- c.) Water samples spiked with cis or trans dioxathion or dioxenethiol will be prepared by the Mississippi State Department of Environmental Quality (MSDEQ) personnel and distributed to each laboratory for inclusion in this study.
- d.) Within three weeks of receipt of samples, all results of analyses and all confirmatory results will be reported to MSDEQ, who will collate them and distribute the results to the participating laboratories.
- e.) A meeting will be held to review the results of analyses and to decide the next step in the implementation of the analytical methods to be used in monitoring well water samples from the Hercules Incorporated Hattiesburg plant.
- f.) After its approval of this sampling and analysis protocol, MSDEQ will determine the time frame for the completion of all sampling and analysis activities and will set the date and time of the review meeting.
- g.) Only results greater than or equal to the Limit of Quantitation will be reported. The numerical sum of the cis and trans isomers of dioxathion will be reported as dioxathion. Dioxenethiol will be reported as separate compound.

APPENDIX B

BORING LOGS AND WELL CONSTRUCTION DIAGRAMS

MONITORING WELL COMPLETION FORM

PROJECT NAME Hercules
 LOCATION Hattiesburg, MS
 DATE COMPLETED 2/22/00
 DRILLER G + E Services
 GEOLOGIST Ryan

PAGE 1 OF 1
 WELL NO. MW-7
 DRILLING METHOD HSA
 METHOD OF DEVELOPMENT _____

PADLOCK

WEEPHOLE

STATIC LEVEL = ▽

INITIAL LEVEL = 13.5' ▽

HEIGHT OF TOP OF SURFACE CASING ABOVE GROUND SURFACE _____

ELEVATION/HEIGHT OF TOP OF RISER PIPE _____

FILLER MATERIAL _____

SIZE AND TYPE OF APRON _____

PAD ELEVATION _____

GROUND SURFACE ELEVATION _____

TYPE OF SURFACE SEAL Portland Cement with Sand

INSIDE DIAMETER OF SURFACE CASING 4"

TYPE OF SURFACE CASING 4" x 4" x 5' Hinged Metal Shroud

DEPTH OF SURFACE CASING BELOW GROUND 2.4'

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE 1'

INSIDE DIAMETER OF RISER PIPE 2"

TYPE OF RISER PIPE PVC

DIAMETER OF BOREHOLE 6 3/4"

TYPE OF BACKFILL Pure bold Bentonite gel

DEPTH OF TOP OF SEAL (PRE/POST HYDRATION) 6'

TYPE OF SEAL Bentonite Chips

DEPTH OF TOP OF SAND PACK (INITIAL/POST SURGE/FINAL) 8'

DEPTH OF TOP OF SCREENED SECTION 10.4'

TYPE OF SAND PACK 20/40 Filter Pack

TYPE OF SCREENED SECTION PVC Factory Slotted Pipe

OPENING SPACING 10 slot

OPENING SIZE 0.01"

INSIDE DIAMETER OF SCREENED SECTION 2"

DEPTH OF BOTTOM OF SCREENED SECTION 20.4'

LENGTH OF BLANK SECTION N/A

CENTRALIZER _____

DEPTH OF BOTTOM OF PLUGGED BLANK SECTION 20.4'

TYPE OF BACKFILL BELOW OBSERVATION PIPE N/A

DEPTH OF BOREHOLE 20.8'



SHEET 1 OF

BORING IDENTIFICATION MW-7
CORE HOLE DIAMETER 8"
BORING START
TIME 1045 DATE 2-22-00
BORING COMPLETED
TIME 1159 DATE 2-22-00
FINAL BORING DEPTH 20'

Eco-Systems, Inc.
Environmental Engineers and Scientists

MONITORING WELL COMPLETION FORM

PROJECT NAME Hercules
 LOCATION Hattiesburg, MS
 DATE COMPLETED 2/22 ORIGINAL DEPTH _____
 DRILLER G & E Services DRILL METHOD HSA
 GEOLOGIST J Ryan DATE 2/22/00

PAGE 1 OF 1
 WELL NO. MW-8
 ORIGINAL WATER LEVEL _____
 DEPTH INTERVAL _____

SEE BORING LOG FOR STRATIGRAPHY

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 4.0'

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE GROUND SURFACE -NA

TYPE OF SURFACE SEAL Portland Cement w/ Sand

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE 2 1/2"

INSIDE DIAMETER OF SURFACE CASING 4"

TYPE OF SURFACE CASING 4" x 4" x 5' Hinged Metal Shovel

DEPTH OF SURFACE CASING BELOW GROUND 2.4"

INSIDE DIAMETER OF RISER PIPE 2.0"

TYPE OF RISER PIPE PVC

DIAMETER OF BOREHOLE 6 3/4"

TYPE OF BACKFILL Pure Gold Bentonite Grout

ELEVATION / DEPTH TOP OF SEAL _____

TYPE OF SEAL Bentonite Chips

ELEVATION / DEPTH BOTTOM OF SEAL 2.16"

DEPTH OF TOP OF SAND PACK 4.0"

TYPE OF SAND PACK 20/40 Filter Pack

ELEVATION / DEPTH TOP OF SCREENED SECTION 6.0"

TYPE OF SCREENED SECTION PVC slotted Pipe

DESCRIBE OPENINGS 10 slot

INSIDE DIAMETER OF SCREENED SECTION 0.01

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 16.0"

LENGTH OF BLANK SECTION 0.3"

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 16.3"

ELEVATION/DEPTH BOTTOM OF SAND COLUMN -

TYPE OF BACKFILL BELOW OBSERVATION PIPE -

ELEVATION/DEPTH OF HOLE 16.3"

SHEET 1 OF

BORING IDENTIFICATION MW-B
BORE HOLE DIAMETER 6"
BORING START
TIME 16:10 DATE 2/22/00
BORING COMPLETED
TIME 1635 DATE 2-22-00
FINAL BORING DEPTH 16.3'

Eco-Systems, Inc.
Environmental Engineers and Scientists

MONITORING WELL COMPLETION FORM

PROJECT NAME Hercules
 LOCATION Hattiesburg, MS
 DATE COMPLETED 2/28/00
 DRILLER G + E Services
 GEOLOGIST _____

PAGE _____ OF _____
 WELL NO. MW-9
 DRILLING METHOD HSA
 METHOD OF DEVELOPMENT _____

PADLOCK

WEEPHOLE

HEIGHT OF TOP OF SURFACE CASING ABOVE GROUND SURFACE _____

ELEVATION/HEIGHT OF TOP OF RISER PIPE 2.8'

FILLER MATERIAL NA

SIZE AND TYPE OF APRON NA

PAD ELEVATION NA

GROUND SURFACE ELEVATION _____

TYPE OF SURFACE SEAL Portland Cement w/ sand

INSIDE DIAMETER OF SURFACE CASING 4"

TYPE OF SURFACE CASING 4" x 4" x 5' Hinged Metal Shroud

DEPTH OF SURFACE CASING BELOW GROUND 2.4'

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE 1'

INSIDE DIAMETER OF RISER PIPE 2"

TYPE OF RISER PIPE PVC

DIAMETER OF BOREHOLE 6 3/4"

TYPE OF BACKFILL Pure bold Bentonite be l

STATIC LEVEL = _____

DEPTH OF TOP OF SEAL (PRE/POST HYDRATION) 3'

TYPE OF SEAL Bentonite chips

DEPTH OF TOP OF SAND PACK (INITIAL/POST SURGE/FINAL) 5.0'

DEPTH OF TOP OF SCREENED SECTION 7.2'

TYPE OF SAND PACK 20/40 Filter Pack

TYPE OF SCREENED SECTION PVC Factory Sloped Pipe

OPENING SPACING 10 slot

OPENING SIZE 0.01"

INSIDE DIAMETER OF SCREENED SECTION 2"

INITIAL LEVEL = _____

DEPTH OF BOTTOM OF SCREENED SECTION 17.2'

LENGTH OF BLANK SECTION 0.3'

CENTRALIZER

DEPTH OF BOTTOM OF PLUGGED BLANK SECTION 17.5'

TYPE OF BACKFILL BELOW OBSERVATION PIPE N/A

DEPTH OF BOREHOLE 17.5'



BORING LOG

SHEET 1 OF 1

PROJECT NAME Hercules
 PROJECT LOCATION Hattiesburg, MS
 PROJECT NUMBER _____
 GEOLOGIST J. Ryan
 CLASSIFICATION SCHEME _____
 DRILLER G+E Services
 DRILL METHOD HSA
 WEATHER Sunny, Warm (70°), Windy

BORING IDENTIFICATION MW-9
 BORE HOLE DIAMETER 8"
 BORING START TIME 1445 DATE 2/22/00
 BORING COMPLETED TIME 1518 DATE 2-22-00
 FINAL BORING DEPTH 17.5'

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	DEPTH AFTER _____ MINUTES	THICKNESS	VOLUME
	2			No Sampling (0-5')			
	4						
2" (Full)	6.64	3/6		Sandy-Clay, med-stiff to stiff, mottled coloring (brown, red, grey), sand content increases w/ depth, no odor, dense			
	8	2/4					
14"	10.29	2/2		mst for wet, firm, gray-tan			
	12	4/8		wet, loose, orange/ginger			
	14						
20"	16.13	7/13	SP:	SAT, med-dense, white-tan, Grav Sand			
	18	13/7	CH 3	16.6' DRY stiff, brown tan (f-ss) 16.6' cl w/ si (trace sil stringers)			
	20						
	15						

Set MW-9 (16' Screen) TD=17.5'



MONITORING WELL COMPLETION FORM

PROJECT NAME Hercules
 LOCATION Hattiesburg, MS
 DATE COMPLETED 2/23 ORIGINAL DEPTH _____
 DRILLER G+E Services DRILL METHOD HSA
 GEOLOGIST J. Ryan DATE 2/23/00

PAGE 1 OF 1
 WELL NO. MW-10
 ORIGINAL WATER LEVEL _____
 DEPTH INTERVAL _____

SEE BORING LOG FOR STRAIGRAPHY

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 3.3'

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE GROUND SURFACE NA

TYPE OF SURFACE SEAL Portland Cement w/ Sand

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE 1'

INSIDE DIAMETER OF SURFACE CASING 4"

TYPE OF SURFACE CASING 4" x 4" x 5' Hinged Metal Shovel

DEPTH OF SURFACE CASING BELOW GROUND 2.4"

INSIDE DIAMETER OF RISER PIPE 2"

TYPE OF RISER PIPE PVC

DIAMETER OF BOREHOLE 6 3/4"

TYPE OF BACKFILL Pure Gold Bentonite Gel

ELEVATION / DEPTH TOP OF SEAL _____

TYPE OF SEAL Bentonite Chips

ELEVATION / DEPTH BOTTOM OF SEAL 2.0"

DEPTH OF TOP OF SAND PACK 4.0"

TYPE OF SAND PACK 20/40 Filter Pack

ELEVATION / DEPTH TOP OF SCREENED SECTION 6.7"

TYPE OF SCREENED SECTION PVC Slotted Pipe

DESCRIBE OPENINGS 10 slot

INSIDE DIAMETER OF SCREENED SECTION 0.01"

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 14.7"

LENGTH OF BLANK SECTION _____

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 14.7"

ELEVATION/DEPTH BOTTOM OF SAND COLUMN _____

TYPE OF BACKFILL BELOW OBSERVATION PIPE N/A

ELEVATION/DEPTH OF HOLE 14.7"

BORING LOG

SHEET 1 OF

PROJECT NAME Hercules
PROJECT LOCATION Hattiesburg, MS
PROJECT NUMBER _____
GEOLOGIST J Ryan
CLASSIFICATION SCHEME _____
DRILLER G+E Services
DRILL METHOD HSA
WEATHER _____

BORING IDENTIFICATION MW-10
BORE HOLE DIAMETER 8"
BORING START TIME 9:55 DATE 2/23/00
BORING COMPLETED TIME 10:07 DATE 2/23/00
FINAL BORING DEPTH 14'

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	DEPTH AFTER _____ MINUTES	THICKNESS	VOLUME
				No Sampling (refer to TP-12)			



MONITORING WELL COMPLETION FORM

PROJECT NAME Hercules
 LOCATION Hattiesburg, MS
 DATE COMPLETED 2/23 ORIGINAL DEPTH _____
 DRILLER J Ryan G+E DRILL METHOD HSA
 GEOLOGIST J Ryan DATE 2/23/00

PAGE 1 OF 1
 WELL NO. MW-11
 ORIGINAL WATER LEVEL _____
 DEPTH INTERVAL _____

SEE BORING LOG FOR STRATIGRAPHY

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE _____

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE GROUND SURFACE _____

TYPE OF SURFACE SEAL Portland Cement w/ Sand

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE 1"

INSIDE DIAMETER OF SURFACE CASING 4"

TYPE OF SURFACE CASING 4" x 4" x 5' Hinged Metal / Shovel

DEPTH OF SURFACE CASING BELOW GROUND 2.4'

INSIDE DIAMETER OF RISER PIPE 2"

TYPE OF RISER PIPE PVC

DIAMETER OF BOREHOLE 6 3/4"

TYPE OF BACKFILL Pure Gold Bentonite Gel

ELEVATION / DEPTH TOP OF SEAL _____

TYPE OF SEAL Bentonite Chips

ELEVATION / DEPTH BOTTOM OF SEAL 1.0"

DEPTH OF TOP OF SAND PACK 3.0"

TYPE OF SAND PACK 20/40 Filter Pack

ELEVATION / DEPTH TOP OF SCREENED SECTION 6.7"

TYPE OF SCREENED SECTION PVC Slotted Pipe

DESCRIBE OPENINGS 10 slot

INSIDE DIAMETER OF SCREENED SECTION 0.01

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 14"

LENGTH OF BLANK SECTION _____

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 14"

ELEVATION/DEPTH BOTTOM OF SAND COLUMN 1

TYPE OF BACKFILL BELOW OBSERVATION PIPE _____

ELEVATION/DEPTH OF HOLE 14"

BORING LOG

SHEET 1 OF 1

PROJECT NAME Hercules BORING IDENTIFICATION MW-11
 PROJECT LOCATION Hattiesburg, MS BORE HOLE DIAMETER 8"
 PROJECT NUMBER _____ BORING START TIME 8:05 DATE 2/23/00
 GEOLOGIST J Ryan BORING COMPLETED TIME 8:15 DATE 2/23/00
 CLASSIFICATION SCHEME _____
 DRILLER G+E Services FINAL BORING DEPTH 14'
 DRILL METHOD HSA
 WEATHER Cloudy and Mild

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	DEPTH AFTER _____ MINUTES	THICKNESS	VOLUME
				No Sampling (refer to TP-13)			

TEMPORARY MONITORING POINT COMPLETION FORM

PROJECT NAME Hercules PAGE 1 OF 1
 LOCATION Hattiesburg, MS WELL NO. TP-1
 DATE COMPLETED 4/28/99 BOREHOLE DEPTH _____ BOREHOLE WATER LEVEL ~6'
 DRILLER G+E Services DRILL METHOD HSA STATIC WATER LEVEL ~6.3' GL.
 GEOLOGIST J Ryan INSPECTED BY _____ DATE _____ SCREEN INTERVAL 6.8-16.8'

SEE BORING LOG FOR STRATIGRAPHY

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 172.18 3.2'

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE GROUND SURFACE NA 3.2'

TYPE OF SURFACE SEAL NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF PROTECTIVE CASING NA

DEPTH OF PROTECTIVE CASING BELOW GROUND NA

INSIDE DIAMETER OF RISER PIPE _____

TYPE OF RISER PIPE 1" PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High-Solid Bentonite Grout

ELEVATION / DEPTH TOP OF SEAL 3'

TYPE OF SEAL Bent. Chips

ELEVATION / DEPTH BOTTOM OF SEAL 5'

DEPTH OF TOP OF SAND PACK 5'

TYPE OF SAND PACK 20/40 Silica Sand Native 12-17' 20/40 4.5/2'

ELEVATION / DEPTH TOP OF SCREENED SECTION 6.8'

FILTER SOCK No!

TYPE OF SCREENED SECTION 1" PVC

DESCRIBE OPENINGS 10-26+

INSIDE DIAMETER OF SCREENED SECTION 1"

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 16.8'

LENGTH OF BLANK SECTION 2"

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 17'

ELEVATION/DEPTH BOTTOM OF SAND COLUMN 17'

TYPE OF BACKFILL BELOW OBSERVATION PIPE Native

ELEVATION/DEPTH OF HOLE 17.0'



SHEET 1 OF 1

BORING IDENTIFICATION TP-1

BORE HOLE DIAMETER 6"

1. *Journal of Management Studies*, 1997, 34, 1, 1-14.

BORING START 1355 11-20-90

TIME 1:55 DATE 7 28 77

BORING COMPLETED 11-22-23

TIME 1218 DATE 4-28-77

FINAL BORING DEPTH 17'

Eco-Systems, Inc.
Environmental Engineers and Scientists

TEMPORARY MONITORING POINT COMPLETION FORM

PROJECT NAME Hercules PAGE 1 OF 1
 LOCATION Hall'sburg, MS WELL NO. TP-2
 DATE COMPLETED _____ BOREHOLE DEPTH 17.0' BOREHOLE WATER LEVEL 8'
 DRILLER G+E DRILL METHOD HSA STATIC WATER LEVEL _____
 GEOLOGIST Ryan INSPECTED BY _____ DATE 4-28-99 SCREEN INTERVAL 7-17'

SEE BORING LOG FOR STRATIGRAPHY

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 3.0' 171.72

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE NA / 3.0' GROUND SURFACE

TYPE OF SURFACE SEAL NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF PROTECTIVE CASING NA

DEPTH OF PROTECTIVE CASING BELOW GROUND NA

INSIDE DIAMETER OF RISER PIPE 1"

TYPE OF RISER PIPE 1" PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High-Solids Spumy-Bentonite Chips - Hydrated

ELEVATION / DEPTH TOP OF SEAL 3'

TYPE OF SEAL Bentonite chips

ELEVATION / DEPTH BOTTOM OF SEAL 4.5'

DEPTH OF TOP OF SAND PACK 4.5'

TYPE OF SAND PACK 20/40 Sand (to 13') Native 13-17'

ELEVATION / DEPTH TOP OF SCREENED SECTION 16.8' 6.8'

FILTER SOCK No

TYPE OF SCREENED SECTION 10 Slot PVC

DESCRIBE OPENINGS 10 Slot

INSIDE DIAMETER OF SCREENED SECTION 1"

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 16.8'

LENGTH OF BLANK SECTION 2'

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 17.0'

ELEVATION/DEPTH BOTTOM OF SAND COLUMN 17.0'

TYPE OF BACKFILL BELOW OBSERVATION PIPE Native Sand

ELEVATION/DEPTH OF HOLE 17.0'

BORING LOG

SHEET 1 OF 1

PROJECT NAME <u>TASK 2 - RI Hercules</u>	BORING IDENTIFICATION <u>TP-2</u>
PROJECT LOCATION <u>HATTIESBURG, MS</u>	BORE HOLE DIAMETER <u>2" → 6"</u>
PROJECT NUMBER <u>HER-99</u>	
GEOLOGIST <u>RYAN</u>	BORING START TIME <u>1135</u> DATE <u>4-26-99</u>
CLASSIFICATION SCHEME <u>USCS</u>	
DRILLER <u>G & E SERVICES, Inc.</u>	BORING COMPLETED TIME <u>1212</u> DATE <u>4-28-99</u>
DRILL METHOD <u>HSA w/ J-Spans</u>	
WEATHER <u>Sunny & Hot (80°)</u>	FINAL BORING DEPTH <u>17.0'</u>

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT
				INITIAL DEPTH	DEPTH AFTER	THICKNESS
				~ 8'		
				MINUTES		VOLUME
20"	0.0	2/3	SM			DAMP-DRY, LOOSE, BROWN, organics w/ sand
	2	3/3	SM			V.f. SCL (6")
22"	0.0	6/9	SM			Med dense, Lt. brown, v. SiSa (v.f.)
	4	13/15	SM			w/ gray mottling, v.f. SiSa tr.
21"	0.0	24/10	SM			tan laminae @ 6.5' SiSa (v.f.)
	6	9/12	SM			f-med trace gravel
23"	0.0	13/15	SM			w/ gravel
	8	17/10	SM			
22"	0.0	18/14	SM			
	10	14/15	SM			
21"	0.0	12/14	SM			
	12	16/18	SM			
NS	14	NS	NS			No Sampling (2-15') Drill out w/ HSA (heaving)
20"	16	3/12	SPS			15' SAT, LOOSE, tan-white, Gravelly Sand w/ Ji
	18	14/10	SPS			
	20					Set TP-2 from ~6.5-16.5' TD=17.0'
						Backfill w/ native sand to ~13'
						20/40 Sand to ~4.5'
						Pellets to ~0.5'



TEMPORARY MONITORING POINT COMPLETION FORM

PROJECT NAME Heracles PAGE 1 OF 1
 LOCATION Hattiesburg, MS WELL NO. TP-3
 DATE COMPLETED 4/28/99 BOREHOLE DEPTH _____ BOREHOLE WATER LEVEL ~8'
 DRILLER GRS Services DRILL METHOD HSA STATIC WATER LEVEL _____
 GEOLOGIST J Ryan INSPECTED BY _____ DATE _____ SCREEN INTERVAL 9.6-14.6'

SEE BORING LOG FOR STRATIGRAPHY

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 169.74
 HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE NA/2.5' GROUND SURFACE
 TYPE OF SURFACE SEAL NA
 DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA
 INSIDE DIAMETER OF SURFACE CASING NA
 TYPE OF PROTECTIVE CASING NA
 DEPTH OF PROTECTIVE CASING BELOW GROUND NA
 INSIDE DIAMETER OF RISER PIPE _____
 TYPE OF RISER PIPE 1" PVC
 DIAMETER OF BOREHOLE 6"
 TYPE OF BACKFILL High Solids Bentonite Grout
 ELEVATION / DEPTH TOP OF SEAL 3.0'
 TYPE OF SEAL Bentonite Chips
 ELEVATION / DEPTH BOTTOM OF SEAL 8.0'
 DEPTH OF TOP OF SAND PACK 8.0'
 TYPE OF SAND PACK 20/40 Sand (no native)
 ELEVATION / DEPTH TOP OF SCREENED SECTION 9.5'
 FILTER SOCK No!
 TYPE OF SCREENED SECTION 10 slot 1" PVC
 DESCRIBE OPENINGS 10 slot
 INSIDE DIAMETER OF SCREENED SECTION 1"
 ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 14.6'
 LENGTH OF BLANK SECTION Flush
 ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 14.6'
 ELEVATION/DEPTH BOTTOM OF SAND COLUMN 16.0'
 TYPE OF BACKFILL BELOW OBSERVATION PIPE Sand 20/40
 ELEVATION/DEPTH OF HOLE 16.0'


Eco-Systems, Inc.
 Environmental Engineers and Scientists



BORING LOG

SHEET 1 OF 1

PROJECT NAME <u>Tank 2 - RI Hercules</u>	BORING IDENTIFICATION <u>TP-3</u>
PROJECT LOCATION <u>Hattiesburg, MS</u>	BORE HOLE DIAMETER <u>6"</u>
PROJECT NUMBER <u>HER-99</u>	
GEOLOGIST <u>Ryan</u>	BORING START TIME <u>1500</u> DATE <u>4-28-99</u>
CLASSIFICATION SCHEME <u>USCS</u>	
DRILLER <u>G+E Services</u>	BORING COMPLETED TIME <u>1527</u> DATE <u>4-28-99</u>
DRILL METHOD <u>HSA w/s-spoons</u>	
WEATHER <u>Sunny Hot (88°)</u>	FINAL BORING DEPTH <u>16'</u>

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	DEPTH AFTER MINUTES	THICKNESS	VOLUME
NS	2		NS	NO Sampling 0-4'			
Full	4 0.0 6	2/4 4/12		DAMP, med. H-gray + brn v. clay 4-5.1' Loose, tan, silty (5.1')			
	8			NO Sampling (6-9')			
22"	10 12	12/15 19/5	SM	SAT, med-dense; tan w/white, silty (F-med) to gravel.			
	14			NO Sampling			
18"	16 18 20	3/4 5/5		SAT, as above (14-16 ft), silty to gravel Med-st - stiff, buff-tan, silty to lignite.			
				Set TP-3 to 16.5' TD = 16.0' 9.6' - 14.6'			

TEMPORARY MONITORING POINT COMPLETION FORM

PROJECT NAME Heracles PAGE 1 OF 1
 LOCATION Hattiesburg MS WELL NO. TP-4
 DATE COMPLETED 4/20/99 BOREHOLE DEPTH _____ BOREHOLE WATER LEVEL ~4'
 DRILLER G+E Services DRILL METHOD HSA STATIC WATER LEVEL _____
 GEOLOGIST RYAN INSPECTED BY _____ DATE _____ SCREEN INTERVAL 5-10'

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 163.64

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE GROUND SURFACE 2.5'

TYPE OF SURFACE SEAL NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF PROTECTIVE CASING NA

DEPTH OF PROTECTIVE CASING BELOW GROUND NA

INSIDE DIAMETER OF RISER PIPE _____

TYPE OF RISER PIPE 1" PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High Solid Bentonite Grout

ELEVATION / DEPTH TOP OF SEAL 1.6'

TYPE OF SEAL Bentonite Chips

ELEVATION / DEPTH BOTTOM OF SEAL 4'

DEPTH OF TOP OF SAND PACK 4'

TYPE OF SAND PACK 20/40 Sand (w/ native)

ELEVATION / DEPTH TOP OF SCREENED SECTION 5'

FILTER SOCK NO!

TYPE OF SCREENED SECTION 10-Slot 1" PVC

DESCRIBE OPENINGS 10-Slot

INSIDE DIAMETER OF SCREENED SECTION 1"

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 10'

LENGTH OF BLANK SECTION 2" Flush

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 10'

ELEVATION/DEPTH BOTTOM OF SAND COLUMN 14'

TYPE OF BACKFILL BELOW OBSERVATION PIPE SAND 20/40

ELEVATION/DEPTH OF HOLE 14'

SEE BORING LOG FOR STRATIGRAPHY



BORING LOG

SHEET 1 OF 1

PROJECT NAME <u>Task 2 - RI Hercules</u>	BORING IDENTIFICATION <u>TP-4</u>
PROJECT LOCATION <u>Hattiesburg, MS</u>	BORE HOLE DIAMETER <u>6"</u>
PROJECT NUMBER <u>HER-99</u>	
GEOLOGIST <u>Ryan</u>	BORING START TIME <u>1602</u> DATE <u>4-28-99</u>
CLASSIFICATION SCHEME <u>USCS</u>	
DRILLER <u>G+E Services</u>	BORING COMPLETED TIME <u>1620</u> DATE <u>4-28-99</u>
DRILL METHOD <u>HSA w/ s-spoons</u>	
WEATHER <u>Sunny + hot (88°)</u>	FINAL BORING DEPTH <u>14'</u>

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	DEPTH AFTER _____ MINUTES	THICKNESS	VOLUME
NS	2		NS	Damp, firm, brown, No Sampling (observed cuttings) V-CL-Sa (V. Ls)			
17"	5	6/7		V. damp, loose, tan, moist, firm, gray-tan, v. silty (cut sh.)			
	8	7/6	NS	No Sampling 7-10'			
22"	10	7/7	CL	DRY, stiff (crumbly), green-gray, Calcareous clay br. silt.			
	12	7/7		v. stiff, w/ brown mottling			
	14	7/10		TD = 14.0'			
	16			<p>• Sand zone has pinched in this direction.</p> <p>• Def 5' screen 5-10' b/s.</p>			
	17						
	18						
	19						
	20						
	22			TD = 17.0'			



MONITORING WELL COMPLETION FORM

PROJECT NAME Hercules
 LOCATION Hattiesburg, MS
 DATE COMPLETED 4/29/99
 DRILLER GTE Services
 GEOLOGIST RSartor

PAGE 1 OF 1
 WELL NO. TP-5
 DRILLING METHOD _____
 METHOD OF DEVELOPMENT _____

PADLOCK

WEEPHOLE

HEIGHT OF TOP OF SURFACE CASING ABOVE GROUND SURFACE 460.54

ELEVATION/HEIGHT OF TOP OF RISER PIPE NA/2.6'

FILLER MATERIAL NA

SIZE AND TYPE OF APRON NA

PAD ELEVATION NA

GROUND SURFACE ELEVATION NA

TYPE OF SURFACE SEAL NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF SURFACE CASING NA

DEPTH OF SURFACE CASING BELOW GROUND NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA

INSIDE DIAMETER OF RISER PIPE 1"

TYPE OF RISER PIPE 1" PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High Solids Bentonite Grout

DEPTH OF TOP OF SEAL (PRE/POST HYDRATION) 6'

TYPE OF SEAL Bentonite Chips

DEPTH OF TOP OF SAND PACK (INITIAL/POST SURGE/FINAL) 7'

DEPTH OF TOP OF SCREENED SECTION 9'

TYPE OF SAND PACK 20/40 Sand (1' of native)

TYPE OF SCREENED SECTION 10-5/16" screen

OPENING SPACING 10-5/16"

OPENING SIZE 1"

INSIDE DIAMETER OF SCREENED SECTION 1"

DEPTH OF BOTTOM OF SCREENED SECTION 14'

LENGTH OF BLANK SECTION Flush

CENTRALIZER

DEPTH OF BOTTOM OF PLUGGED BLANK SECTION 12'

TYPE OF BACKFILL BELOW OBSERVATION PIPE Native

DEPTH OF BOREHOLE 15

STATIC LEVEL =

INITIAL LEVEL =



SHEET 1 OF

BORING IDENTIFICATION TP-5

BORE HOLE DIAMETER 6"

BORING START 11/1/62

BORING START
TIME 1700 DATE 4/29/99

BORING COMPLETED 11-28-95

BORING COMPLETED 11-28-95

TIME 1715 DATE 4/29/93

FINAL BORING DEPTH 15

3-15

TEMPORARY MONITORING POINT COMPLETION FORM

PROJECT NAME Hercules PAGE 1 OF 1
 LOCATION Hattiesburg, MS WELL NO. TP-6
 DATE COMPLETED 4/28/99 BOREHOLE DEPTH _____ BOREHOLE WATER LEVEL _____
 DRILLER G&F Services DRILL METHOD HSA STATIC WATER LEVEL _____
 GEOLOGIST Ryan DATE _____ SCREEN INTERVAL _____
 INSPECTED BY _____

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 158.63

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE GROUND SURFACE NA

TYPE OF SURFACE SEAL NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF PROTECTIVE CASING NA

DEPTH OF PROTECTIVE CASING BELOW GROUND NA

INSIDE DIAMETER OF RISER PIPE 1"

TYPE OF RISER PIPE 1" PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High-Solid Bentonite Grout

ELEVATION / DEPTH TOP OF SEAL 2'

TYPE OF SEAL Bentonite Chips

ELEVATION / DEPTH BOTTOM OF SEAL 7.0

DEPTH OF TOP OF SAND PACK 7.0'

TYPE OF SAND PACK 20/40 Sand

ELEVATION / DEPTH TOP OF SCREENED SECTION 10'

FILTER SOCK NO!

TYPE OF SCREENED SECTION 10-slot screen

DESCRIBE OPENINGS 10-slot

INSIDE DIAMETER OF SCREENED SECTION 1"

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 15'

LENGTH OF BLANK SECTION NA

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION Flush

ELEVATION/DEPTH BOTTOM OF SAND COLUMN 15'

TYPE OF BACKFILL BELOW OBSERVATION PIPE 20/40 Sand

ELEVATION/DEPTH OF HOLE 17'

SEE BORING LOG FOR STRATIGRAPHY

BORING LOG

SHEET 1 OF

PROJECT NAME Task 2 - RI Hercules
 PROJECT LOCATION Hattiesburg, MS
 PROJECT NUMBER HER-99
 GEOLOGIST Ryan
 CLASSIFICATION SCHEME USCS
 DRILLER G+E Services
 DRILL METHOD HSA w/ S-Spoons
 WEATHER Sunny + hot (88°)

BORING IDENTIFICATION TP-6
 BORE HOLE DIAMETER 6"
 BORING START TIME 1655 DATE 4-28-99
 BORING COMPLETED TIME 1725 DATE 4-28-99
 FINAL BORING DEPTH 17'

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	DEPTH AFTER _____ MINUTES	THICKNESS	VOLUME
14"	2	1/3 #1/6		DRY, soft, dk. brn, silt of cl			
18"	4	3/4 4/4		DAMP, stiff-v. st, lt. brn, silt tr. gravel			
22"	6	5/7 7/7		V. damp, med, olive-brn, silt tr. gravel			
22"	8	10/11 22/22		WET - med-dense olive-brn, silt tr. gravel			
20"	10	10/14 14/14		SAT, med, end-white (Sa) silt tr. gravel			
	12			No Sampling 10-15'			
	14						
	16	2/6 10/17					
10"	18			v. damp, med-stiff, gray-green v. silt w/ si			
	20						
	22						
	24						
	26						
	28						
	30						
	32						
	34						
	36						
	38						
	40						
	42						
	44						
	46						
	48						
	50						
	52						
	54						
	56						
	58						
	60						
	62						
	64						
	66						
	68						
	70						
	72						
	74						
	76						
	78						
	80						
	82						
	84						
	86						
	88						
	90						
	92						
	94						
	96						
	98						
	100						
	102						
	104						
	106						
	108						
	110						
	112						
	114						
	116						
	118						
	120						
	122						
	124						
	126						
	128						
	130						
	132						
	134						
	136						
	138						
	140						
	142						
	144						
	146						
	148						
	150						
	152						
	154						
	156						
	158						
	160						
	162						
	164						
	166						
	168						
	170						
	172						
	174						
	176						
	178						
	180						
	182						
	184						
	186						
	188						
	190						
	192						
	194						
	196						
	198						
	200						

MONITORING WELL COMPLETION FORM

PROJECT NAME Hercules
 LOCATION Hattiesburg, MS
 DATE COMPLETED 4/28/99
 DRILLER G+E Services
 GEOLOGIST J Ryan

PAGE 1 OF 1
 WELL NO. TP-7
 DRILLING METHOD _____
 METHOD OF DEVELOPMENT _____

PADLOCK

WEEPHOLE

HEIGHT OF TOP OF SURFACE CASING ABOVE GROUND SURFACE 167.17

ELEVATION/HEIGHT OF TOP OF RISER PIPE _____

FILLER MATERIAL NA

SIZE AND TYPE OF APRON NA

PAD ELEVATION NA

GROUND SURFACE ELEVATION NA

TYPE OF SURFACE SEAL NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF SURFACE CASING NA

DEPTH OF SURFACE CASING BELOW GROUND NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE 1'

INSIDE DIAMETER OF RISER PIPE 1" PVC

TYPE OF RISER PIPE 1" PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High-Solid Bentonite Grout

DEPTH OF TOP OF SEAL (PRE/POST HYDRATION) 3'

TYPE OF SEAL Bentonite Chips

DEPTH OF TOP OF SAND PACK (INITIAL/POST SURGE/FINAL) 4.8'

DEPTH OF TOP OF SCREENED SECTION 5'3"

TYPE OF SAND PACK 20/40 Sand (bottom 1' native)

TYPE OF SCREENED SECTION 20-50 mesh screen

OPENING SPACING 10-50 mesh

OPENING SIZE 1"

INSIDE DIAMETER OF SCREENED SECTION 1"

DEPTH OF BOTTOM OF SCREENED SECTION ~10'3"

LENGTH OF BLANK SECTION ~10'3"

CENTRALIZER

DEPTH OF BOTTOM OF PLUGGED BLANK SECTION 10'3"

TYPE OF BACKFILL BELOW OBSERVATION PIPE Native sands

DEPTH OF BOREHOLE 12'

STATIC LEVEL = _____

INITIAL LEVEL = _____



BORING LOG

SHEET 1 OF

PROJECT NAME Task 2 - RI Hercules
 PROJECT LOCATION Hathesburg, MS
 PROJECT NUMBER HER-95
 GEOLOGIST Ryan/Santor
 CLASSIFICATION SCHEME USCS
 DRILLER G & E Services
 DRILL METHOD HSA w/ s-spoons
 WEATHER Sunny hot

BORING IDENTIFICATION TP-7
 BORE HOLE DIAMETER 6"
 BORING START TIME 1605 DATE 2-29-99
 BORING COMPLETED TIME 1620 DATE 4-29-99
 FINAL BORING DEPTH 12'

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	DEPTH AFTER _____ MINUTES	THICKNESS	VOLUME
9-2 12	12	2/2 5/12	///	Damp loose	no	gray (st-f) S.S. w/peat deposits	
5-7 16"	2	2/6 9/11	///	Damp loose	no	gray (st-f) S.S. w/peat	
22"	1.5	4/4 4/8	///	Damp soft	no	gray (st-f) S.S. w/peat	
				• TDE 12' • Convert to TP-7 • Cave in + 9' • 20/40 to 4.0' • Seal to 3.0'			

Eco-Systems, Inc.
 Environmental Engineers and Scientists



TEMPORARY MONITORING POINT COMPLETION FORM

PROJECT NAME Hercules PAGE 1 OF 1
 LOCATION Hattiesburg, MS WELL NO. TP-8
 DATE COMPLETED 4/29/95 BOREHOLE DEPTH _____ BOREHOLE WATER LEVEL _____
 DRILLER G & E Service's DRILL METHOD HSA STATIC WATER LEVEL _____
 GEOLOGIST R Sartor SCREEN INTERVAL 12.5 - 17.5
 INSPECTED BY _____ DATE _____

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 183.75

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE GROUND SURFACE NA

TYPE OF SURFACE SEAL NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF PROTECTIVE CASING NA

DEPTH OF PROTECTIVE CASING BELOW GROUND NA

INSIDE DIAMETER OF RISER PIPE 1"

TYPE OF RISER PIPE 1" PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High solids Bentonite Grout

ELEVATION / DEPTH TOP OF SEAL 9'

TYPE OF SEAL Bentonite chips

ELEVATION / DEPTH BOTTOM OF SEAL 10'

DEPTH OF TOP OF SAND PACK 10'

TYPE OF SAND PACK 26/40 Sand near 6 1/2" casing

ELEVATION / DEPTH TOP OF SCREENED SECTION 12'5"

FILTER SOCK NO!

TYPE OF SCREENED SECTION 10-slot green

DESCRIBE OPENINGS 10-slot

INSIDE DIAMETER OF SCREENED SECTION 1"

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 12.5

LENGTH OF BLANK SECTION FWL

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 17.5

ELEVATION/DEPTH BOTTOM OF SAND COLUMN 18.5

TYPE OF BACKFILL BELOW OBSERVATION PIPE 20/40 Sand

ELEVATION/DEPTH OF HOLE 18.5

SEE BORING LOG FOR STRATIGRAPHY

BORING LOG

SHEET 1 OF 1

PROJECT NAME Task 2-RI Hercules
 PROJECT LOCATION Hattiesburg, MS
 PROJECT NUMBER HER-99
 GEOLOGIST Ryan/Sarber
 CLASSIFICATION SCHEME USCS
 DRILLER G+E Services
 DRILL METHOD ISA w/ 3-spoons
 WEATHER Sunny/Hot

BORING IDENTIFICATION TP-8
 BORE HOLE DIAMETER 6"
 BORING START TIME 1450 DATE 4/29/99
 BORING COMPLETED TIME 1521 DATE 4/29/99
 FINAL BORING DEPTH 18.5'

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	MINUTES	THICKNESS	VOLUME
18"	2	4/7 6/4	NS	13'			
	4		NS				
18"	6	2/3 7/11	NS				
	8		NS				
10-12"	10	11/7 12	NS				
	14		NS				
18"	16	13/7 24/17	NS				
	18 1/2		NS				
	20	5/3 9/12					
	22						
	24						
	26						
	28						
	30						
	32						
	34						
	36						
	38						
	40						
	42						
	44						
	46						
	48						
	50						

moist med-stiff clay color brown
 no sampling 2-5
 damp med-stiff clay gray w/ red mottling 9.01
 no sampling 7-10
 moist med-dense loose no odor orange (f-m) 9.92/gravel
 no sample 11-15 water @ 13'
 saturated med-dense loose no odor tan (f-m) 9.92/gravel
 no sampling 17-18.5
 damp, dense stiff no odor gray 9.01

- Completed @ 15.2 @ 18.5'
- Convert to TP-8, screen @ 12.5-17.5'
- Cave in to 18'
- 20/40 to 10'
- Seal to 9'



TEMPORARY MONITORING POINT COMPLETION FORM

PROJECT NAME Hercules PAGE 1 OF 1
 LOCATION Hattiesburg, MS WELL NO. TP-9
 DATE COMPLETED 4/29/99 BOREHOLE DEPTH _____ BOREHOLE WATER LEVEL _____
 DRILLER GTE Services DRILL METHOD HSA STATIC WATER LEVEL _____
 GEOLOGIST RS arter SCREEN INTERVAL 4-9'
 INSPECTED BY _____ DATE _____

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 163.44

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE GROUND SURFACE NA

TYPE OF SURFACE SEAL NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF PROTECTIVE CASING NA

DEPTH OF PROTECTIVE CASING BELOW GROUND NA

INSIDE DIAMETER OF RISER PIPE 1"

TYPE OF RISER PIPE 1" PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High Solids Bentonite Grout

ELEVATION / DEPTH TOP OF SEAL 2'

TYPE OF SEAL Ben Ch. ps

ELEVATION / DEPTH BOTTOM OF SEAL 3'

DEPTH OF TOP OF SAND PACK 3'

TYPE OF SAND PACK 20/40 (inert)

ELEVATION / DEPTH TOP OF SCREENED SECTION _____

FILTER SOCK No.

TYPE OF SCREENED SECTION 10-50+

DESCRIBE OPENINGS 10-50+

INSIDE DIAMETER OF SCREENED SECTION 1"

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 9'

LENGTH OF BLANK SECTION Plug

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 9'

ELEVATION/DEPTH BOTTOM OF SAND COLUMN 10'

TYPE OF BACKFILL BELOW OBSERVATION PIPE Native

ELEVATION/DEPTH OF HOLE 10'

Eco-Systems, Inc.
Environmental Engineers and Scientists

SEE BORING LOG FOR STRATIGRAPHY

99 10:27 M:\DRWG2\FORMS\FRM005

BORING LOG

SHEET 1 OF

PROJECT NAME <u>Task Z - RT Hercules</u>	BORING IDENTIFICATION <u>TP-9</u>
PROJECT LOCATION <u>Hattiesburg, MS</u>	BORE HOLE DIAMETER <u>6"</u>
PROJECT NUMBER <u>AER-99</u>	
GEOLOGIST <u>Ryan / Sartor</u>	BORING START TIME <u>1815</u> DATE <u>4/29/99</u>
CLASSIFICATION SCHEME <u>USCS</u>	
DRILLER <u>G+E Services</u>	BORING COMPLETED TIME <u> </u> DATE <u> </u>
DRILL METHOD <u>HSA w/ S-spoons</u>	
WEATHER <u>Sunny Hot</u>	FINAL BORING DEPTH <u> </u>

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	DEPTH AFTER	THICKNESS	VOLUME
18"	2	2/2	~ ~ ~	damp loam no odor Black/gray S.S. / green water @ 4'			
	5	1/1	~ ~ ~	no sampling 2-5			
10"	7	1/1	~ ~ ~	damp, stiff to moist no odor gray w/ mottling S.C.			
	10	2/3	~ ~ ~	No Sample 7-10			
20"	12	4/6	~ ~ ~	damp stiff no gray/green S.C.			
	15		~ ~ ~	no sampling 12-15			
	17	2/3	~ ~ ~	damp stiff no gray/green S.C.			
20	19	10/11	~ ~ ~	no sampling 17-20			
	20	4/9	~ ~ ~	damp dense no green @ 4.5 ft			
	22	12/14	~ ~ ~				
	24		~ ~ ~				
	26		~ ~ ~				
	28		~ ~ ~				
	30		~ ~ ~				
	32		~ ~ ~				
	34		~ ~ ~				
	36		~ ~ ~				
	38		~ ~ ~				
	40		~ ~ ~				
	42		~ ~ ~				
	44		~ ~ ~				
	46		~ ~ ~				
	48		~ ~ ~				
	50		~ ~ ~				
	52		~ ~ ~				
	54		~ ~ ~				
	56		~ ~ ~				
	58		~ ~ ~				
	60		~ ~ ~				
	62		~ ~ ~				
	64		~ ~ ~				
	66		~ ~ ~				
	68		~ ~ ~				
	70		~ ~ ~				
	72		~ ~ ~				
	74		~ ~ ~				
	76		~ ~ ~				
	78		~ ~ ~				
	80		~ ~ ~				
	82		~ ~ ~				
	84		~ ~ ~				
	86		~ ~ ~				
	88		~ ~ ~				
	90		~ ~ ~				
	92		~ ~ ~				
	94		~ ~ ~				
	96		~ ~ ~				
	98		~ ~ ~				
	100		~ ~ ~				

+ Drill new Boring to 10 ft bgs
screen @ 4-9'

- Set TP-9
- Case in to 8'
- 20/40 to 3'
- Seat to 2'

MONITORING WELL COMPLETION FORM

PROJECT NAME Hercules
 LOCATION Hattiesburg, MS
 DATE COMPLETED 4/29/99
 DRILLER G+E Services
 GEOLOGIST R Sarter

PAGE 1 OF 1
 WELL NO. T1-10
 DRILLING METHOD _____
 METHOD OF DEVELOPMENT 8-14.5'

PADLOCK

WEEPHOLE

HEIGHT OF TOP OF SURFACE CASING ABOVE GROUND SURFACE _____

ELEVATION/HEIGHT OF TOP OF RISER PIPE 179.69/2'

FILLER MATERIAL NA

SIZE AND TYPE OF APRON NA

PAD ELEVATION NA

GROUND SURFACE ELEVATION NA

TYPE OF SURFACE SEAL NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF SURFACE CASING NA

DEPTH OF SURFACE CASING BELOW GROUND NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE 4 1/2'

INSIDE DIAMETER OF RISER PIPE 1" PVC

TYPE OF RISER PIPE 1" PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL _____

DEPTH OF TOP OF SEAL (PRE/POST HYDRATION) _____

TYPE OF SEAL Bentonite Chips

DEPTH OF TOP OF SAND PACK (INITIAL/POST SURGE/FINAL) 5 1/2"

DEPTH OF TOP OF SCREENED SECTION 8'

TYPE OF SAND PACK 20/40 Sand Pack (Native)

TYPE OF SCREENED SECTION 10-5/16" PVC

OPENING SPACING 10-5/16"

OPENING SIZE _____

INSIDE DIAMETER OF SCREENED SECTION 1"

DEPTH OF BOTTOM OF SCREENED SECTION 14.5'

LENGTH OF BLANK SECTION Flush

CENTRALIZER

DEPTH OF BOTTOM OF PLUGGED BLANK SECTION 14.5'

TYPE OF BACKFILL BELOW OBSERVATION PIPE Native

DEPTH OF BOREHOLE 17

STATIC LEVEL = _____

INITIAL LEVEL = _____

Eco-Systems, Inc.
 Environmental Engineers and Scientists



BORING LOG

SHEET 1 OF

PROJECT NAME <u>Task 2 - RI Hercules</u>	BORING IDENTIFICATION <u>TP-10</u>
PROJECT LOCATION <u>Hattiesburg, MS</u>	BORE HOLE DIAMETER <u>6"</u>
PROJECT NUMBER <u>HR-95</u>	
GEOLOGIST <u>Sartar</u>	BORING START TIME <u>1058</u> DATE <u>1-29-95</u>
CLASSIFICATION SCHEME <u>USCS</u>	
DRILLER <u>G+E Services</u>	BORING COMPLETED TIME <u>1115</u> DATE <u>4-29-95</u>
DRILL METHOD <u>HSA w/ 3-spoons</u>	
WEATHER <u>Sunny / Hot</u>	FINAL BORING DEPTH <u>17 1/2'</u>

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT
				INITIAL DEPTH <u>~ 11'</u>	DEPTH AFTER <u> </u> MINUTES <u> </u>	THICKNESS <u> </u>
22"	0.0	3/4 6/5		Dry	loose	Brown/black (f-f) S, Sa (11)
12"	0.5	6/6 3/3		Damp	1	(f-m) S
12"	1.0	3/3 6/3		Moist	Firm	5' sample off-gray, S, H w/ clay
14"	2.0	3/4 H/4		Moist	Loose	gray (f-f) S, Sa
12"	3.4	3/4 4/5		Moist	Loose	
10"	18	7/9 12/12		wet (f-m)	medium dense	tan (f-m) G, Sa - 15
20"	13.5	10/10 14/17		saturated	1	
no sample 14-14.5						
20"	16	11/1 4/5		stiff	gray w/ tan	(f-m) G, Sa w/ H 5.0' w/ Gm
	18					
	10					
	15					

• completed @ 1115 @ 16.5' TD (14.5-17')

• Convert to TP-10 (8-14.5')

• 20/40 to 5 1/2'

• Seal to 4 1/2'

• 1' of Caucin to 13.5'



TEMPORARY MONITORING POINT COMPLETION FORM

PROJECT NAME Hercules PAGE 1 OF 1
LOCATION Hattiesburg, MS WELL NO. TP-11
DATE COMPLETED 4/29/99 BOREHOLE DEPTH _____ BOREHOLE WATER LEVEL _____
DRILLER G+E Services DRILL METHOD HSA STATIC WATER LEVEL _____
GEOLOGIST R Sartor DATE _____ SCREEN INTERVAL 8-13
INSPECTED BY _____

SEE BORING LOG FOR STRATIGRAPHY

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 162.26

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE NA
GROUND SURFACE

TYPE OF SURFACE SEAL NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF PROTECTIVE CASING NA

DEPTH OF PROTECTIVE CASING BELOW GROUND NA

INSIDE DIAMETER OF RISER PIPE 1"

TYPE OF RISER PIPE PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High Solids Bentonite Grout

ELEVATION / DEPTH TOP OF SEAL 5.5

TYPE OF SEAL Bent Chips

ELEVATION / DEPTH BOTTOM OF SEAL 6.5

DEPTH OF TOP OF SAND PACK 6.5'

TYPE OF SAND PACK 20/40 Sand (4' of fall back)

ELEVATION / DEPTH TOP OF SCREENED SECTION 8'

FILTER SOCK No!

TYPE OF SCREENED SECTION 10 slot

DESCRIBE OPENINGS 10 slot screen

INSIDE DIAMETER OF SCREENED SECTION _____

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 13'

LENGTH OF BLANK SECTION Flush

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 13'

ELEVATION/DEPTH BOTTOM OF SAND COLUMN 15'

TYPE OF BACKFILL BELOW OBSERVATION PIPE Native

ELEVATION/DEPTH OF HOLE 15'

Geo-Systems, Inc.
Environmental Engineers and Scientists



SHEET 1 OF

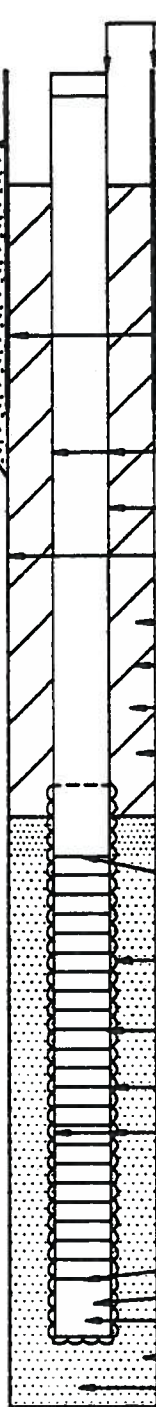
BORING IDENTIFICATION TP-11
BORE HOLE DIAMETER 6"
BORING START
TIME 1735 DATE 4/21/99
BORING COMPLETED
TIME 1735 DATE 4/21/99
FINAL BORING DEPTH 15'

Eco-Systems, Inc.
Environmental Engineers and Scientists

TEMPORARY MONITORING POINT COMPLETION FORM

PROJECT NAME Hercules PAGE 1 OF 1
 LOCATION Hattiesburg, MS WELL NO. TP-12
 DATE COMPLETED 4/29/95 BOREHOLE DEPTH _____ BOREHOLE WATER LEVEL ~ 7'
 DRILLER G+E Services DRILL METHOD HSA STATIC WATER LEVEL _____
 GEOLOGIST RSantor INSPECTED BY _____ DATE _____ SCREEN INTERVAL 5-13'

SEE BORING LOG FOR STRATIGRAPHY



ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 159.95

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE GROUND SURFACE 2.5'

TYPE OF SURFACE SEAL NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF PROTECTIVE CASING NA

DEPTH OF PROTECTIVE CASING BELOW GROUND NA

INSIDE DIAMETER OF RISER PIPE 1"

TYPE OF RISER PIPE 1" PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High Solids Bentonite Grout

ELEVATION / DEPTH TOP OF SEAL 3'

TYPE OF SEAL Bentonite chips

ELEVATION / DEPTH BOTTOM OF SEAL _____

DEPTH OF TOP OF SAND PACK Native to 8' to 20' 40 sand

TYPE OF SAND PACK 20/40 Sand

ELEVATION / DEPTH TOP OF SCREENED SECTION 5'

FILTER SOCK yes

TYPE OF SCREENED SECTION 10-5/16 1" PVC

DESCRIBE OPENINGS 10-5/16

INSIDE DIAMETER OF SCREENED SECTION 1"

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 13'

LENGTH OF BLANK SECTION Plus

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 13'

ELEVATION/DEPTH BOTTOM OF SAND COLUMN 17'

TYPE OF BACKFILL BELOW OBSERVATION PIPE Native

ELEVATION/DEPTH OF HOLE 17'

BORING LOG

SHEET 1 OF

PROJECT NAME <u>Track 2 - RI Hercules</u>	BORING IDENTIFICATION <u>TP-12</u>
PROJECT LOCATION <u>Hattiesburg, MS</u>	BORE HOLE DIAMETER <u>6"</u>
PROJECT NUMBER <u>HER-99</u>	
GEOLOGIST <u>Ryan Sartor</u>	BORING START TIME <u>925</u> DATE <u>4-29-99</u>
CLASSIFICATION SCHEME <u>USCS</u>	
DRILLER <u>G+E Services</u>	BORING COMPLETED TIME <u>0945</u> DATE <u>4-29-99</u>
DRILL METHOD <u>HSA w/ 3-spools</u>	
WEATHER <u>Sunny/hot</u>	FINAL BORING DEPTH <u>17'</u>

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	DEPTH AFTER _____ MINUTES	THICKNESS	VOLUME
6-2	22"	2.7	3/3	<p><i>Damp Loose brown to orange (f) S.S. w/ cl GISA</i></p> <p><i>NO Sampling to 5' off S. Sand</i></p> <p><i>tan w/ v. f. S. Sand</i></p> <p><i>NO sampling 6-10'</i></p> <p><i>saturated loose tan (f) 9' 9" w/ gravel</i></p> <p><i>NO sampling 12-15' 13' (Driller said TOP clay).</i></p> <p><i>Damp med stiff gray w/ orange</i></p> <p><i>TD=17'</i></p> <p><i>• Convert to TP-12 fto 5'-13'</i></p> <p><i>• Native to 8'</i></p> <p><i>• 20/40 to 4'</i></p> <p><i>• Seal to 3'</i></p>			
2-4	20"	0.5	2/3				
	4"	3/4					
4-6	18"	6	3/6				
	16"	16	6/7				
	14"	14					
	12"	12	12/13				
	10"	10					
	8"	8					
	6"	6					
	4"	4					
	2"	2					
	0"	0					



TEMPORARY MONITORING POINT COMPLETION FORM

PROJECT NAME Hercules PAGE 1 OF 1
 LOCATION Hattiesburg, MS WELL NO. TP-13
 DATE COMPLETED 4/29/99 BOREHOLE DEPTH _____ BOREHOLE WATER LEVEL ~ 5'
 DRILLER G+E Services DRILL METHOD HSA STATIC WATER LEVEL _____
 GEOLOGIST J Ryan INSPECTED BY _____ DATE _____ SCREEN INTERVAL 4-11'

ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 156.99

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE 3'
 GROUND SURFACE

TYPE OF SURFACE SEAL NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF PROTECTIVE CASING NA

DEPTH OF PROTECTIVE CASING BELOW GROUND NA

INSIDE DIAMETER OF RISER PIPE 1"

TYPE OF RISER PIPE 1" PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High Solids Bentonite Grout

ELEVATION / DEPTH TOP OF SEAL 2'

TYPE OF SEAL Bentonite Chips

ELEVATION / DEPTH BOTTOM OF SEAL 3'

DEPTH OF TOP OF SAND PACK 3' / 20/40 Sand (N. N. fine)

TYPE OF SAND PACK 2'

ELEVATION / DEPTH TOP OF SCREENED SECTION 4'

FILTER SOCK yes

TYPE OF SCREENED SECTION 10-slot 1" PVC

DESCRIBE OPENINGS 10-slot

INSIDE DIAMETER OF SCREENED SECTION 1"

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 11'

LENGTH OF BLANK SECTION Flow

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 11'

ELEVATION/DEPTH BOTTOM OF SAND COLUMN 14'

TYPE OF BACKFILL BELOW OBSERVATION PIPE Sand 20/40

ELEVATION/DEPTH OF HOLE 14'

SEE BORING LOG FOR STRATIGRAPHY



BORING LOG

SHEET 1 OF

PROJECT NAME Task 2 - RI Hercules
 PROJECT LOCATION Hattiesburg, MS
 PROJECT NUMBER HER-95
 GEOLOGIST Santor
 CLASSIFICATION SCHEME USCS
 DRILLER G + R Services
 DRILL METHOD HSA w/ S-spoons
 WEATHER Sunny/Hot

BORING IDENTIFICATION TP-13
 BORE HOLE DIAMETER 6"
 BORING START TIME 810 DATE 4-29-99
 BORING COMPLETED TIME 835 DATE 4-29-99
 FINAL BORING DEPTH 14'

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	DEPTH AFTER _____ MINUTES	THICKNESS	VOLUME
18"	0.6	5/4	SC	DRY, LOOSE, brown-gray, CLSa (0-2')			
19"	1.0	4/4	SC	Damp Loose light (brown), CLSa w/ gravel (2'-5')			
8"	16.4	4/4	SM	saturated (5') med-dense (vf-f) S.S. w/ trace (5'-7')			
18"	8	6/17	SP	(f-med) Gravelly Sand w/ Sil (7-11)			
12"	10	6/12	SP	Loose (f) Gravelly Sand w/ silt & cl			
10"	12	3/2	CL	Damp stiff brown-gray, Mottling, S.C. 10-10.5'			
14"	14	2/5	CL				
	16						
	18						
	20						
	15						

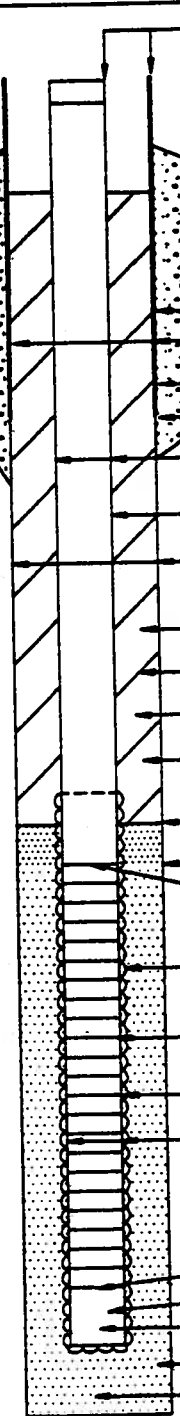
• Convert to TP-13 from 4-11'. TD = 14'
 • Add filter sock + 20/40 from TD.



TEMPORARY MONITORING POINT COMPLETION FORM

PROJECT NAME Hercules PAGE 1 OF 1
 LOCATION Hattiesburg, MS WELL NO. TP-14
 DATE COMPLETED 5/10/99 BOREHOLE DEPTH _____ BOREHOLE WATER LEVEL _____
 DRILLER G & E Services DRILL METHOD HSA STATIC WATER LEVEL _____
 GEOLOGIST J Ryan INSPECTED BY _____ DATE _____ SCREEN INTERVAL _____

SEE BORING LOG FOR STRATIGRAPHY



ELEVATION OF TOP OF SURFACE CASING/RISER PIPE 164.34

HEIGHT OF TOP OF SURFACE CASING/RISER PIPE ABOVE GROUND SURFACE 2.6'

TYPE OF SURFACE SEAL NA

DEPTH OF SURFACE SEAL BELOW GROUND SURFACE NA

INSIDE DIAMETER OF SURFACE CASING NA

TYPE OF PROTECTIVE CASING NA

DEPTH OF PROTECTIVE CASING BELOW GROUND NA

INSIDE DIAMETER OF RISER PIPE 1"

TYPE OF RISER PIPE PVC

DIAMETER OF BOREHOLE 6"

TYPE OF BACKFILL High Solids Bentonite Grout

ELEVATION / DEPTH TOP OF SEAL 1'

TYPE OF SEAL Bentonite Pellets

ELEVATION / DEPTH BOTTOM OF SEAL 3'

DEPTH OF TOP OF SAND PACK 5.0'

TYPE OF SAND PACK 20/40 Sand

ELEVATION / DEPTH TOP OF SCREENED SECTION 7.6'

FILTER SOCK Yes

TYPE OF SCREENED SECTION 10-slot 1" PVC

DESCRIBE OPENINGS 10-slot

INSIDE DIAMETER OF SCREENED SECTION 1"

ELEVATION / DEPTH BOTTOM OF SCREENED SECTION 12.6"

LENGTH OF BLANK SECTION Flush

ELEVATION/DEPTH BOTTOM OF PLUGGED BLANK SECTION 12.6"

ELEVATION/DEPTH BOTTOM OF SAND COLUMN 14'

TYPE OF BACKFILL BELOW OBSERVATION PIPE Native

ELEVATION/DEPTH OF HOLE 14"

BORING LOG

SHEET 1 OF

PROJECT NAME Task 2 - RI Hercules
 PROJECT LOCATION Hattiesburg, MS
 PROJECT NUMBER HER-95
 GEOLOGIST Ryan
 CLASSIFICATION SCHEME USCS
 DRILLER GTE Services
 DRILL METHOD HSA w/ s-spoons
 WEATHER

BORING IDENTIFICATION TP-14
 BORE HOLE DIAMETER 3"
 BORING START TIME 1830 DATE 5-10-99
 BORING COMPLETED TIME 1650 DATE 5-10-99
 FINAL BORING DEPTH

RECOVERY (INCHES)	DEPTH IN FEET	SYMBOL	LITHOLOGY	GROUNDWATER		FREE PRODUCT	
				INITIAL DEPTH	DEPTH AFTER	THICKNESS	VOLUME
	2			DAMP, firm, brown, moist (2')		CLs	
	4			DAMP (35) loose, H. sen, light-stained		Fill. old (2.5' - 3.1')	
	6			moist (5'), firm, brown		Silsa tr. cl (3.1' - 5')	
	8			wet-sat, loose, lt. sen		Silts (5' - 7')	
	10			SAT		Silsa f-med (fine gravel)	
	12					w/ gravel @ 10.5'	
	14						
	16						
	18						
	20						
	22						
	24						
	26						
	28						
	30						
	32						
	34						
	36						
	38						
	40						
	42						
	44						
	46						
	48						
	50						
	52						
	54						
	56						
	58						
	60						
	62						
	64						
	66						
	68						
	70						
	72						
	74						
	76						
	78						
	80						
	82						
	84						
	86						
	88						
	90						
	92						
	94						
	96						
	98						
	100						



**APPENDIX C
SAMPLE COLLECTION LOGS**



Groundwater Sample Collection Log

Project Name: Hercules
Project Number: HER99072

Boring ID: MW-1
Site Location: Hattiesburg, Mississippi

Start Date: 10/14/2002 Finish Date: 10/14/2002
Sample Technician: Charles Coney and Rodney Sartor
Purge/Sample Method: Peristaltic Pump
Well Diameter: 2"
Total Depth of Well: 17
Approximate Depth of Water Column
(h= TD of well - water level [TOC]): 11.47
Calculated Well Volume ($V=6hd^2$)
(V = vol in gal; D = well diam. in ft): 1.9

Water Level Measurements		
Date	Time	Water Level (TOC)
10/14/2002	9:31	5.53

WELL DEVELOPMENT/PURGING DATA								
Date/Time	Cumulative Volume (gal)	pH	Specific Conductivity (umohs)	Temperature (Celsius)	Turbidity (NTU)	D.O. (mg/l)	ORP (mv)	Comments
10/14/2002 10:20	2	6.19	125.6	20.5	13.7			
10:30		6.14	74.9	20.7	13.7			
10:40		6.05	140.2	20.8	13.2			
11:02		6.06	129.5	22.5	13.3			
11:15		5.91	127.0	22.5	14.3			

Sample Identification: _____
Weather Conditions During Sampling: _____
Comments: _____
Signature: _____ Date: _____

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
10/14/2002	11:30		

Boring ID: MW-4

Site Location: Hattiesburg, Mississippi

Start Date:	10/14/2002	Finish Date:	10/14/2002
Sample Technician:	Charles Coney and Rodney Sartor		
Purge/Sample Method:	Peristaltic Pump		
Well Diameter:	2"		
Total Depth of Well:	15		
Approximate Depth of Water Column			
(h= TD of well - water level [TOC]):	4.60		
Calculated Well Volume ($V=6hD^2$)			
(V = vol in gal; D = well diam. in ft):	0.8		

[illegible][illegible]

Sample Identification: _____

Weather Conditions During Sampling:

Comments: _____

Signature: _____ Date: _____

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
10/14/2002	13:05		



Groundwater Sample Collection Log

Project Name: Hercules
Project Number: HER99072

Boring ID: MW-5
Site Location: Hattiesburg, Mississippi

Start Date: 10/14/2002 Finish Date: 10/14/2002
Sample Technician: Charles Coney and Rodney Sartor
Purge/Sample Method: Peristaltic Pump
Well Diameter: 2"
Total Depth of Well: 15
Approximate Depth of Water Column
(h= TD of well - water level [TOC]): 6.3
Calculated Well Volume ($V=6hd^2$)
(V = vol in gal; D = well diam. in ft): 1.1

Water Level Measurements		
Date	Time	Water Level (TOC)
10/14/2002	13:47	8.7

WELL DEVELOPMENT/PURGING DATA

Date/Time	Cumulative Volume (gal)	pH	Specific Conductivity (umohs)	Temperature (Celsius)	Turbidity (NTU)	D.O. (mg/l)	ORP (mv)	Comments
10/14/2002 14:05		6.68	484.0	26.2	3.28			
14:16		6.78	483.0	25.8	2.35			
14:20		6.72	396.0	25.5	2.52			
14:22		6.71	896.0	25.2	1.69			
14:25	2.5	6.72	560.0	25.1	1.61			
14:30	3.5	6.64	734.0	25.3	1.43			
14:34		6.64	428.0	24.9	2.87			
14:37		6.6	555.0	24.6	1.60			
14:41	4	6.54	325.0	24.6	1.67			
14:44		6.51	294.0	24.7	2.28			
14:46	4.5	6.62	416.0	24.4	1.61			
14:49	4.75	6.47	442.0	24.6	1.76			

Sample Identification: _____

Weather Conditions During Sampling: _____

Comments: _____

Signature: _____ Date: _____

GROUNDWATER SAMPLE CONTAINERS

Date	Time	Sample Container	Preservative
10/14/2002	14:50		



Groundwater Sample Collection Log

Project Name: Hercules
Project Number: HER99072

Boring ID: MW-6
Site Location: Hattiesburg, Mississippi

Start Date: 10/14/2002 Finish Date: 10/14/2002
Sample Technician: Charles Coney and Rodney Sartor
Purge/Sample Method: Peristaltic Pump
Well Diameter: 2"
Total Depth of Well: 18
Approximate Depth of Water Column
(h= TD of well - water level [TOC]): 9.95
Calculated Well Volume ($V=6hD^2$)
(V = vol in gal; D = well diam. in ft): 1.7

Water Level Measurements		
Date	Time	Water Level (TOC)
10/14/2002	15:52	8.05

WELL DEVELOPMENT/PURGING DATA

Date/Time	Cumulative Volume (gal)	pH	Specific Conductivity (umohs)	Temperature (Celsius)	Turbidity (NTU)	D.O. (mg/l)	ORP (mv)	Comments
10/14/2002 16:00		6.72	110.6	24.9	1.93			
16:03		5.75	118.5	24.6	1.58			
16:05		5.68	104.2	24.5	1.26			
16:08		5.56	147.7	24.4	1.26			
16:09		5.61	120.2	24.2	1.09			
16:11		5.57	181.7	24.0	1.26			
16:13		5.63	80.0	23.9	1.48			
16:15		5.55	170.0	24.0	1.30			
16:17		5.57	186.8	24.2	1.18			
16:19		5.49	184.8	24.1	1.05			

Sample Identification: _____

Weather Conditions During Sampling: _____

Comments: _____

Signature: _____ Date: _____

GROUNDWATER SAMPLE CONTAINERS

Date	Time	Sample Container	Preservative
10/14/2002	16:22		

Boring ID: MW-1
Site Location: Hattiesburg, Mississippi

Start Date:	<u>12/4/02</u>	Finish Date:	<u>12/4/02</u>
Sample Technician:	<u>Charles Coney</u>		
Purge/Sample Method:	<u>Peristaltic Pump</u>		
Well Diameter:	<u>2"</u>		
Total Depth of Well:	<u>20.5</u>		
Approximate Depth of Water Column			
(h= TD of well - water level [TOC]):	<u>15.35</u>		
Calculated Well Volume ($V=6hd^2$)			
(V = vol in gal; D = well diam. in ft):	<u>2.6</u>		

[illegible][illegible]

Weather Conditions During Sampling: cloudy and warm, low 60's

Comments: Delivered sample directly to Glenn Jones of Bonner Laboratory

Signature: Samuel T. [illegible] Date: 12/17/02

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
12/4/02	10:45	1 L Amber	none

Boring ID: MW-2
Site Location: Hattiesburg, Mississippi

Start Date:	<u>12/4/02</u>	Finish Date:	<u>12/4/02</u>
Sample Technician:	<u>Charles Coney</u>		
Purge/Sample Method:	<u>Peristaltic Pump</u>		
Well Diameter:	<u>2"</u>		
Total Depth of Well:	<u>20.5</u>		
Approximate Depth of Water Column			
(h= TD of well - water level [TOC]):	<u>14.95</u>		
Calculated Well Volume ($V=6hd^2$)			
(V = vol in gal; D = well diam. in ft):	<u>2.5</u>		

Water Level Measurements		
Date	Time	Water Level (TOC)
12/4/02	15:18	5.55
	15:21	5.70
	15:25	5.70

[illegible]

Weather Conditions During Sampling: very cloudy, breezy, lower 60's

Signature: Spencer Trinch Date: 12/17/02

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
12/4/02	15:45	1 L amber	none

Boring ID: MW-3
Site Location: Hattiesburg, Mississippi

Start Date:	12/4/02	Finish Date:	12/4/02
Sample Technician:	Charles Coney		
Purge/Sample Method:	Peristaltic Pump		
Well Diameter:	2"		
Total Depth of Well:	18		
Approximate Depth of Water Column			
(h= TD of well - water level [TOC]):	11.75		
Calculated Well Volume ($V=6hd^2$)			
(V = vol in gal; D = well diam. in ft):	2.0		

Water Level Measurements		
Date	Time	Water Level (TOC)
12/4/02	14:35	6.25
	14:42	6.25

[illegible]

Weather Conditions During Sampling: very cloudy, breezy, lower 60's

Comments: Delivered sample directly to Bonner Laboratory

Signature: Spencer Tripp Date: 12/17/02

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
12/4/02	15:00	1 L amber	none

Boring ID: MW-4
Site Location: Hattiesburg, Mississippi

Start Date:	<u>12/4/02</u>	Finish Date:	<u>12/5/02</u>
Sample Technician:	<u>Charles Coney</u>		
Purge/Sample Method:	<u>Peristaltic Pump</u>		
Well Diameter:	<u>2"</u>		
Total Depth of Well:	<u>18.5</u>		
Approximate Depth of Water Column			
(h= TD of well - water level [TOC]):		<u>8.58</u>	
Calculated Well Volume ($V=6hd^2$)			
(V = vol in gal; D = well diam. in ft):		<u>1.5</u>	

Water Level Measurements		
Date	Time	Water Level (TOC)
12/4/02	10:27	9.92
12/5/02	12:45	9.67
12/5/02	12:55	9.71

[illegible]

Signature: Spencer Truchello Date: 12/17/02

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
12/5/02	13:15	1L ambers	none
		40 mL septa vials	HCl



Groundwater Sample Collection Log

Project Name: Hercules
Project Number: HER99072

Boring ID: MW-5
Site Location: Hattiesburg, Mississippi

Start Date: 12/4/02 Finish Date: 12/5/02

Sample Technician: Charles Coney

Purge/Sample Method: Peristaltic Pump

Well Diameter: 2"

Total Depth of Well: 18.5

Approximate Depth of Water Column

(h= TD of well - water level [TOC]): 10.45

Calculated Well Volume ($V=6hd^2$)

(V = vol in gal; D = well diam. in ft): 1.8

Water Level Measurements

Date	Time	Water Level (TOC)
12/4/02	11:10	8.05
12/5/02	13:50	7.40
12/5/02	14:02	8.14

WELL DEVELOPMENT/PURGING DATA

[illegible]

Sample Identification: MW-5

Weather Conditions During Sampling: cloudy, breezy, lower 40's

Comments: Sample was relinquished directly to Bonner Laboratory

Signature: Spencer T. White Date: 12/17/02

GROUNDWATER SAMPLE CONTAINERS

Date	Time	Sample Container	Preservative
12/5/02	14:20	1L ambers	none



Groundwater Sample Collection Log

Project Name: Hercules
Project Number: HER99072

Boring ID: MW-6
Site Location: Hattiesburg, Mississippi

Start Date: 12/4/02 Finish Date: 12/5/02
Sample Technician: Charles Coney
Purge/Sample Method: Peristaltic Pump, volume based
Well Diameter: 2"
Total Depth of Well: 23.25
Approximate Depth of Water Column
(h= TD of well - water level [TOC]): 15.52
Calculated Well Volume ($V=6hd^2$)
(V = vol in gal; D = well diam. in ft): 2.6

Water Level Measurements		
Date	Time	Water Level (TOC)
12/4/02	11:07	7.73

WELL DEVELOPMENT/PURGING DATA								
Date/Time	Cumulative Volume (gal)	pH	Specific Conductivity (umohs)	Temperature (Celsius)	Turbidity (NTU)	D.O. (mg/l)	ORP (mv)	Comments
12/5/02 14:57	2.6	5.47	163	20.4	5.4	1.82		
15:10	5.2	5.46	165	20.6	7.3	1.70		
15:25	7.8	5.50	167	20.5	4.6	1.75		

Sample Identification: MW-6

Weather Conditions During Sampling: cloudy, breezy, lower 40's

Comments: Sample was relinquished directly to Bonner Analytical

Signature: James Trichello Date: 12/17/02

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
12/5/02	15:30	1L ambers	none



Groundwater Sample Collection Log

Project Name: Hercules
Project Number: HER99072

Boring ID: MW-7
Site Location: Hattiesburg, Mississippi

Start Date:	<u>12/4/02</u>	Finish Date:	<u>12/4/02</u>
Sample Technician:	<u>Spencer Trichell</u>		
Purge/Sample Method:	<u>Peristaltic Pump</u>		
Well Diameter:	<u>2"</u>		
Total Depth of Well:	<u>22.5</u>		
Approximate Depth of Water Column			
(h= TD of well - water level [TOC]):	<u>8.89</u>		
Calculated Well Volume ($V=6hd^2$)			
(V = vol in gal; D = well diam. in ft):	<u>1.5</u>		

Water Level Measurements		
Date	Time	Water Level (TOC)
12/4/02	11:53	13.61
12/4/02	15:50	13.68

[illegible]

Sample Identification: MW-7

Weather Conditions During Sampling: raining, warm, lower 60's

Comments: Sample was relinquished directly to Bonner analytical

Signature: Gordon Tinkell Date: 12/17/02

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
12/4/02	16:20	1L ambers	none
		40mL septa vials	HCl

Boring ID: MW-8
Site Location: Hattiesburg, Mississippi

Start Date:	12/4/02	Finish Date:	12/5/02
Sample Technician:	Charles Coney		
Purge/Sample Method:	Peristaltic Pump		
Well Diameter:	2"		
Total Depth of Well:	20		
Approximate Depth of Water Column			
(h= TD of well - water level [TOC]):	5.91		
Calculated Well Volume ($V=6hd^2$)			
(V = vol in gal; D = well diam. in ft):	1.0		

[illegible][illegible]

Weather Conditions During Sampling: cloudy, breezy, lower 40's

Comments: Relinquished samples directly to Bonner Laboratory

Signature: Spencer Trishell Date: 12/17/02

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
12/5/02	15:50	40 mL septa vials	HCl
		1L ambers	none



Groundwater Sample Collection Log

Project Name: Hercules
Project Number: HER99072

Boring ID: MW-9
Site Location: Hattiesburg, Mississippi

Start Date: 12/4/02 Finish Date: 12/5/02
Sample Technician: Charles Coney
Purge/Sample Method: Peristaltic Pump
Well Diameter: 2"
Total Depth of Well: 20
Approximate Depth of Water Column
(h= TD of well - water level [TOC]): 8.65
Calculated Well Volume ($V=6hd^2$)
(V = vol in gal; D = well diam. in ft): 1.5

Water Level Measurements		
Date	Time	Water Level (TOC)
12/4/02	11:05	11.35
12/5/02	9:20	11.32
12/5/02	9:41	11.34

WELL DEVELOPMENT/PURGING DATA								
Date/Time	Cumulative Volume (gal)	pH	Specific Conductivity (umohs)	Temperature (Celsius)	Turbidity (NTU)	D.O. (mg/l)	ORP (mv)	Comments
12/5/02 9:31	0.25	5.25	151	13.1	3.4	1.55		
9:36	0.35	5.16	147	14.2	3.2	0.81		
9:41	0.45	5.15	152	13.8	3.7	0.76		
9:46	0.55	5.80	510	16.1	0.9	0.75		
9:51	0.65	5.81	526	15.2	1.1	0.67		
9:56	0.75	5.82	532	14.3	1.1	0.71		
10:01	0.85	5.8	545	15.5	1.0	0.47		
10:06	1	5.82	557	16.7	1.0	0.65		

Sample Identification: MW-9

Weather Conditions During Sampling: cloudy, breezy, lower 40's

Comments: Samples relinquished directly to Bonner Analytical

Signature: Spencer Trickett Date: 12/17/02

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
12/5/02	10:15	40 mL septa vials	HCl
		1L ambers	none

Boring ID: MW-10
Site Location: Hattiesburg, Mississippi

Start Date:	12/4/02	Finish Date:	12/4/02
Sample Technician:	Charles Coney		
Purge/Sample Method:	Peristaltic Pump		
Well Diameter:	2"		
Total Depth of Well:	18.5		
Approximate Depth of Water Column			
(h= TD of well - water level [TOC]):	8.77		
Calculated Well Volume ($V=6hd^2$)			
(V = vol in gal; D = well diam. in ft):	1.5		

Water Level Measurements		
Date	Time	Water Level (TOC)
12/4/02	10:18	9.73
	16:00	9.75
	16:11	20:24

[illegible]

Weather Conditions During Sampling: raining, lower 60's

Comments: Samples relinquished directly to Bonner Laboratory

Signature: Spencer Trickell Date: 12/17/02

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
12/4/02	16:38	40 mL septa vials	HCl
		1L amber	none

Boring ID: MW-11
Site Location: Hattiesburg, Mississippi

Start Date:	12/4/02	Finish Date:	12/4/02
Sample Technician:	Charles Coney		
Purge/Sample Method:	Peristaltic Pump		
Well Diameter:	2"		
Total Depth of Well:	17		
Approximate Depth of Water Column			
(h= TD of well - water level [TOC]): 9.95			
Calculated Well Volume ($V=6hd^2$)			
(V = vol in gal; D = well diam. in ft): 1.7			

Water Level Measurements		
Date	Time	Water Level (TOC)
12/4/02	10:38	7.05

[illegible]

Weather Conditions During Sampling: cloudy and warm

Comments: Samples were relinquished directly to Bonner Laboratory

Signature: Spencer Trickett Date: 12/12/02

GROUNDWATER SAMPLE CONTAINERS			
Date	Time	Sample Container	Preservative
12/4/02	12:10	1L amber	none
		40 mL septa vials	HCl

APPENDIX D
LABORATORY ANALYTICAL REPORTS



Mississippi State Chemical Laboratory

DR. KEVIN L. ARMBRUST
State Chemist

Results are presented for the analysis of dioxathion in four well water samples. The only previous experience the laboratory has had with this compound was to perform experiments to qualitatively identify its structural isomers on two occasions. The compounds were characterized by their UV and IR spectra, and were chromatographed both by liquid and gas chromatography (LC and GC). Some infusion and LC experiments with standards were done. No quantitative methods were developed. An extraction method was chosen that is amenable to recovering residues of many pesticides. The samples were buffered and the pH adjusted to 8.0 followed by three extractions with methylene chloride. The extracts were combined and then exchanged into acetonitrile containing internal standard for analysis by HPLC/UV and HPLC/MS. Sample extracts were maintained at 4°C.

The UV and MS data were taken simultaneously from the same injections of samples. The instrument used was a micromass Quattro Micro. The analytical column was an Alltech Altima C-18 (5u), 4.6mm X 250mm and maintained at 35°C. The mobile phase was 75:25 acetonitrile:water, isocratic at 1.0 ml/min. Two UV wavelengths were monitored for the entire run, but residues were quantitated from the 254 nm data for the internal standard and for dioxenethion. Concentrations of cis- and trans-dioxathion were determined from the 200 nm data.

Samples were introduced into the MS by atmospheric pressure chemical ionization at 300°C. The flow rate for the nebulizing gas was 400 L/hr. The ion chosen for quantitation was m/z 270.

Results and quantitation levels are reported for samples based on a signal-to-noise ratio of 5:1 for both detection techniques.

HPLC/UV RESULTS

MSCL No.	26,523	26,524	26,525	26,526A	26,526B	Laboratory Blank Water	Lower Level of Quantitation
Sample ID	MW-1	MW-4	Rinsate	MW-5	MW-5 Duplicate		
Volume	1,000 ml	1,000 ml	625 ml	1,000 ml	1,000 ml		
	PARTS PER BILLION						
Cis-dioxathion	ND*	ND	ND	ND	ND	ND	1.0
Trans-dioxathion	1.5	ND	ND	10	4.3	ND	1.0
Dioxenethion	ND	25	ND	ND	ND	ND	0.30

*ND = None Detected

	Spiking Level	Laboratory Spiked Water	Percent Recovery	Spiked MW-5 Replicate	Average MW-5 Replicates	Net Level Found	Percent Net Recovery
	PARTS PER BILLION						
Cis-dioxathion	42	47	112	36	ND	36	85.7
Trans-dioxathion	42	43	102	40	7.2	33	78.6
Dioxenethion	53	69	130	87	ND	87	164

HPLC/MS RESULTS

MSCL No.	26,523	26,524	26,525	26,526A	26,526B	Laboratory Blank Water	Lower Level of Quantitation
Sample ID	MW-1	MW-4	Rinsate	MW-5	MW-5 Duplicate		
Volume	1,000 ml	1,000 ml	625 ml	1,000 ml	1,000 ml		
	PARTS PER BILLION						
Cis-dioxathion	ND	ND	ND	ND	ND	ND	0.21
Trans-dioxathion	ND	ND	ND	0.92	1.0	ND	0.21
Dioxenethion	ND	32	ND	ND	ND	ND	0.53

	Spiking Level	Laboratory Spiked Water	Percent Recovery	Spiked MW-5 Replicate	Average MW-5 Replicates	Net Level Found	Percent Net Recovery
	PARTS PER BILLION						
Cis-dioxathion	42	64	152	45	ND	45	107
Trans-dioxathion	42	101	240	59	0.5	58	138
Dioxenethion	53	84	158	50	ND	50	94.3

YOUR COMPANY NAME: <u>CLC</u>		CLIENT PO.#		CLIENT PROJECT NUMBER	
YOUR COMPANY ADDRESS: <u>1000 N. 1st St.</u> <u>Suite 100</u> <u>Phoenix, AZ 85004</u>					
NAME OF PERSON TO CONTACT: <u>Mr. J. Smith</u>					
CONTACT PERSON'S PHONE: <u>(602) 555-1234</u>					
CONTACT PERSON'S EMAIL:					
FAX: <u>(602) 555-5678</u>					
SAMPLE DESCRIPTION		DATE	TIME	MATRIX	
1	M.W. 1	10/10/00	1130	Lignite	
2	M.W. 2	10/10/00	1300	Lignite	
3	M.W. 3	10/10/00	1400	Lignite	
4	M.W. 4	10/10/00	1450	Lignite	
5					
6					
7					
8					
9					
10					
SAMPLE COLLECTOR/RELINQUISHED BY: <u>J. Smith</u>		DATE <u>10/10/00</u>	TIME <u>1130</u>	RECEIVED BY:	
METHOD OF SHIPMENT (If Any) <u>Truck</u>		RELINQUISHED BY:			
REMARKS: <u>See logbook for details</u>					